

**12th INTERNATIONAL ZEUGMA CONGRESS ON
SCIENTIFIC RESEARCH**

October 2-4, 2024/ Gaziantep, Turkiye



PROCEEDINGS BOOK

Edited by
Prof. Dr. Osman ERKMEN
Gulnaz GAFUROVA

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12th INTERNATIONAL ZEUGMA CONGRESS ON SCIENTIFIC RESEARCH



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Gulnaz GAFUROVA**

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CONFERENCE ID

CONFERENCE TITLE

12th INTERNATIONAL ZEUGMA CONGRESS ON SCIENTIFIC
RESEARCH

DATE and PLACE

October 2-4, 2024 / Gaziantep, Turkiye

ORGANIZATION

IKSAD-Institute of Economic Development and Social Research,
Türkiye

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NUMBER OF PAPERS FROM TÜRKİYE 68

OTHER COUNTRIES 73

NUMBER OF REJECTED PAPERS 15

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Pakistan, Portugal, Morocco, Iran, Algeria, Republic of Serbia,
Ethiopia, Ukraine, Thailand

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PHOTO GALLERY

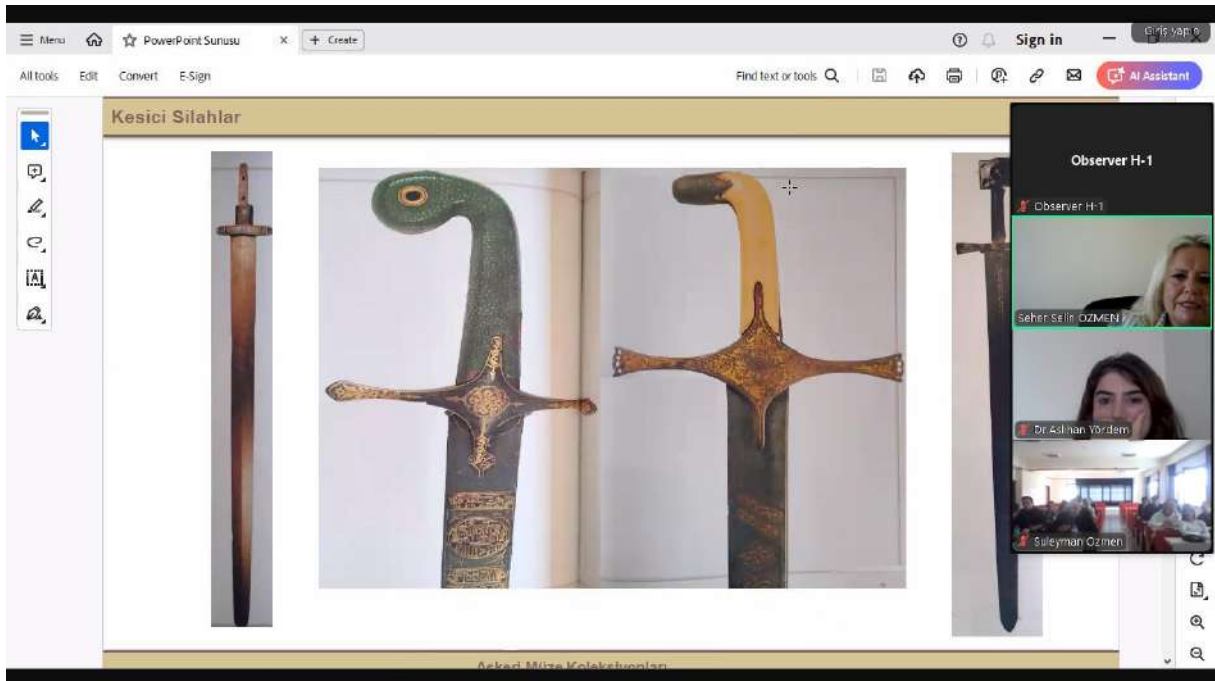
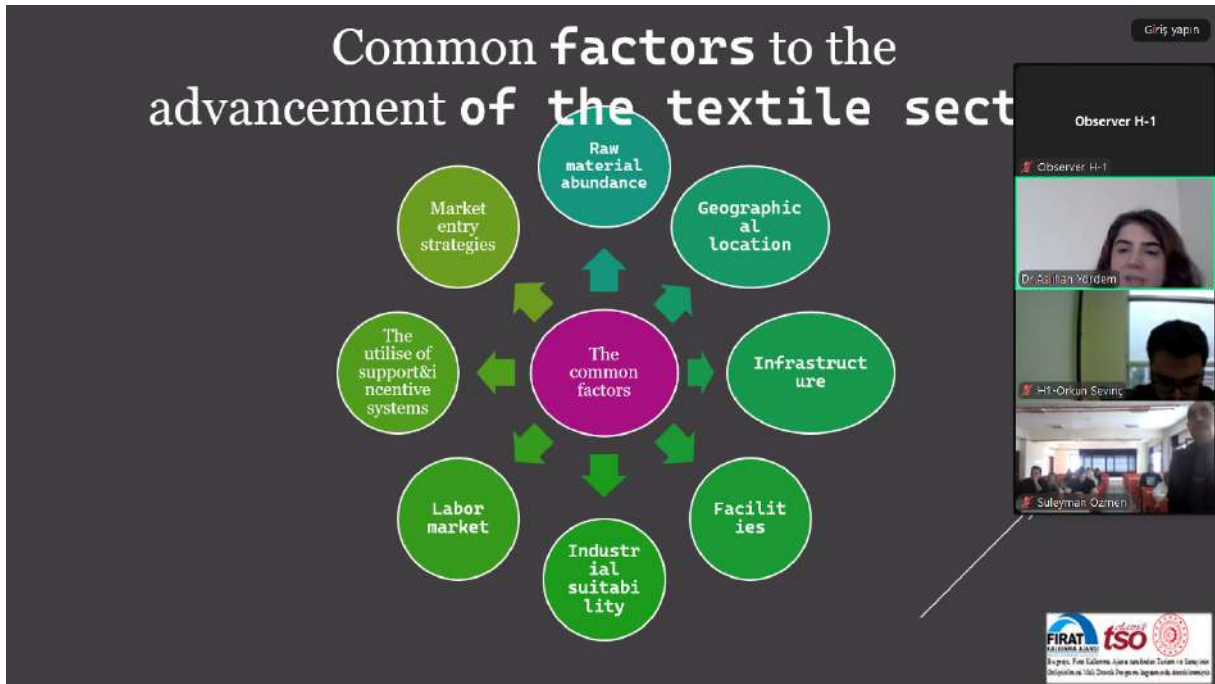


PHOTO GALLERY

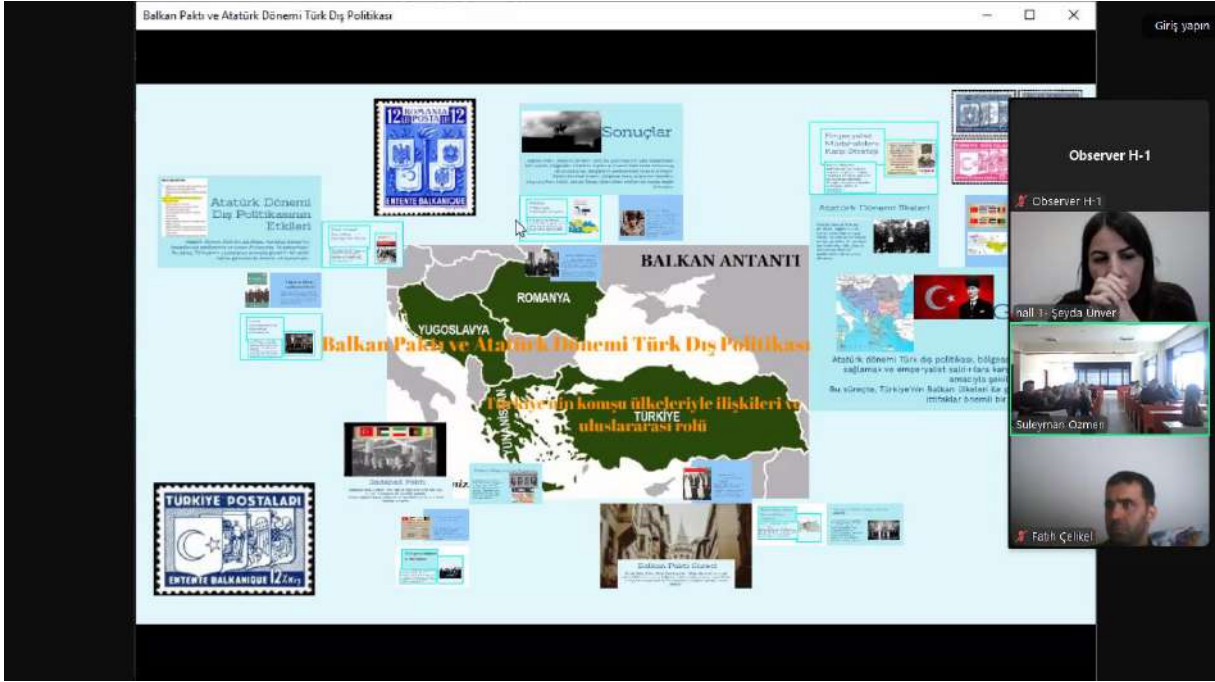


PHOTO GALLERY

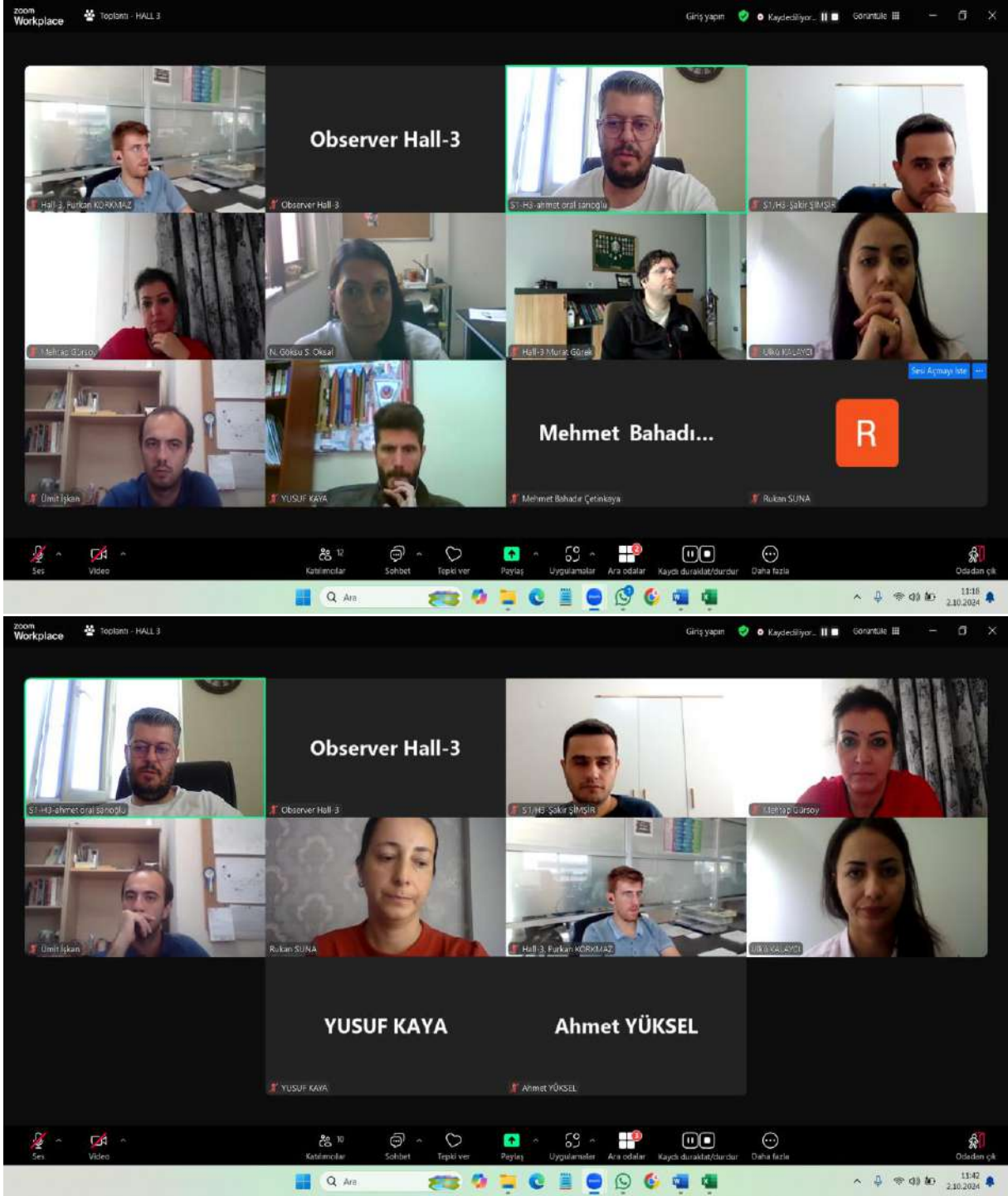


PHOTO GALLERY

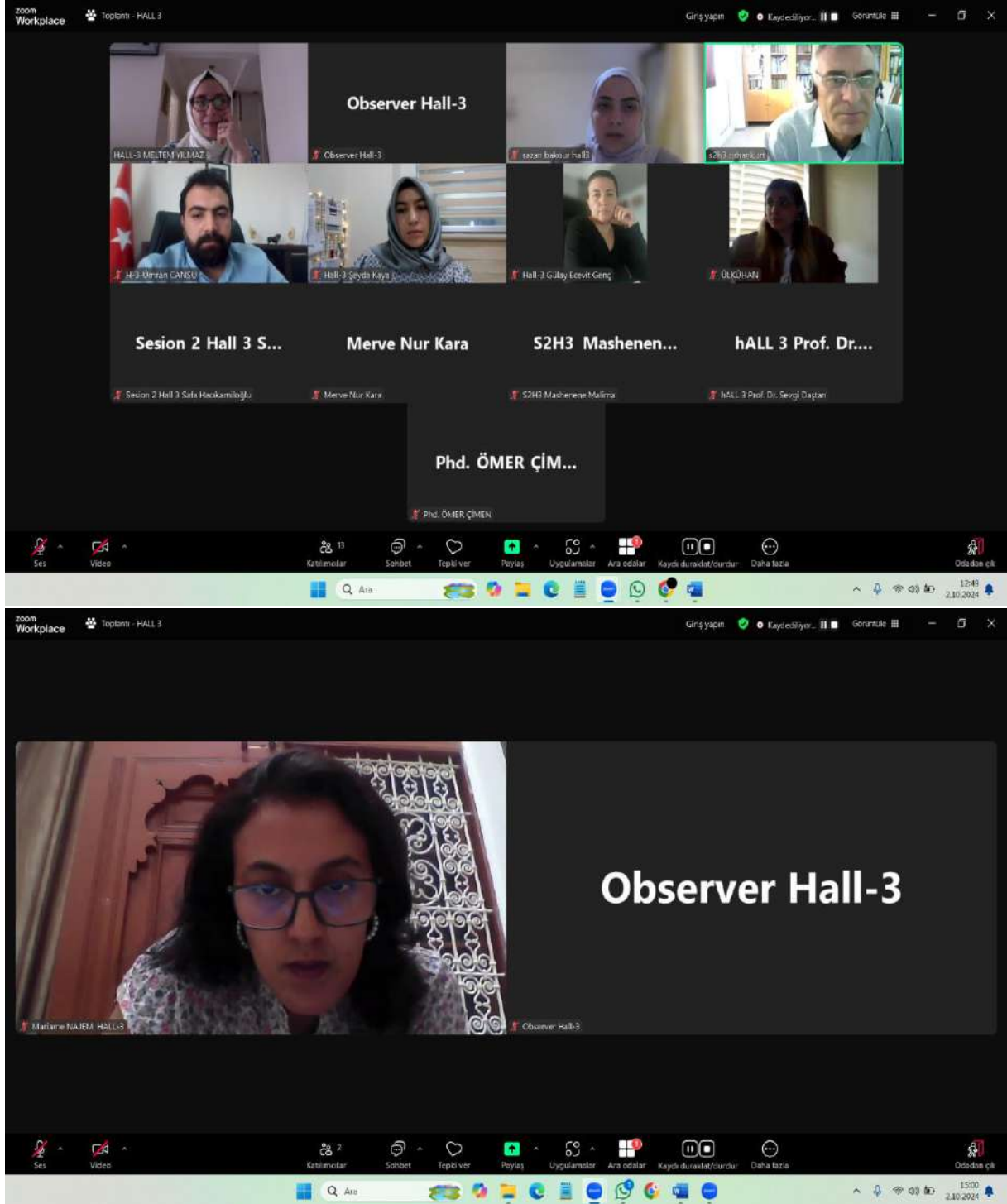


PHOTO GALLERY

The image displays two screenshots of a Zoom meeting photo gallery. The top screenshot shows a grid of 8 participants in a meeting titled "Zoom Toplantı - HALL 2". The participants are arranged in a 2x4 grid. The bottom screenshot shows a grid of 8 participants in a meeting titled "Zoom Toplantı - HALL 2". The participants are arranged in a 2x4 grid. The bottom screenshot also shows a large green square with a white 'h' in the center, which is a placeholder for a participant's video feed.

Top Screenshot Participants:

- Observer Hall-2
- H-2 Hatice SARIL
- Hall-2 İsmihan Hilal Emre
- Museyeva Aygün
- EMİNE CİNCIOĞLU
- NURGÜL ÖZDEMİR
- Doç. Dr. H. Kerem Hoşgör
- HALL2 PARVIN NAJAFGULIYEVA
- HALL 1 atanmamış katılımcı

Bottom Screenshot Participants:

- Observer Hall-2
- hall 2- HULYA KUCUKOGLU
- Hall-2: Tuğçe Kurt
- Hall-2: Sevilay KARAMUSTAFAOĞLU
- Dilek ÇAĞIRGAN
- ELIF SOZER
- Şeyma KOCA
- Emine Cincioğlu
- hicran Kaymaztürkmen
- esmbalacı

PHOTO GALLERY

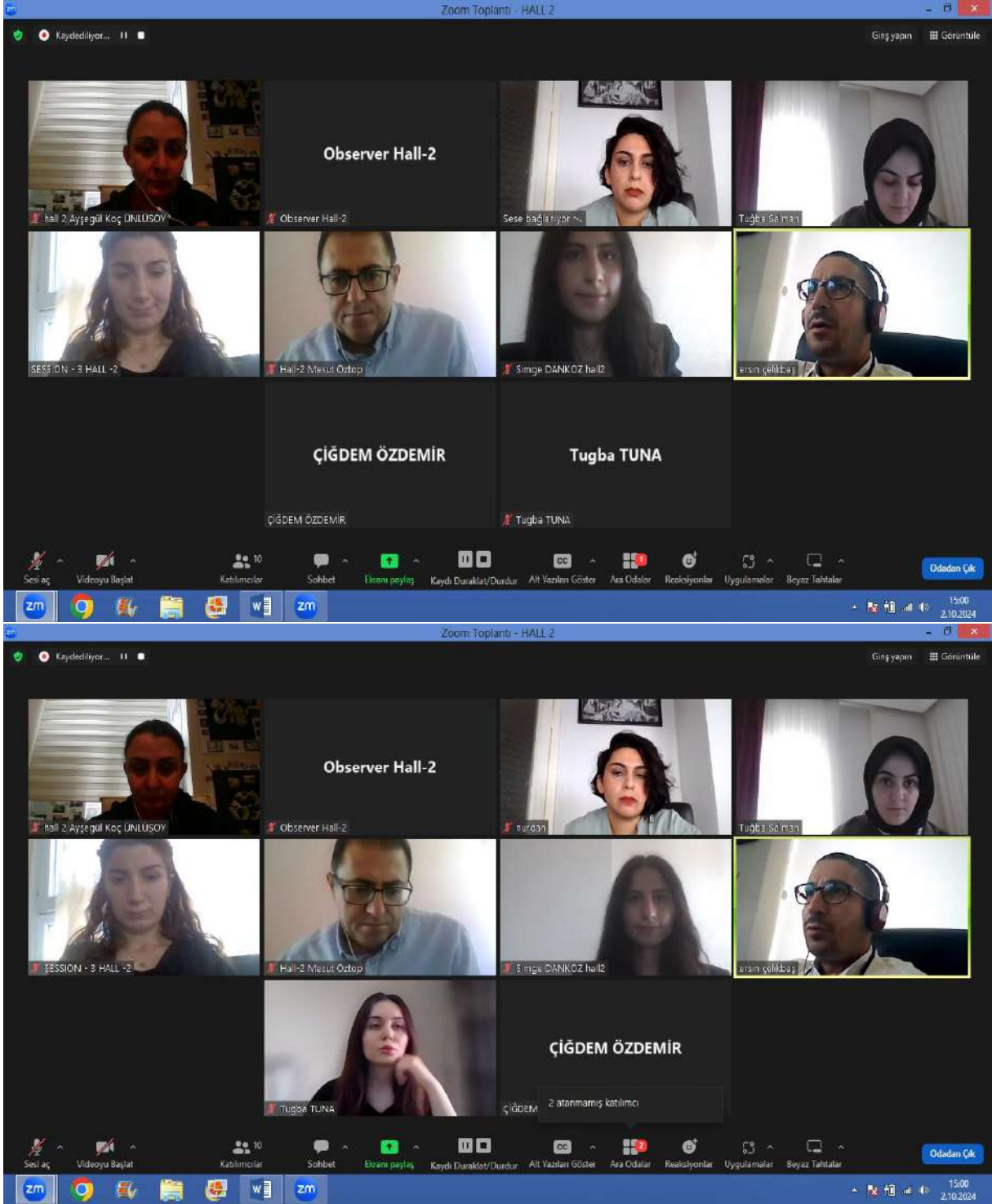


PHOTO GALLERY

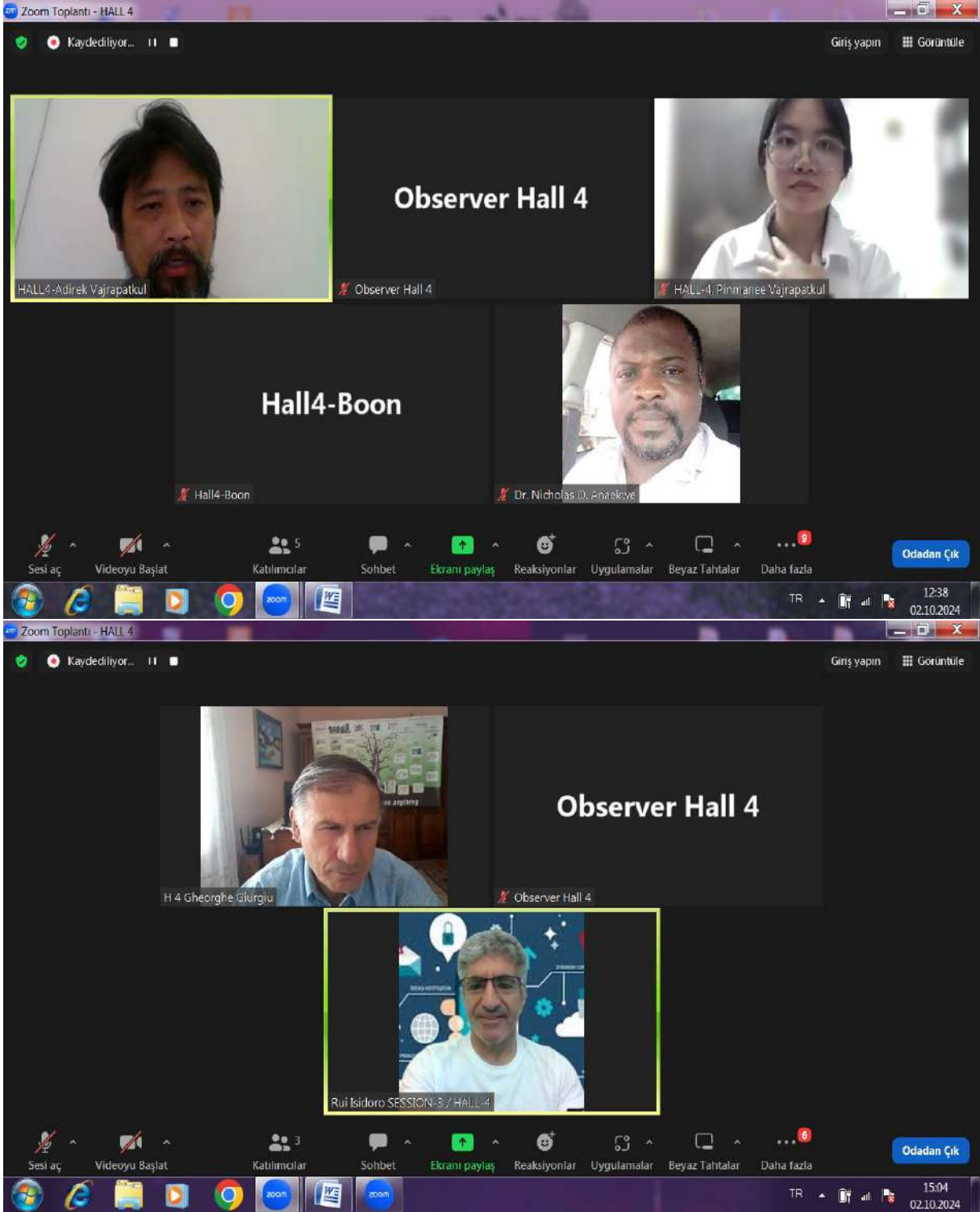


PHOTO GALLERY

The image displays two screenshots of a Zoom meeting interface. The top screenshot shows a presentation slide titled "Storytelling" with a bullet point: "Storytelling may be one of the very oldest human activities after the acquisition of language" (Archibald et al., 2013). The slide includes an image of ancient cave paintings. The bottom screenshot shows a presentation slide titled "ENERGY CRISIS – MASS MEDIA COVEREGE" (sic) with a sub-heading "Energy crisis". The text on the slide discusses the energy crisis of 2021-2022, its impact on communication, and compares it to the 2008-2009 crisis. It includes an image of a woman reading a newspaper. Both screenshots show the Zoom meeting controls at the bottom and the Windows taskbar at the very bottom.

zoom Workplace | Конференция | Экран (S1-H6-Valentina Marinescu) | Вход | Запись... | Вид | - | X

Observer Hall-6 | Observer Hall-6 | S1-H6-Valentina Marinescu

NUMER IN SOCIOLOGICAL TABLES - Microsoft PowerPoint pentru uz personal

Storytelling

- "Storytelling may be one of the very oldest human activities after the acquisition of language" (Archibald et al., 2013).

Se face clic pentru aăugare note

Активация Windows | windows, перейдите в

Звук | Видео | Участники | Чат | Отреагировать | Поделиться | Приложения | Пауза/остановить запись | Сессионные залы | Дополнительно | Выйти из зала

Поиск | 12°C Mostly cloudy | 10:08 02.10.2024

zoom Workplace | Конференция | Экран (S1-H6-Valentina Marinescu) | Вход | Запись... | Вид | - | X

Observer Hall-6 | Observer Hall-6 | session 1 Hall 6... | S1-H6-Valentina Marinescu | session 1 Hall 6 Mari...

ENERGY CRISIS – MASS MEDIA COVEREGE (sic) - Microsoft PowerPoint pentru uz personal

ENERGY CRISIS – MASS MEDIA COVEREGE

Energy crisis

The energy crisis of 2021 – 2022 shows the importance of communication in managing an unexpected situation with social, economic and geopolitical impact.

Unlike the previous crisis (2008 – 2009) - centered especially on the banking sector and, through reverberation, with effects in the labor market - the current energy crisis includes both the banking system and the entire production-distribution-sales chain and, simultaneously, the road net work (Menning, 2013).

Se face clic pentru aăugare note

Активация Windows | windows, перейдите в

Звук | Видео | Участники | Чат | Отреагировать | Поделиться | Приложения | Пауза/остановить запись | Сессионные залы | Дополнительно | Выйти из зала

Поиск | 12°C Mostly cloudy | 10:16 02.10.2024

PHOTO GALLERY

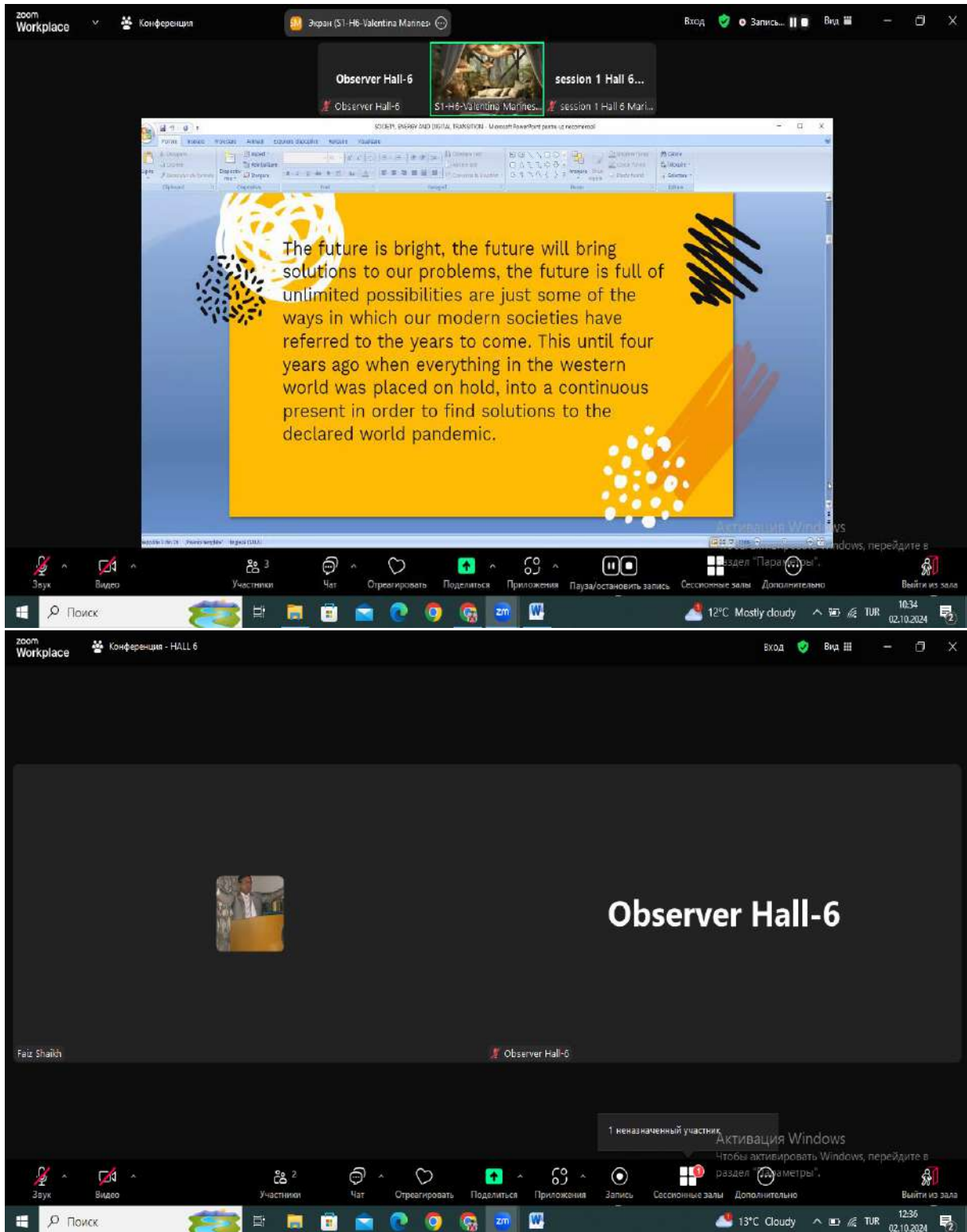


PHOTO GALLERY

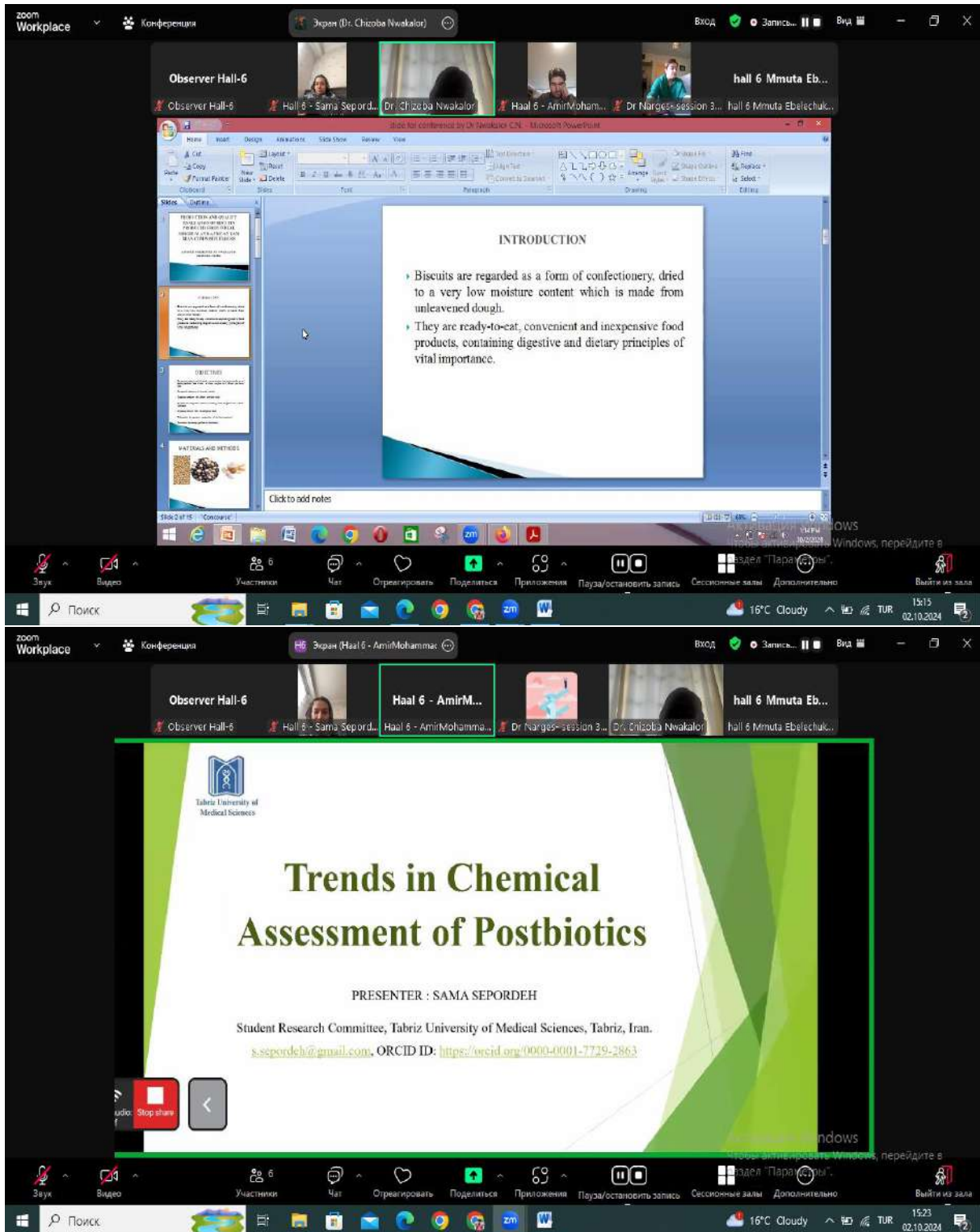


PHOTO GALLERY

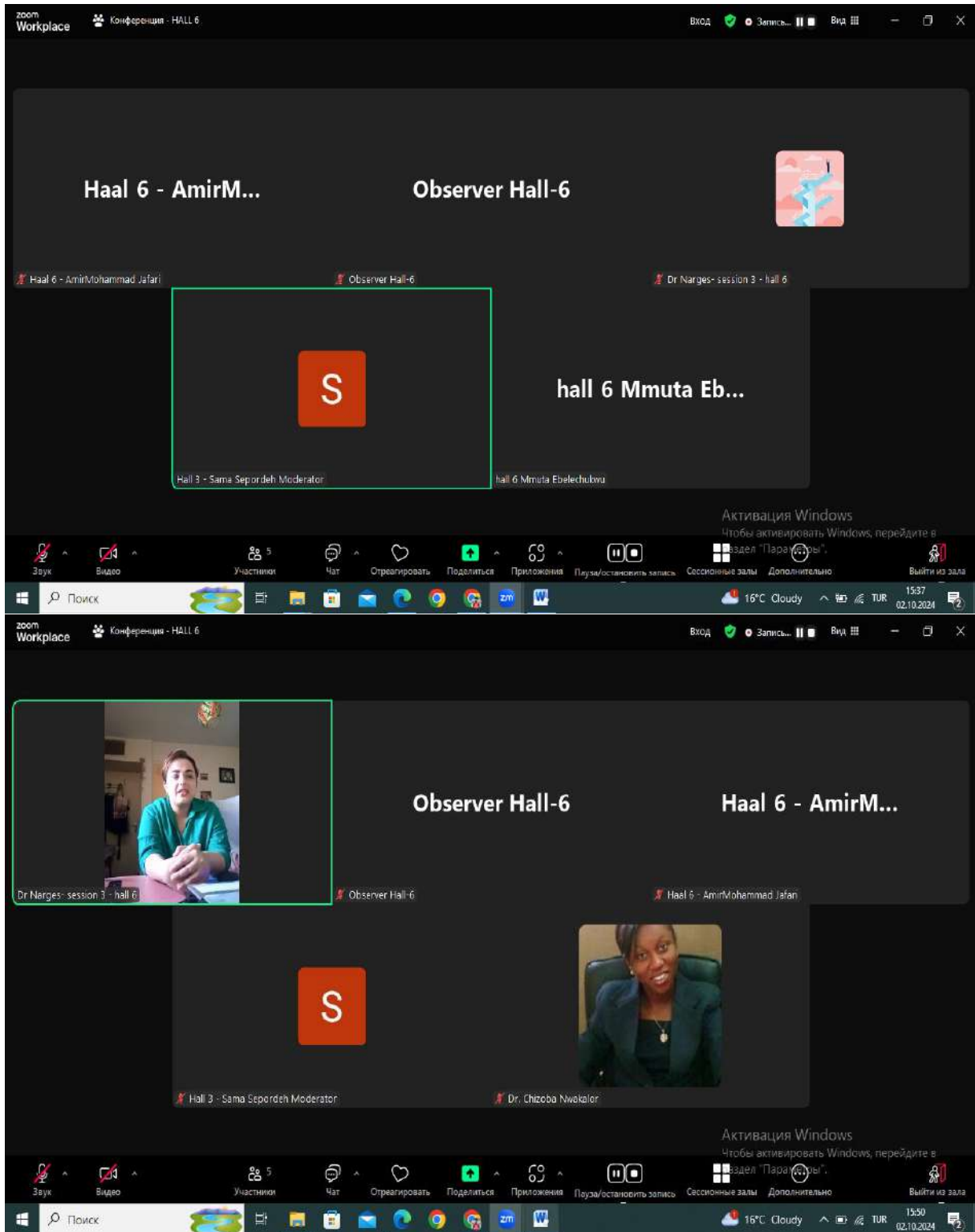


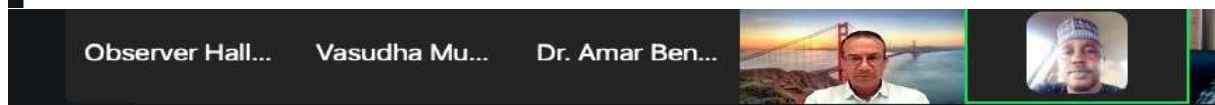
PHOTO GALLERY



INTRODUCTION

Social media platforms such as Facebook, Instagram, and Twitter have become an integral part of students' lives, offering spaces for self-expression, community building, and social interaction (Boyd, 2014). However, these platforms also present challenges, including concerns around privacy, self-esteem, and social pressure.

Constant engagement with social media is linked to shifts in students' behavior, including altered communication patterns, heightened exposure to cyberbullying, and the development of online personas that often differ from their offline identities (Valkenburg & Peter, 2011).



**INNOVATING EARLY CHILDHOOD EDUCATION: A PLAY-BASED LEARNING
APPROACH WITH TECHNOLOGY INTEGRATION**

by

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Jigawa State College of Education and Legal Studies, Ringim

Nigeria

**12th International ZEUGMA
CONGRESS ON SCIENTIFIC RESEARCH
OCTOBER 2-4, 2024
Gaziantep, Turkey**



PHOTO GALLERY

The screenshot shows a Zoom meeting interface. At the top, there are video thumbnails for participants: 'server Hall...', 'Vasudha Mu...', and three other individuals. Below the thumbnails is the Microsoft PowerPoint application window. The title bar reads 'SDG: SANI ABDULLAHI SULE - PowerPoint'. The ribbon includes 'Design', 'Transitions', 'Animations', 'Slide Show', 'Record', 'Review', 'View', and 'Help'. The 'Shape Format' ribbon is active, showing options for 'Shape Fill', 'Shape Outline', and 'Shape Effects'. The main content area displays a grid of 17 Sustainable Development Goal (SDG) icons. To the right of the icons is a slide with the following text:

Benefits Driven by Sustainable Development Goals (SDGs) for Developing Countries: A Systematic Review (2016-2024)

The Sustainable Development Goals (SDGs) are a global framework adopted by the United Nations in 2015 to address pressing challenges like poverty, inequality, and climate change. This review explores the wide-ranging benefits of SDG implementation for developing countries.

by SANI ABDULLAHI SULE

At the bottom of the Zoom window, there is a chat area with several participants: 'server Hall...', 'H5_FILALI S...', 'Dr. Amar Ben...', 'Moderator', 'server Hall-5', 'HALL-5, El Basri Moham...', 'H5_FILALI SALOUA', 'Dr. Amar Benyahia sessi...', 'Arkoparno De Sarkar', and 'Moderator - Prof.'.

12th INTERNATIONAL ZEUGMA CONGRESS ON SCIENTIFIC RESEARCH



CONGRESS PROGRAM
October 2-4, 2024 / Gaziantep, Türkiye

Identification and Characterization of Limestone Formations Using Electrical Tomography in the Ouled Abou Region (SW of Casablanca, Morocco)

Mohamed EL BASRI, Hasnaa HARMOUZI, Khalil El-Hami

PHOTO GALLERY

This screenshot shows a Zoom meeting in gallery view. The participants are arranged in a grid:

- Top-left: H1-Orkun Sevinç
- Top-middle: observer-1
- Top-right: Fatih Çelikel
- Middle-left: Dr. Aslihan Yördem
- Middle-middle: Hall-1, Ufuk BEKTAŞ
- Middle-right: Hall-1- Şeyda Ünver
- Bottom-middle: Suleyman Ozmen

The Zoom control bar at the bottom includes: Sesi aç, Videoyu Başlat, Katılımcılar (7), Sohbet, Ekranı paylaş, Kaydı Durdur/Durdur, Alt Yazıları Göster, Reaksiyonlar, Uygulamalar, Beyaz Tahtalar, Daha fazla, and Odadan Çık.

This screenshot shows a Zoom meeting in gallery view with a presentation slide displayed. The slide content is:

HAYAT BOYU ÖĞRENME, ULUSAL YETERLİLİKLER ÇERÇEVESİ VE MİKRO YETERLİLİKLER
LIFELONG LEARNING, NATIONAL QUALIFICATIONS FRAMEWORK, MICRO-CREDENTIALS

Prof. Dr. Özer Çelikoğlu, Lec. Orkan Sevinç
Barın University

II. ULUSLARARASI ZEUGMA BİLİMSEL ARAŞTIRMALAR KONGRESİ

The Zoom control bar at the bottom includes: Sesi aç, Videoyu Başlat, Katılımcılar (7), Sohbet, Ekranı paylaş, Kaydı Durdur/Durdur, Alt Yazıları Göster, Reaksiyonlar, Uygulamalar, Beyaz Tahtalar, Daha fazla, and Odadan Çık.

PHOTO GALLERY

The image shows a Zoom meeting interface. The top bar indicates the session is titled "Session-2/Hall-1 Mustafa KARAGÜLLE" and shows the user is logged in as "Kaydediliyor...". The main content area displays a presentation slide from LibreOffice Impress. The slide is titled "TROMBOSİTOPENİK HASTALARIN AYIRICI TANISINDA MENİBİR LABORATUVAR PARAMETRESİ : PLATELETEKRİT" and is presented by "Doç.Dr. Mustafa Karagülle" from the "Bilecik Şeyh Edebali Üniversitesi Tıp Fakültesi İç Hastalıkları ABD". The slide features a background of red blood cells and the university's logo. To the right of the slide, a gallery of participants is visible, showing several video feeds of attendees. The bottom bar of the Zoom interface includes controls for "Sesi aç", "Videoyu Başlat", "Katılımcılar", "Sohbet", "Ekranı paylaş", "Kaydı Duraklat/Durdur", "Alt Yazıları Göster", "Reskijyonlar", "Uygulamalar", "Beyaz Tahtalar", "Diğer", and "Odadan Çık". A notification indicates "3 atanmamış katılımcı".

Zoom Meeting: Session-2/Hall-1 Mustafa KARAGÜLLE

Kaydediliyor... Giriş yapın

SÖZLÜ SUNUM ZERİGMA KONGRESİ ppt - LibreOffice Impress

Doç.Dr. Mustafa Karagülle
Bilecik Şeyh Edebali Üniversitesi Tıp Fakültesi
İç Hastalıkları ABD

TROMBOSİTOPENİK HASTALARIN AYIRICI TANISINDA MENİBİR LABORATUVAR PARAMETRESİ : PLATELETEKRİT

hali-1-Esra Tuğçe Gül
H1-Observatör
H1-Beyza AVCI
HALL-1 mehmet aksoy
hali-1 merve çirak balta
Session-2/Hall-1 Mustafa KARAGÜLLE
hali-1 pelin ÇINAR İYİAPICI
Ata Elvan Hall 1
Yunus Emre Boga

3 atanmamış katılımcı

Sesi aç Videoyu Başlat Katılımcılar Sohbet Ekranı paylaş Kaydı Duraklat/Durdur Alt Yazıları Göster Reskijyonlar Uygulamalar Beyaz Tahtalar Diğer Odadan Çık

PHOTO GALLERY

The image shows a Zoom meeting interface. The main window displays a presentation slide with the following text:

**65 YAŞ VE ÜZERİ TİP 2 DM'Lİ BİREYLERDE
KOR STABİLİZASYON EGZERSİZLERİNİN
MOBİLİTE ÜZERİNE ETKİSİ**

Fzt.Pelin ÇINAR İYİYAPICI

02.10.2024

The interface also shows a gallery of participants on the right side, including:

- Hall 1-Esra Tuğçe Güllü
- H1-Observer
- H1-Beyza AVCI
- HALL-1 mehmet aksoy
- hall-1 merve çirak baltacı
- Session-2/Hall-1 Mustafa KA...
- hall-1 pelin ÇINAR İYİYAPICI
- Ata Elvan Hall 1

Below the gallery, the name **Yunus Emre Boga** is visible, along with a button for **Ara Odalar** (1) and a **Odadan Çık** button.

The bottom toolbar includes icons for: Sesi aç, Videoyu Başlat, Katılımcılar, Sohbet, Ekranı paylaş, Kaydı Durdur/Durdur, Alt Yazıları Göster, Reaksiyonlar, Uygulamalar, Beyaz Tahtalar, Daha fazla, and Odadan Çık.

The bottom section of the image shows a gallery of participants in a different view, including:

- HALL-1 Prof. Dr. Fatih Çalgıcı (SUBU-LEE)
- H1-Observer
- veli shakirmuruv
- HALL-1, Serhat Karaca
- İrem ALTINOK
- Aysegül Yücel (53-H1)
- Emir ESİM
- Seda Hatice Gökler
- beste funa
- ersan ay
- Hall 1 - Durul Dil...
- Hall 1 - Durul Dilden-Beymen

PHOTO GALLERY

The image displays a Zoom meeting interface. The top bar shows the meeting title "HALL-1, Serhat Karaca ekranını görüntüyorsunuz" and the status "Kaydediliyor...". The main content area is split into two parts. On the left, a presentation slide titled "Design of Coil Winding Machine" is shown, featuring two views: "Top View" and "Perspective View". The "Top View" shows a 3D model of the machine with labels for "Unloader Unit", "Tension Control Unit", and "Winding and Travers Units". The "Perspective View" shows a 3D model of the machine with a blue control panel. On the right, a grid of video thumbnails shows participants: Veli Shakhmurov, H1-Observer, HALL-1, Serhat Karaca, İrem ALTINOK, Emir ESİM, Seda Hatice Gökler, ersan ay, HALL-1 Prof. Dr. Fatih Çalığı, and beste.tuna. Below the thumbnails, a name card for "Aysegul Yucel (... Hall 1 - Durul D..." is visible. The bottom toolbar includes icons for "Sesi aç", "Videoyu Başlat", "Katılımcılar", "Sohbet", "Ekranı paylaş", "Kaydı Durdur/Durdur", "Alt Yazıları Göster", "Reaksiyonlar", "Uygulamalar", "Beyaz Tahtalar", "Daha fazla", and "Odadın Çık".

The second screenshot shows a Zoom meeting with a presentation slide titled "FARKLI KAOLEN KAYNAKLARININ SERAMİK SAĞLIK GEREÇLERİNDE SİR ÖZELLİKLERİNE ETKİLERİ". The slide features the "creavit" logo, the "ARGE Merkezi" logo, and the logo of "Uludağ University Faculty of Engineering". The text on the slide reads: "FARKLI KAOLEN KAYNAKLARININ SERAMİK SAĞLIK GEREÇLERİNDE SİR ÖZELLİKLERİNE ETKİLERİ". Below the title, the authors are listed: "Orçun ZİRRE¹, Besir HULAN TUNA², İrem ALTINOK³, Seray SİLİK⁴, Prof. Dr. Fatih ÇALIŞKAN⁵". At the bottom of the slide, it says: "Çalışmaların Sürdürülmesi İçin: 1611-14-15, Tokat'ta Yapılan Bilimsel İncelemeler". The Zoom interface shows the same grid of participants as the first screenshot, with a name card for "Hall 1 - Durul D..." visible.

12th INTERNATIONAL ZEUGMA CONGRESS ON SCIENTIFIC RESEARCH



CONGRESS PROGRAM

October 2-4, 2024 / Gaziantep, Türkiye

Zoom Meeting ID: 829 5595 6031

Zoom Passcode: 121212

<https://us02web.zoom.us/j/82955956031?pwd=w0m6CMCGx5AMjTxXePR7rle4kj5iJQ.1>

IMPORTANT, PLEASE READ CAREFULLY

- ❖ To be able to attend a meeting online, login via <https://zoom.us/join> site, enter ID "Meeting ID or Personal Link Name" and solidify the session.
- ❖ The Zoom application is free and no need to create an account.
- ❖ The Zoom application can be used without registration.
- ❖ The application works on tablets, phones and PCs.
- ❖ The participant must be connected to the session 5 minutes before the presentation time.
- ❖ All congress participants can connect live and listen to all sessions.
- ❖ Moderator is responsible for the presentation and scientific discussion (question-answer) section of the session.

Points to Take into Consideration - TECHNICAL INFORMATION

- ◆ Make sure your computer has a microphone and is working.
- ◆ You should be able to use screen sharing feature in Zoom.
- ◆ Attendance certificates will be sent to you as pdf at the end of the congress.
- ◆ Requests such as change of place and time will not be taken into consideration in the congress program.

Participants Countries: Türkiye, Azerbaijan, Nigeria, Romania, India, Lebanon, Pakistan, Portugal, Morocco, Iran, Algeria, Republic of Serbia, Ethiopia, Ukraine, Thailand

SESSION-1 / HALL-1	
02.10.2024/ 10:00-12:00 (Turkiye Time)	
Moderator: Asst. Prof. Süleyman ÖZMEN	
Zoom Meeting ID: 829 5595 6031 / Zoom Passcode: 121212	

AUTHOR	AFFILIATION	TITLE
Dr. Aslıhan YÖRDEM	<i>Istanbul University</i>	INTERNATIONAL TRADE IN THE TEXTILE AND RAW MATERIALS SECTOR: THE CASE OF GAZIANTEP
Dr. Ufuk BEKTAŞ	<i>Istanbul University- Cerrahpaşa</i>	BIBLIOMETRIC ANALYSIS of JOB SATISFACTION LITERATURE
Asst. Prof. Dr. Şeyda ÜNVER Prof. Dr. Ömer ALKAN	<i>Ataturk University</i>	SOCIODEMOGRAPHIC DETERMINANTS OF LIFE SATISFACTION DURING COVID-19 PERIOD WITH NEGATIVE BINOMIAL REGRESSION MODEL
Prof. Dr. Ömer ALKAN Asst. Prof. Dr. Şeyda ÜNVER	<i>Ataturk University</i>	FACTORS AFFECTING MIGRATION BEHAVIORS IN TURKEY DURING THE COVID-19 PERIOD
Asst. Prof. Süleyman ÖZMEN	<i>Istanbul Rumeli University, Global Policies Research and Implementation Center (RUPAM/GPRC)</i>	THE BALKAN PACT AND TURKISH FOREIGN POLICY IN THE ATATURK ERA
Dr. Fatih ÇELİKEL	<i>MEB, Incesu Anatolian Higher Education</i>	THE UNIVERSAL INTERPRETATION OF THE STORY OF PROPHET YUNUS IN COMMENTARIES
Dr. Fatih ÇELİKEL	<i>MEB, Incesu Anatolian Higher Education</i>	ANALYSIS OF THE WORK NAMED "THE WORD OF ALLAH" IN TERMS OF READING DIFFERENCES AND THE PHENOMENON OF MIRACLE
Lec. Özer ÇULHAOĞLU Lec. Orkun SEVINÇ	<i>Bartın University</i>	LIFE LONG LEARNING, NATIONAL QUALIFICATIONS FRAMEWORK, MICRO-CREDENTIALS
Asst. Prof. Seher Selin ÖZMEN	<i>Istanbul Rumeli University, Global Policies Research and Implementation Center (RUPAM/GPRC)</i>	THE CONTRIBUTION OF DATA ON OTTOMAN WEAPON TECHNOLOGY TO OTTOMAN ARCHAEOLOGY

SESSION-1 / HALL-2 02.10.2024/ 10:00-12:00 (Turkiye Time) Moderator: Assoc. Prof. Dr. NURGÜL ÖZDEMİR	
Zoom Meeting ID: 829 5595 6031 / Zoom Passcode: 121212	

AUTHOR	AFFILIATION	TITLE
MUSAYEVA Aygün Cavanşir qızı	<i>Azərbaycan Dövlət Pedaqoji Universiteti</i>	MODERN ÇAĞDA ÇOCUKLARDA GELİŞİM SORUNLARI
Lec. Dr. Ayşe TORAMAN KARAGÜLMEZ	<i>Zonguldak Bülent Ecevit University</i>	EFFECT OF DIABETIC FOOT AWARENESS TRAINING ON DIABETES KNOWLEDGE LEVELS OF ELDERLY CARE SERVICES PROGRAM STUDENTS
Lec. Dr. Ayşe TORAMAN KARAGÜLMEZ	<i>Zonguldak Bülent Ecevit University</i>	IMPORTANCE OF LIFE SPACE MOBILITY IN ELDERLY INDIVIDUALS
Haydar Kerem HOŞGÖR Hacer GÜNGÖRDÜ	<i>Usak University</i>	RELATIONSHIP BETWEEN ORGANIZATIONAL CLIMATE AND ORGANIZATIONAL TRUST IN HEALTH INSTITUTIONS: A META-ANALYSIS STUDY
PhD Hatice OKSAL Research Assistant PhD Emine CİNCİOĞLU	<i>Sakarya Training and Research Hospital, Child Advocacy Center Sakarya University</i>	EVALUATION OF POTENTIAL MENTAL CHANGES RELATED TO VISUAL FUNCTION IN PATIENTS RECEIVING INTRAVITREAL INJECTIONS
Assoc. Prof. Dr. NURGÜL ÖZDEMİR İMMİHAN HİLAL EMRE	<i>Gaziantep University</i>	HOW DO COGNITIVE APPRAISALS, FREE WILL AND DETERMINISM AFFECT THE SOCIAL FUNCTIONING OF INDIVIDUALS WITH SCHIZOPHRENIA?
Grad. Stu. Hatice SARI Asst. Prof. Elif Sibel ATIŞ TEKELİ	<i>Marmara University</i>	INVESTIGATION OF ANTHROPOMETRIC CHARACTERISTIC AND EXPLOSIVE POWER PARAMETERS OF YOUNG INDIVIDUALS PERFORMING REGULAR EXERCISE
P.H. NAJAFGULIYEVA	<i>Azerbaijan Medical University</i>	THE WAYS TO PREVENT RELAPSES IN PATIENTS WITH NON-SPECIFIC ULCERATIVE COLITS
Selda USUL ERGÖRÜN Prof. Hande ŞAHİN	<i>Kirikkale University</i>	INVESTIGATION OF WOMEN'S PSYCHOLOGICAL POWER PERCEPTION ACCORDING TO VARIOUS VARIABLES

SESSION-1 / HALL-3 02.10.2024/ 10:00-12:00 (Turkiye Time) Moderator: Asst. Prof. Ahmet Oral SARIOĞLU	
Zoom Meeting ID: 829 5595 6031 / Zoom Passcode: 121212	

AUTHOR	AFFILIATION	TITLE
Asst. Prof. Şakir ŞİMŞİR	<i>Nevşehir Hacı Bektaş Veli University</i>	BIO-INSPIRED SYMBOL DETECTION APPROACH FOR MIMO-FBMC/OQAM SYSTEM
Assoc. Prof. Dr. Mehtap GÜRSOY	<i>Aksaray University</i>	THE EFFECTS OF DIFFERENT GIBERELLIC ACID DOSES APPLIED TO RAPESEED (<i>Brassica napus</i> L.) CULTIVARS ON GERMINATION AND SEEDLING DEVELOPMENT
Lec. Ümit İŞKAN Lec. Ahmet YÜKSEL	<i>Yalova University</i>	A STUDY ON THERMODYNAMIC PROPERTIES OF REFRIGERANT MIXTURES CONTAINING R32 AS AN ALTERNATIVE TO R410A
Furkan KORKMAZ Mehmet Fatih KAYA Mehmet Bahadır ÇETİNKAYA Murat GÜREK	<i>Hasçelik Cable Co., R&D Center Erciyes University</i>	DETERMINATION OF THE DIMENSIONAL STRUCTURE OF ALUMINIUM CONDUCTOR CARBON FIBRE REINFORCED (ACFR) CORE WITH FINITE ELEMENT METHOD
Res. Asst. Dr. Yavuz Selim AKSÜT Asst. Prof. Dr. Yusuf KAYA Res. Asst. Kadir SÜNNETÇİ Asst. Prof. Dr. Onur DOĞAN	<i>Gümüşhane University</i>	THE POZZOLANIC POTENTIAL OF MINE WASTES IN ENVIRONMENTALLY FRIENDLY CONCRETE PRODUCTION
Yasin İlker SIZLI Asst. Prof. Nazire Göksu SOYDAN OKSAL	<i>Mersin University</i>	METEOROLOGICAL DROUGHT ANALYSIS IN İZMİR PROVINCE
Asst. Prof. Ahmet Oral SARIOĞLU	<i>Gaziantep University</i>	MIXED LIGAND METAL COMPLEXES WITH SCHIFF BASE AND 1,10-PHENANTHROLINE SYNTHESIS AND CHARACTERIZATION
Dr.Research Ass. Rukan SUNA KARATEKİN	<i>Mersin University</i>	THE EFFECT OF PRICKLY PEAR SEED EXTRACT ON THE CORROSION BEHAVIOR OF MILD STEEL IN ACIDIC ENVIRONMENTS
Dr. Ülkü KALAYCI ŞAHİNOĞLU	<i>Istanbul University-Cerrahpasa</i>	DUST FORMATION, ASSESSMENT METHODS, AND CONTROL IN BLASTING ACTIVITIES

SESSION-1 / HALL-4	
02.10.2024/ 10:00-12:00 (Turkiye Time)	
Moderator: Dr. Agbo, D.C.	
Zoom Meeting ID: 829 5595 6031 / Zoom Passcode: 121212	

AUTHOR	AFFILIATION	TITLE
Youssef ADNAN Brahim EL IBRAHIMI Nada Kheira SEBBAR Hassan OUACHTAK Abdelaziz AIT ADDI	<i>Ibn Zohr University Mohammed V University</i>	PERFORMANCE OF C4-SHOP A HETEROCYCLIC ORGANIC COMPOUND AGAINST CORROSION OF CARBON STEEL IN 1 M HCl: ELECTROCHEMICAL, THERMODYNAMIC AND THEORETICAL ASSESSMENT
Agbo, D.C. Okafor, U. Eze, N.C. Anyasi, R.O.	<i>Ebonyi State University Federal Polytechnic University of South Africa</i>	TOBACCO GROWTH IMPROVEMENT BY INDOLE ACETIC ACID (IAA) FOR THE CONTROL OF SOIL ORGANIC POLLUTION
Anaekwe, N. O. Uchechukwu, T.O. Chukwu, M. A Alomaja, F.	<i>Alex Ekwueme Federal University</i>	DETERMINATION OF THE CATION EXCHANGE CAPACITY AND SUITABILITY OF CLAY SAMPLES FROM IKWO FOR WASTEWATER TREATMENT
Noreen Sajjad Ayesha Sultan Syeda Laila Rubab	<i>University of Lahore University of Education</i>	OPTIMIZED PRODUCTION OF BIODIESEL VIA BASE-CATALYZED TRANSESTERIFICATION FROM NON-EDIBLE (TAMARINDUS INDICA) SEED OIL
DIAYI V.N. AKINLABI, A. K. FALOPE F.Y. MOSAKU A.M.	<i>Federal University of Agriculture</i>	EFFECT OF AFRICAN WALNUT SHELL (TETRACARPIDIUM CONOPHORUM) ON THE PHYSICO-MECHANICAL PROPERTIES OF MODIFIED AND UNMODIFIED NATURAL RUBBER.
Ajmal Shah Asad Ullah Aleena Faridoon Khan	<i>Abdul Wali Khan University</i>	FABRICATION AND CHARACTERIZATION OF A NEW GREEN ADSORBENT MADE OF CHITOSAN/RICE HUSK BIOCHAR-BASED COMPOSITE FOR ADSORPTIVE REMOVAL OF METHYLENE BLUE
Huma Ikram Shehar Bano Darakhshan Jabeen Haleem	<i>University of Karachi</i>	REPURPOSING THE ANTIHYPERTENSIVE DRUG FENFLURAMINE AS AN ANTIPILEPTIC AGENT

SESSION-1 / HALL-5 02.10.2024/ 10:00-12:00 (Turkiye Time) Moderator:	
Zoom Meeting ID: 829 5595 6031 / Zoom Passcode: 121212	

AUTHOR	AFFILIATION	TITLE
DR. CHUKWUEMEKA G. EME	<i>National Open University of Nigeria (NOUN)</i>	THE EFFECTS OF STRATEGIC INTELLIGENCE ON COMPETITIVE ADVANTAGE IN THE NIGERIAN FOOD AND BEVERAGE MANUFACTURING INDUSTRY
DR EME, CHUKWUEMEKA, G	<i>National Open University of Nigeria (NOUN)</i>	GLOBALIZATION OF ECONOMIES AND THE SUSTAINABLE DEVELOPMENT OF THREE SELECTED EURO-DOLLAR COUNTRIES
Dr Josiane El Khoury Julie Botti	<i>University of Balamand</i>	INVOLVEMENT IN ADVERTISING: EXAMINING THE EFFECT OF IDENTIFICATION THEORY CHARACTERISTICS – CASE STUDY: BEIRUT BEER ADS BETWEEN 2015 AND 2024
Mohammed Adem Bekele Dr. Preethi Keerthi Dsouza	<i>Mangalore University Wollo University</i>	IMPACT OF DEBT AND DIVIDEND POLICY ON FIRM PERFORMANCE: EMPIRICAL INSIGHTS FROM ETHIOPIA
Rasool Bux Junejo Dr.Faiz Muhammad Shaikh Dr.Liaquat Ali Bhutto Muhammad Zafar Wassan Syed Mehtab Ali Shah Eng. Syed Mujeeb Hyder Shah	<i>University of Larkano</i>	WOMEN ENTREPRENEURSHIP AND HONOUR KILLING OF WOMEN IN SMES BUSINESS: A CASE STUDY OF THULL DISTRICT JACOBABAD
Dr. Daniel Marcel Charity Adamu Medugu Mohammed Alhaji Musa	<i>Mudiame University Irrua Federal Polytechnic Mubi</i>	MODERATING EFFECT OF GOVERNMENT SUPPORT ON THE RELATIONSHIP BETWEEN LOCAL BUSINESS ENVIRONMENT ON SMEs PERFORMANCE IN ADAMAWA STATE, NIGERIA

SESSION-1 / HALL-6 02.10.2024/ 10:00-12:00 (Turkiye Time) Moderator: Professor, Valentina MARINESCU	
Zoom Meeting ID: 829 5595 6031 / Zoom Passcode: 121212	

AUTHOR	AFFILIATION	TITLE
Abdul Haque Khan, Lecturer Dr Abdullah Khan Seema Sadiq, Asst. Prof.	<i>A.G.I.C. K. Delhi University S.N.C.</i>	UNEXPECTED SOCIAL CHALLENGES DURING PANDEMIC
Horia Vicențiu Pătrașcu	<i>National University of Science and Technology</i>	A FORGOTTEN PHILOSOPHICAL PROBLEM: THE HARMFULNESS OF HOPE
Professor, Valentina MARINESCU Lecturer, Ramona MARINACHE	<i>University of Bucharest</i>	HUMOR IN SOCIOLOGICAL TALES
Lecturer, Ramona MARINACHE Professor, Valentina MARINESCU	<i>University of Bucharest</i>	WOMEN MOTORCYCLISTS – SOCIOLOGICAL INSIGHTS
Annisatul Fadilah	<i>UIN KH. ABDURRAHMAN WAHID PEKALONGAN</i>	BALANCING DIFFERENCES: CHALLENGES AND OPPORTUNITIES FOR HARMONIZING SCIENCE AND RELIGION
Professor, Valentina MARINESCU Dr., Anda Anca RODIDEAL Lecturer, Ramona MARINACHE	<i>University of Bucharest Bucharest City Center for Educational Resources and Assistance</i>	ENERGY CRISIS – MASS MEDIA COVEREGE
Lecturer, Ramona MARINACHE Professor, Valentina MARINESCU Dr., Anda Anca RODIDEAL	<i>University of Bucharest Bucharest City Center for Educational Resources and Assistance</i>	SOCIETY, ENERGY AND DIGITAL TRANSITION
Najwatul Istiqomah Isnaeni Mutiara	<i>UIN K.H. Abdurrahman Wahid Pekalongan</i>	STRATEGIES FOR INTERNALIZING RELIGIOUS MODERATION VALUES

SESSION-2 / HALL-1 02.10.2024/ 12:30-14:30 (Turkiye Time) Moderator: Ass.Prof, Mustafa KARAGÜLLE	
Zoom Meeting ID: 829 5595 6031 / Zoom Passcode: 121212	

AUTHOR	AFFILIATION	TITLE
Ass.Prof, Mustafa KARAGÜLLE	<i>Bilecik Şeyh Edebali University</i>	A NEW LABORATORY PARAMETER IN DIFFERENTIAL DIAGNOSIS OF THROMBOCYTOPENIC PATIENTS: PLATELETECRIT
Dr. Merve ÇIRAK BALTA Dr. Büşra EKINCI Asst. Prof. Dr. İbrahim Halil ERDOĞDU Asst. Prof. Dr. Nesibe KAHRAMAN ÇETİN Prof. Dr. Nil ÇULHACI	<i>Van Yüzüncü Yıl University Aydın State Hospital Aydın Adnan Menderes University</i>	EVALUATION OF MUTATION PROFILE DETECTED BY NEXT GENERATION SEQUENCING IN PROSTATE ADENOCARCINOMAS AND ITS RELATIONSHIP WITH HISTOPATHOLOGICAL PARAMETERS
Ümit AKAY Didem KARADİBAK Ata ELVAN	<i>Dokuz Eylül University Izmir University of Economics</i>	FAZLA KİLOLU VE OBEZ BİREYLERDE KRONİK HASTALIK VARLIĞININ SOLUNUM KAS KUVVETİ ÜZERİNE ETKİSİ
Prof. Dr. Aida ŞAHMUR Prof. Dr. Veli ŞAHMUROV	<i>Antalya Bilim University</i>	THE GLOBAL DYNAMICS OF CONVENTIONAL CANCER TUMOR GROWTH MODEL
Veli Shakhmurov Rishad Shakhmurov	<i>Antalya Bilim University University of Alabama</i>	THE SEPARABILITY PROPERTIES OF NONLOCAL GINZBURG-LANDAU TYPE EQUATIONS
Pelin CINAR İYİYAPICI Asst. Prof. Günseli USGU	<i>Hasan Kalyoncu University</i>	65 YAŞ ve ÜZERİ Tip 2 DM'li BİREYLERDE KOR STABİLİZASYON EGZERSİZLERİNİN MOBİLİTE ÜZERİNE ETKİSİ
Yasemin GÜMÜŞTAŞ Res. Asst. Yunus Emre BOGA	<i>Cukurova University Iğdır University</i>	INVESTIGATION OF COLOR FORMATION IN HONEY AND FACTORS AFFECTING THE CHANGE OF HONEY COLOR
Phd.St.Mehmet AKSOY Prof.Dr.Hatice ERÖKSÜZ	<i>Elazığ Veterinary Control Institute Fırat University</i>	TAZE DOKU İLE FPPE DOKULARDA qRT-PCR YÖNTEMİYLE DOĞAL KUDUZ VİRÜSÜ TESPİTİNİN KARŞILAŞTIRMASI
Vet. Med. Beyza AVCI Prof. Dr. Kader YILDIZ	<i>Kirikkale University</i>	CYSTOSPOROSIS IN CATS
Res. Asst. Dr. Esra Tuğçe GÜL Prof. Dr. Osman OLGUN Lec. Dr. Seyit Ahmet GÖKMEN Prof. Dr. Yusuf CUFADAR Assoc. Prof. Dr. Behlül SEVİM	<i>Selcuk University Ondokuz Mayıs University Aksaray University</i>	EFFECT OF USING PREBIOTIC ADDED WHEAT INSTEAD OF CORN IN MALE BROILER DIETS ON PERFORMANCE AND SLAUGHTERING CHARACTERISTICS

SESSION-2 / HALL-2 02.10.2024/ 12:30-14:30 (Turkiye Time) Moderator: Prof. Dr. Dilek ÇAĞIRGAN Zoom Meeting ID: 829 5595 6031 / Zoom Passcode: 121212	
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AUTHOR	AFFILIATION	TITLE
Asst. Prof. Hülya KÜÇÜKOĞLU	<i>Bozok University</i>	MINDFULNESS IN LANGUAGE TEACHING
Asst. Prof. Dr. Ercan BARAN	<i>Bingol University</i>	REVIEW OF BRUCE MASTERS' BOOK 'THE ARABS OF THE OTTOMAN EMPIRE (1516-1918) A SOCIAL AND CULTURAL HISTORY'
Asst. Prof. Dr. Ercan BARAN	<i>Bingol University</i>	TRACING THE LOVE OF IMADUDDIN IN THE BOOK OF CORCI ZEYDAN 'SALADIN AYYUBI'
Şeyma KOCA Prof. Dr. Mümtaz SARIÇİÇEK	<i>Erciyes University</i>	PERSONA ARCHETYPE IN MELİH CEVDET ANDAY'S THEATER PLAY TITLED INSPECTORS
Tuğçe KURT Prof. Sevilay KARAMUSTAFAOĞLU	<i>Amasya University</i>	EXAMINING THE SELF-REGULATION SKILLS OF MIDDLE SCHOOL STUDENTS AT DIFFERENT LEARNING LEVELS
Esmâ BALCI Assoc. Prof. Dr. Esra BENLİ ÖZDEMİR	<i>Ministry of Education Gazi University</i>	2023 KAHRAMANMARAŞ DEPREMİ SONRASI ORTAOKUL ÖĞRENCİLERİNİN "DEPREM" KAVRAMINA YÖNELİK BİLİŞSEL YAPILARININ VERİ ÇEŞİTLEMESİ YOLUYLA İNCELENMESİ: HATAY İLİ ÖRNEĞİ
Hicran KAYITMAZTÜRKMEN Assoc. Prof. Dr. Yalçın KARALI	<i>İnönü University</i>	SINIF ÖĞRETMENLERİNİN İLKOKUMA YAZMA SÜRECİNDE KARŞILAŞTIKLARI ÖĞRENCİ KAYNAKLI SORUNLARIN İNCELENMESİ
Res. Asst. Elif SÖZER Prof. Dr. Dilek ÇAĞIRGAN	<i>IstanbulUniversity-Cerrahpaşa</i>	EXAMPLES OF MATERIALS USED BY PROSPECTIVE MATHEMATICS TEACHERS TO RELATE LENGTH MEASUREMENTS TO DAILY LIFE
Prof. Dr. Dilek ÇAĞIRGAN Res. Asst. Elif SÖZER	<i>IstanbulUniversity-Cerrahpaşa</i>	THE MATERIALS IDENTIFIED BY PRE-SERVICE MATHEMATICS TEACHERS ON MAKING CONNECTIONS WITH DAILY LIFE IN GEOMETRY TEACHING

SESSION-2 / HALL-3	
02.10.2024/ 12:30-14:30 (Turkiye Time)	
Moderator: Prof. Dr. Orhan KURT	
Zoom Meeting ID: 829 5595 6031 / Zoom Passcode: 121212	

AUTHOR	AFFILIATION	TITLE
Meltem YILMAZ Assoc. Prof. Dr. Gülay ECEVİT GENÇ	<i>Istanbul University Istanbul University Health Sciences Institute</i>	MEDICAL AND VETERINARY USE OF VERBASCUM SPECIES: AN ETHNOBOTANICAL REVIEW
Şeyda KAYA Eda SÖNMEZ GÜRER Beyza Nur KILIÇ Merve TURAN Taner DAŞTAN	<i>Gaziantep Islam Science and Technology University Sivas Cumhuriyet University</i>	THE DETERMINATION OF ANTICANCER EFFECT OF Elettaria cardamomum L. PLANT ON HELA AND MCF-7 CELL LINES
Asst. Prof. Ümran CANSU	<i>Harran University</i>	GELATIN EXTRACTION FROM FISH SCALES: THE INFLUENCE OF EXTRACTION TEMPERATURE ON GELATIN YIELD AND SOME PROPERTIES
Assoc. Prof. Tuğça BİLENLER KOÇ Lec. Ülkühan BAĞIŞ Prof.İhsan KARABULUT	<i>Inonu University Cumhuriyet University</i>	EFFECT OF ENCAPSULATED CLARY SAGE OIL ON PATHOGENIC FOOD CONTAMINANTS
MAMMADOVA Zulfiyya Jalal qizi GURBANOV Elshad Majnun oglu	<i>Baku State University</i>	SPECIES COMPOSITION AND STRUCTURE OF JUNIPERUSETA-ELYTRIGIASETUM- TRIFOLIOSUM FORMATION IN THE MOUNTAIN XEROPHYTE (FRIGANA) VEGETATION OF AZERBAIJAN
Res. Asst. M. Safa HACİKAMİLOĞLI Res. Asst. Merve Nur KARA Prof. Dr. Orhan KURT	<i>Ondokuz Mayıs University</i>	EFFECT OF GERMINATION TEMPERATURE ON GERMINATION PARAMETERS IN WHEAT
Agri. Engineer Mashenene, C. MALİMA Res. Asst. M. Safa HACİKAMİLOĞLI Prof. Dr. Orhan KURT	<i>Ondokuz Mayıs University</i>	EFFECT OF GERMINATION TEMPERATURE ON GERMINATION PARAMETERS IN COTTON
Res. Asst. Yunus Emre BOGA Ömer ÇİMEN	<i>Iğdır University Niğde Ömer Halisdemir University</i>	ALTERNATİF YEM HAMMEDDESİ OLARAK SOYA FASULYESİ YERİNE BEZELYE PROTEİNİ KULLANIMI
Razan BAKOUR Asst. Prof. Gülay ECEVİT GENÇ	<i>Istanbul University Istanbul University Health Sciences Institute</i>	OVERVIEW OF ETHNOBOTANICAL AND MEDICINAL USES OF MORINGA PEREGRINA FIORI

SESSION-2 / HALL-4 02.10.2024/ 12:30-14:30 (Turkiye Time) Moderator: Dr. Adirek Vajrapatkul	
Zoom Meeting ID: 829 5595 6031 / Zoom Passcode: 121212	

AUTHOR	AFFILIATION	TITLE
Adirek Vajrapatkul Boonta Wayupab Pinmanee Vajrapatkul	<i>Sukhothai Thammathirat Open University</i> <i>Central Food Retail Company Limited</i> <i>Srinakharinwirot University</i>	DYNAMIC RELATIONSHIPS AND STRUCTURAL BREAKS IN TECHNOLOGY STOCKS
Adirek Vajrapatkul Boonta Wayupab Pinmanee Vajrapatkul	<i>Sukhothai Thammathirat Open University</i> <i>Central Food Retail Company Limited</i> <i>Srinakharinwirot University</i>	LIFE EXPECTANCY CYCLE
Adirek Vajrapatkul Boonta Wayupab Pinmanee Vajrapatkul	<i>Sukhothai Thammathirat Open University</i> <i>Central Food Retail Company Limited</i> <i>Srinakharinwirot University</i>	THE DETERMINANTS OF COAL RENT
Adirek Vajrapatkul Boonta Wayupab Pinmanee Vajrapatkul	<i>Sukhothai Thammathirat Open University</i> <i>Central Food Retail Company Limited</i> <i>Srinakharinwirot University</i>	VAR MODEL APPLICATION IN ECONOMIC AND DEMOGRAPHIC VARIABLE ANALYSIS
Adirek Vajrapatkul Boonta Wayupab Pinmanee Vajrapatkul	<i>Sukhothai Thammathirat Open University</i> <i>Central Food Retail Company Limited</i> <i>Srinakharinwirot University</i>	FACTORS INFLUENCING HOUSEHOLD CONSUMPTION
Adirek Vajrapatkul Boonta Wayupab Pinmanee Vajrapatkul	<i>Sukhothai Thammathirat Open University</i> <i>Central Food Retail Company Limited</i> <i>Srinakharinwirot University</i>	A VAR PERSPECTIVE ON AGRICULTURE, MANUFACTURING, AND INCOME
Mohd Kaif Qurratul Ain Ali	<i>Aligarh Muslim University</i>	SUBSTANCE ABUSE AND GENDER-BASED VIOLENCE: IMPACT OF MALE ADDICTION ON DOMESTIC CONFLICTS

SESSION-2 / HALL-5	
02.10.2024/ 12:30-14:30 (Turkiye Time)	
Moderator: Associate Prof. Dr. Mohammad Shah ZAKI	
Zoom Meeting ID: 829 5595 6031 / Zoom Passcode: 121212	

AUTHOR	AFFILIATION	TITLE
Vasudha Mudgal Dr. Nishi Tyagi	<i>Swami Vivekanand Subharti University Chaudhry Charan Singh University</i>	THE IMPACT OF SOCIAL MEDIA USAGE ON STUDENT BEHAVIOUR AND DIGITAL IDENTITY MANAGEMENT
Associate Prof. Dr. Mohammad Shah ZAKI	<i>Istinye University</i>	MISPRONUNCIATION OF ENGLISH CONSONANTS /S/ AND /H/ PRECEEDING CONSONANTS AND VOWELS BY AFGHAN STUDENTS
Baffa Bashari Ibrahim	<i>Jigawa State College of Education and Legal Studies</i>	INNOVATING EARLY CHILDHOOD EDUCATION: A PLAY-BASED LEARNING APPROACH WITH TECHNOLOGY INTEGRATION
Dr. Felicia KING-AGBOTO Dr. Letam Nbane NNA-KUE Dr. Christine Njunne ABIKWEH	<i>Captain Elechi-Amadi Polytechnic Rivers State University Ignatius Ajuru University of Education</i>	FACTORS RESPONSIBLE FOR AGGRESSIVE BEHAVIOR AMONG SECONDARY SCHOOL STUDENTS
Ahmad Abubakar Fauziyya Sa'idu Sama'ila Hassan	<i>Umaru Musa Yar'adua University</i>	COMPARATIVE STUDY OF STUDENTS' ACADEMIC PERFORMANCE IN CHEMISTRY WHEN TAUGHT USING DEMONSTRATION AND LECTURE METHOD AMONG SENIOR SECONDARY SCHOOL IN KATSINA ZONAL EDUCATION QUALITY ASSUARANCE (KZEQA)
Lecturer GABRIEL C. GHERASIM	<i>Babeş-Bolyai University</i>	PHASES IN THE HISTORICAL DEVELOPMENT OF CULTURAL DIPLOMACY
Ivana BALTEZAREVIĆ Radoslav BALTEZAREVIĆ	<i>Megatrend University Institute of International Politics and Economics</i>	COMPREHENDING SUBCONSCIOUS CONSUMER BEHAVIOR IN THE DIGITAL AGE VIA NEUROMARKETING
Sani Abdullahi Sule	<i>Saadatu Rimi University of Education Universitas Sebelas Maret UNS</i>	BENEFITS DRIVEN BY SUSTAINABLE DEVELOPMENT GOALS (SDGS) FOR DEVELOPING COUNTRIES: A SYSTEMATIC REVIEW (2016-2024)

SESSION-2 / HALL-6 02.10.2024/ 12:30-14:30 (Turkiye Time) Moderator: Dr.Faiz Muhammad Shaikh	
Zoom Meeting ID: 829 5595 6031 / Zoom Passcode: 121212	

AUTHOR	AFFILIATION	TITLE
Balogun D.O. Yusuf Z. Okewu A.A. Ibrahim A. Mshelia A.N. Iliyasu H.S.	National Biotechnology Development Agency (NABDA) Kaduna State University Ahmadu Bello University	COMPARATIVE ASSESSMENT OF GROUNDWATER AND SURFACE WATER QUALITY IN GWANTU TOWN, KADUNA STATE
Ebelechukwu C. Mmuta Chimeebele A. Echekeba Josephat O. Ogbuagu RoseMary U. Arinze Adaora S. Ogbuagu Juliana O. Ndubisi	<i>National Biotechnology Research And Development Agency Nnamdi Azikiwe University Federal University of Allied Health Sciences</i>	BIOACTIVE COMPOUNDS IN BUTANOLIC EXTRACT OF MUNG BEAN (<i>Vigna radiata</i>) ROOT
Ahmadu, Onyinoyi. Martha Adeboye, Seyi Egun Adeshina, Dolapo Adetokunbo	<i>National Biotechnology Research Development Agency</i>	EFFECTS OF HYDROPRIMING DURATION AND ROOT PRUNING ON THE GROWTH AND DRY MATTER ACCUMULATION OF TOMATO SEEDLINGS
Njoku-Onu, K A Prof S N Ibe	<i>National Biotechnology Development Agency Michael Okpara University of Agriculture</i>	PHENOTYPIC CHARACTERIZATION OF GOATS IN EBONYI STATE, SOUTH EAST NIGERIA
M. S. Abubakar A. U. Aliyu	<i>Bayero University</i>	A COMPREHENSIVE CHARACTERIZATION AND ENERGY POTENTIAL ANALYSIS OF MUNICIPAL AND VEGETABLE WATES FOR SUSTAINABLE BIOENERGY PRODUCTION IN NORTHERN NIGERIA
Rasool Bux Junejo Dr.Faiz Muhammad Shaikh Dr.Liaquat Ali Bhutto Muhammad Zafar Wassan Syed Mehtab Ali Shah Eng. Syed Mujeeb Hyder Shah	<i>University of Larkano</i>	CLIMATE CHANGE AND WOMEN PARTICIPATION IN CHICKPEA PRODUCTION IN LARKANA-SINDH- PAKISTAN

SESSION-3 / HALL-1 02.10.2024/ 15:00-17:00 (Turkiye Time) Moderator: Prof. Dr. Fatih ÇALIŞKAN	
Zoom Meeting ID: 829 5595 6031 / Zoom Passcode: 121212	

AUTHOR	AFFILIATION	TITLE
Ersan AY Azize İNCE Mustafa ÖZGEÇ Ferdi BOZYILAN	<i>Pakten Sağlık Ürünleri SAN. Ve TİC. A.Ş</i>	ADAPTATION OF BACKWET TEST ON DISPOSABLE HYGIENIC CLOTHES TO PNEUMATIC SYSTEM
Asst. Prof. Seda Hatice GÖKLER	<i>Kahramanmaraş Sütçü İmam University</i>	PREDICTION AND MODELLING OF CARBON EMISSION AMOUNT BY MACHINE LEARNING METHODS
Serhat KARACA Asst. Prof. Emir ESİM	<i>Erciyes University</i>	STRUCTURAL ANALYSIS OF INDUSTRIAL TYPE COIL WINDING MACHINE
Orçun ZIRTIL Beste BULTAN TUNA İrem ALTINOK Sezer KULLUK Prof. Dr. Fatih ÇALIŞKAN	<i>Çanakcılar Seramik San. ve Tic. A.Ş. Sakarya University of Applied Sciences</i>	EFFECTS OF DIFFERENT KAOLIN SOURCES ON THE GLAZE PROPERTIES OF CERAMIC SANITARY WARE
İrem ALTINOK Orçun ZIRTIL Sezer KULLUK Beste BULTAN TUNA Prof. Dr. Fatih ÇALIŞKAN	<i>Çanakcılar Seramik San. ve Tic. A.Ş. Sakarya University of Applied Sciences</i>	THE EFFECT OF DIFFERENT BLACK PIGMENTS ON GLAZE SURFACES
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Asst. Prof. Dr. N. Tuba YUSUFOĞLU Yüksel ÖZDEMİR	<i>Adana Alparslan Türkeş Science and Technology University</i>	"THE NİL COFFEE HOUSE" AS AN EXAMPLE OF MODERN ARCHITECTURE OF THE 1950s IN GAZİANTEP
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Assoc. Prof. Ezgi ÖREN Res. Assistant Tuğba SALMAN	<i>Ataturk University</i>	MACHIAVELLI AND THE LEGITIMATION OF WAR: A CONTROVERSIAL ISSUE

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A.M.Aliyu E.A.Shittu U.A Saleh	AlikoDangote University of Science and Technology Bayero University	PHYTOCHEMICAL CONSTITUENTS AND ANTIOXIDANTS OF SWEET PEPPER VARIETIES (Capsicum annum L.) DEPENDING ON ITS FRUIT COLOURATION
Amal Elrherabi Mohamed Bouhrim Mohamed Bnouham	Mohammed First University Sultan Moulay Slimane University Laboratory of Pharmacology, Pharmacokinetics, and Clinical Pharmacy	UNVEILING THE ANTIDIABETIC MECHANISMS OF LAVANDULA STOECHAS: EFFECTS ON GLUCOSE ABSORPTION AND REGULATION IN EXPERIMENTAL MODELS
Khadija BENAMAR Saad IBNSOUDA KORAICHI Saad BENAMAR Kawtar FIKRI BENBRAHIM	Sidi Mohamed Ben Abdellah University	ANALYSIS OF RELATIONSHIP BETWEEN THE USE OF MEDICINAL AND AROMATIC PLANTS BY PEOPLE IN AIN CHKEF AREA (NORTH CENTRAL MOROCCO) DURING THE PANDEMIC COVID-19 AND THEIR SOCIO-DEMOGRAPHIC FEATURES
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Aliyu Sani Ado Zakari Nuhu Lambu Yasir Hamza Bichi Usman Ahmad	<i>Aliko Dangote University of Science and Technology Bayero University</i>	PREVALENCE OF TUBERCULOSIS IN WUDIL: A CASE STUDY OF PATIENTS ATTENDING THE DOT CLINIC OF WUDIL GENERAL HOSPITAL, KANO
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Farhana Naz Rimsha Imran Maha Tariq	<i>Lahore College for Women University</i>	SUSTAINABLE SOLUTIONS TO GLOBAL AND REGIONAL ENERGY CHALLENGES: THE IMPACT OF ALTERNATIVE ENERGY AND POLICY REFORM
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Assistant Professor K.THAMIZHMARAN	<i>Government College of Engineering</i>	IDENTIFICATION AND RATIFY OF MISBEHAVIOR ATTACK IN WIRELESS MOBILE AD HOC NETWORKSS

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NWAKALOR CHIZOBA NKIRU	<i>FEDERAL POLYTECHNIC OKO</i>	PRODUCTION AND QUALITY EVALUATION OF BISCUITS PRODUCED FROM WHEAT, SORGHUM AND AFRICAN YAM BEAN COMPOSITE FLOURS
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Amirmohammad Jafari Ramin Aslani Sama Sepor deh	<i>Tabriz University of Medical Sciences</i> <i>Tehran University of Medical Sciences</i>	NOVEL APPROACHES OF PESTICIDE DECONTAMINATION IN THE MATRIX OF FOOD PRODUCTS: A REVIEW
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PHYTOCHEMICAL CONSTITUENTS AND ANTIOXIDANTS OF SWEET PEPPER VARIETIES (*Capsicum annuum* L.) DEPENDING ON ITS FRUIT COLOURATION

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ABSTRACT

The experiment was conducted at laboratory of food science and technology department, Aliko Dangote University of science and technology wudil to determine the antioxidants and phytochemicals of three sweets pepper varieties (yellow bell pepper, red and sweet pepper). Three samples of the plant were collected from Teaching and Research research farm of ADUSTECH Gaya after harvesting. The data collected were subjected to analysis of variance (ANOVA) using SPSS single factor at ($P < 0.05$) software. Data on vitamin c, carotenoids, saponins, ascorbic acid, terpenoids, alkaloids, phenol, glycosides, percentage, ash, moisture content, fat, crude fibre were recorded. The result shows the presence of photochemical constituents with percentage moisture, fat and crude fiber was increased in red pepper. Crude protein contained the highest mean for sweet pepper and percentage ash on yellow pepper. The ascorbic acid and carotenoids range is 194.4 and 75.72 increases with yellow bell pepper. The minerals compositions in K, Ca, Zn, Fe, Mn and Pb gave higher mean values in red bell pepper than other varieties with Na and Mg in sweet pepper. Farmers may explore nutrient management strategies to optimize photochemical and antioxidants in sweet peppers, ensuring a continued contribution to daily dietary intake.

Keywords: phytochemicals, antioxidants, sweet pepper and coloration

THE ANTIFUNGAL ACTIVITY OF SOME PLANTS EXTRACTS AGAINST FUNGAL TOMATO'S DISEASES

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Abstract

Pesticides have been applied extensively and improperly. Numerous incidences of acute or chronic toxicity in humans, environmental contamination, increased resistance in the target plant and the emergence of new hazardous species have all resulted from these techniques. The goal of the current investigation is to identify non-polluting substitutes. *Alternaria solani*, *Botrytis cineria*, *Botrytis cineria* on fruit, *Phytophthora infestans* and *Oidium oxysporum* are the four pathogenic fungi against which the in vitro efficiency of five plant extracts (*Peganum harmala*, *Ocimum basilicum*, *Caralluma europaea*, *Nerium oleander* and *Eucalyptus globulus*) is tested. When it came to tomato-related fungal infections, every extract exhibited antifungal efficacy. *Ocimum basilicum* at the top. It inhibited 81% of *Oidium oxysporum* growth at a concentration of 0.2% and 80% of *Botrytis cineria* growth at a concentration of 0.4%. Next came *Nerium oleander*, *Alternaria solani* at a 4% concentration and *Peganum harmala*, which inhibited at a 73% rate. Both *Caralluma europaea* and *Eucalyptus globulus* extracts had an antifungal activity over 30%.

Keywords: Plant extract, fungal diseases, antifungal activity, tomato.

UNEXPECTED SOCIAL CHALLENGES DURING PANDEMIC

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Abstract

The corona problem is probably going to keep us busy for at least two years, as evidenced by a modest recovery of the economy. While the Corona-virus (COVID-19) pandemic is not comparable to the 14th-century Black death or the 1918 flu pandemic, also known as the “Spanish flu,” it has emerged as a significant threat to humankind. The lockdown measures will result in a severe recession (economic downturn), stronger than the global financial catastrophe, with significant long-term negative effects on government spending and the adaptability of government operations. The duty for the future generation has consequently greatly extended or escalated above the huge issues and concerns internationally. The Corona- problem is wrecking our civilisations and is a major threat against humanity. Due to lockdown, everyone is isolated from their social surroundings throughout this epidemic. The social environment has suffered greatly. Everyone feels afraid since they are all alone. Social separation nearly brought our nation’s cohesiveness to an end. In India, a lot of untruths and rumours have been going about. Numerous social difficulties have emerged as a result of this catastrophe. This shutdown exposed every vulnerability in our nation. This nation’s reputation is considered dangerous. Humanity itself is in jeopardy. The primary gift bestowed upon Indians is humanity, but due to the ongoing epidemic, it is in danger of being destroyed by aspects like as hate speech, rumours, fake news, and misunderstandings. Owing to the epidemic, the globe is facing difficulties in the areas of economics, politics, psychology, mental health, religion, the environment, and society. The pandemic has brought about some positive developments regarding environmental issues, including as improved and clean air quality. There has been less pollution in the environment. The coronavirus epidemic has many problems, however this study just briefly addresses COVID-19: Unprecedented Social Challenges before Humanity in the Indian context.

Keywords : Corona-virus, Epidemic and Pandemic,, Social challenge, Economical.

COMPARATIVE STUDY OF STUDENTS' ACADEMIC PERFORMANCE IN CHEMISTRY WHEN TAUGHT USING DEMONSTRATION AND LECTURE METHOD AMONG SENIOR SECONDARY SCHOOL IN KATSINA ZONAL EDUCATION QUALITY ASSUARANCE (KZEQA)

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ABSTRACT: This study aims at comparing the students' academic performance in chemistry when taught using demonstration and lecture method among senior secondary schools in Katsina zonal Quality assurance (KZEQA). The study used questionnaire, where 94 questionnaires were respectively distributed to chemistry students of the selected schools **GOVERNMENT DAY SENIOR SECONDARY SCHOOL KOFAR YANDAKA KATSINA (GDSSSK)** and chemistry teachers of the school, however, with the outliers, 86 students' questionnaires and 6 teachers' questionnaire were retained and served as the basis of the analysis. T-test was applied to analyze the difference between mean scores of the students' performance when taught using demonstration and lecture methods of teaching and learning chemistry. Finding of this study revealed that, demonstration method has positive and strong impact on students' assimilation of chemistry concepts.

Keywords: Comparative Study Academic performance; Students; lecture method; demonstration method.

EFFECTS OF HYDROPRIMING DURATION AND ROOT PRUNING ON THE GROWTH AND DRY MATTER ACCUMULATION OF TOMATO SEEDLINGS.

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This study investigated the effects of hydropriming duration and root pruning on the growth and dry matter accumulation of tomato seedlings in a completely randomized design with three replications. The treatments consisted of five hydropriming durations (control, 24 h, 48 h, 72 h, and 96 h) followed by root pruning at 25 days after sowing (DAS) (pruning 1/3 or 2/3 of the root) and at 32 DAS (pruning 1/3 or 2/3 of the root). The measured parameters included total plant dry matter, leaf dry weight, stem dry weight, root dry weight, and root-to-shoot ratio (mean, minimum, maximum, and coefficient of variation). The results revealed that both hydropriming and root pruning significantly influenced tomato seedling growth. Seedlings that were not root-pruned exhibited significantly higher total dry matter across all hydropriming treatments compared to those that were root-pruned. The highest average dry matter values (1.15g and 1.17g) were recorded for seeds primed for 96 hours and pruned 1/3 at 25 DAS or not pruned at 32 DAS, respectively. Conversely, the lowest average dry matter (0.37g and 0.34g) was observed in seedlings primed for 96 hours and pruned 2/3 at both 25 and 32 DAS. The root-to-shoot ratio showed significant differences, with the highest ratio observed in seedlings primed for 96 hours and pruned 2/3 at 25 DAS, and the lowest ratio in seedlings primed for 72 hours and pruned 2/3 at 32 DAS. Leaf and stem dry weights varied significantly across all treatments, regardless of root pruning intensity and days after sowing. Overall, the interaction between hydropriming duration and root pruning severity had a substantial impact on the growth and dry matter accumulation of tomato seedlings.

Key words: Hydro priming, pruning, Seedling dry weight, Tomato.

THE GLOBAL DYNAMICS OF CONVENTIONAL CANCER TUMOR GROWTH MODEL

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Abstract

We present here, a phase-space analysis of a mathematical model of tumor growth with an immune responses. Consider mathematical analysis of the system of nonlocal equations regarding to dissipativity, boundedness of solutions, invariance of non-negativity, local and global stability and the basins of attractions.

In conventional models of population dynamics, consumption of resources by the individuals occurs at the same spatial location as reproduction and death. We assume in this work that the individual located at a point in the spatial domain can consume resources not only at that point but also at some neighboring region surrounding that point. Movement of the individuals to the nearby location occurs in a faster time scale compared to the movement from one location to the other one. This modifies the modeling approach and gives rise to a nonlocal differential equation with convolution terms describing the nonlocal consumption of resources. Such type reaction-diffusion equations with the nonlocal term is also used to explain the emergence and evolution of biological species and speciation were studied. We derive some features of behavior of the three-dimensional tumor growth models with nonlocal dynamics described in terms of densities of three cells populations: tumor cells, healthy host cells and effector immune cells. We found sufficient conditions, under which trajectories from the positive domain of feasible multipoint initial conditions tend to one of equilibrium points. Here, cases of the small tumor mass equilibria-the healthy equilibrium point, the "death" equilibria have been examined. Biological implications of our results are discussed.

Keywords: Cancer tumor model, immune system, mathematical modeling, stability of dynamical systems, multiphase attractors

FABRICATION AND CHARACTERIZATION OF A NEW GREEN ADSORBENT MADE OF CHITOSAN/RICE HUSK BIOCHAR-BASED COMPOSITE FOR ADSORPTIVE REMOVAL OF METHYLENE BLUE

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ABSTRACT

Water is the most vital resource for the human life. Water pollution as a result of organic dyes and its removal is an important environmental issue that has an increasing scientific interest. This Study New Green Adsorbent Made of Chitosan/Rice Husk Biochar-Based Composite was prepared for the successful for Adsorptive Removal of adsorption of MB. The composite was prepared by using previously made rise husk biochar was prepared by treating it with distilled water, acids and bases to remove impurities, and pyrolyzing it at 550°C for 60 minutes. After that the composite was magnetized using FeCl₃ and FeSO₄. The composite was then washed and dried at 75 °C. Then to the composite chitosan was added in 1:1 to make the final composite. The composite was then characterized with SEM, EDX, FTIR and XRD and applied to the dyes to check adsorption capacity. The composite was found to have fibrous and porous structure. The composite was found to adsorb the MB in the basic conditions. Furthermore, the optimum adsorptions conditions were 0.1g composite, 20ppm dye concentration solution and 90 minutes time for MB. The research shown that a novel green adsorbent composed of chitosan/rice husk Biochar-based composite is highly effective in removing MB from waste-water, offering a viable solution for eco-friendly and clean operations.

Key words: Chitosan/rice husk, Adsorption and MB.

PREVALENCE OF TUBERCULOSIS IN WUDIL: A CASE STUDY OF PATIENTS ATTENDING THE DOT CLINIC OF WUDIL GENERAL HOSPITAL, KANO

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Abstract

This study aimed to determine the incidence and factors influencing tuberculosis (TB) among patients attending the DOT clinic at Wudil General Hospital from August 2023 to August 2024, focusing on gender, age, and HIV status. A total of 351 participants were screened microscopically, and 22 (6.27%) tested positive for TB. Of these, 9 (2.56%) were male and 13 (3.70%) were female. In terms of age distribution, the highest prevalence was observed among patients aged 41-50 years, with 8 (2.28%) cases, followed by those aged 51 and above with 6 (1.71%) cases. There were 5 (1.42%) cases among patients aged 31-40, 2 (0.57%) cases among those aged 0-20, and 1 (0.29%) case among patients aged 21-30. Regarding HIV status, 8 (2.286%) of the TB-positive patients were also HIV-positive, including 3 (0.85%) males and 5 (1.42%) females. Statistical analysis showed no significant differences in terms of gender and ages of the participants ($p < 0.05$). It is recommended that efforts be made to reduce overcrowding and improve housing conditions to mitigate the spread of *Mycobacterium tuberculosis*, the causative agent of this long-standing disease.

Keywords: Tuberculosis, prevalence, DOT clinic, HIV status.

**UNVEILING THE ANTIDIABETIC MECHANISMS OF *LAVANDULA STOECHAS*:
EFFECTS ON GLUCOSE ABSORPTION AND REGULATION IN EXPERIMENTAL
MODELS**

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Abstract: This study explores the antidiabetic potential of *Lavandula stoechas*, a medicinal plant traditionally used in eastern Morocco, particularly for its ability to manage postprandial hyperglycemia. The investigation focused on its role in modulating glucose absorption and its effects on both normal and diabetic Wistar rats.

The experimental approach included evaluating the plant's impact on glucose uptake *in vivo* and *ex vivo*. The oral glucose tolerance test (OGTT) was conducted by inducing hyperglycemia in rats through a glucose load of 2 g/kg, followed by administration of *Lavandula stoechas* aqueous extract at 150 mg/kg. Additionally, the influence of the extract on intestinal glucose absorption was studied, along with its effects on glucose uptake in the isolated hemidiaphragm in an *ex vivo* setting.

Our findings revealed a marked reduction in blood glucose levels in both normal and diabetic rats treated with the extract, compared to the untreated control group. Significant inhibition of intestinal glucose absorption was also observed. Furthermore, the extract enhanced glucose uptake in the isolated hemidiaphragm during *ex vivo* experiments.

This research highlights the potential of *Lavandula stoechas* as a natural agent for diabetes management, offering insights into its glucose-lowering mechanisms.

Keywords : *Lavandula stoechas*, glucose absorption, OGTT, hemidiaphragm, *in vivo*, *ex vivo*, diabetes management.

NOVEL APPROACHES OF PESTICIDE DECONTAMINATION IN THE MATRIX OF FOOD PRODUCTS: A REVIEW

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Abstract:

With the increase in population and economic development, the need and demand for agricultural products is increasing. due to growth of the world's population and the lack of food resources in recent decades, preserving agricultural products from damages caused by pests and diseases seems more necessary than ever. So that the producers of agricultural products have to use all kinds of pesticides to fight the factors that reduce production. Some of these substances penetrate into the tissue of agricultural products and most agricultural products contain amounts of pesticide residues. Pesticide residues found in food items are a worldwide issue as their detrimental effects on human health vary depending on the method and level of exposure. Pesticide exposure to humans primarily occurs through the consumption of food products. It is important to eliminate pesticide residues from food products in order to minimize human exposure to pesticides. There have been many techniques utilized to break down pesticide residues in food items. Different methods, such as washing, blanching, peeling, and thermal treatments, have been discovered to be efficient in decreasing pesticide residues. Emerging technologies like cold plasma, pulsed electric field, irradiation, and ultrasonication have been utilized to break down pesticide residues, considering the specific pesticide and processing conditions. The goal of this article was to give an outline of how emerging technologies are used to break down pesticide residues in matrix of food products.

Keywords: Cold plasma; Pesticide degradation; Irradiation; Pulsed electric field; Food composition; Food contamination.

TRENDS IN CHEMICAL ASSESSMENT OF POSTBIOTICS

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Abstract:

Different terms have been used to define the functional compounds produced by microorganisms in food matrix however, postbiotics (metabiotics or biogenics) is the most used today. There is still no consensus on the definition of postbiotics, but most studies consider that they must provide any physiological benefits to the host, which are sometimes similar to the effects provided by the living probiotics. The use of these substances for food applications still has some unaddressed issues. Primarily, there are gaps in understanding how to effectively integrate them into food products. The preparation and utilization of postbiotics derived from various probiotics show promising results, but it is essential to evaluate the efficacy of postbiotics in addressing food safety-related microorganisms through chemical composition analysis. Therefore, identified postbiotics with specific effects can effectively provide benefits to foods. This review discussed the latest developments in preparing postbiotics produced from lactic acid bacteria. The comprehensive review also covered the role of various instrumental analysis methods and the variables that impact the chemical composition of postbiotics.

Keywords: bioactive compounds; functional food; lactobacillus; postbiotics; probiotics.

DETERMINATION OF THE CATION EXCHANGE CAPACITY AND SUITABILITY OF CLAY SAMPLES FROM IKWO FOR WASTEWATER TREATMENT

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ABSTRACT

A research on determination of the cation exchange capacity (C.E.C), characterization of clay samples from different locations in Ebonyi State, Nigeria and their suitability for wastewater treatments was carried out. Samples were collected from Ikwo and Afikpo cities in the State. The clay samples were characterized using X-ray fluorescence (XRF) for the elemental compositions, X-ray diffraction (XRD) to determine the mineral compositions, SEM for morphology, and Fourier Transform Infrared spectroscopy (FT-IR) for determination of inherent functional groups while CEC was determined following methylene blue method. The results obtained showed that the Ikwo Clay has the higher cation exchange Capacity of 6.34meq/100g at 0 °C and 7.84meq/100g when thermally treated to a temperature of 200 °C. For the chemical characterization, silica (SiO₂) has the highest composition with the range of 62.81% at Afikpo to 53.77% at Ikwo, other results are Al₂O₃ (25.29 % - 18.52 %) and TiO₂ (2.18 % - 2.5 %). The characterization of the clay samples showed that their main mineral constituents was predominantly kaolinite, bentonite and Illite. Wastewater from Abakaliki municipality treated with clay samples in conjunction with the Chemical coagulants (Polyaluminium chloride and Cationic polyelectrolyte) resulted in increased efficiency in the reduction and removal of chemical contaminants such as heavy metals, suspended and dissolved solids. The water quality parameters after treatment were improved thereby showing the viability of clay for wastewater treatment. When compared with the Nigerian Federal Environmental Protection Agency (FEPA) standards, the results from the wastewater treatment using clay showed that important physical and chemical parameters like the biochemical oxygen demand (B.O.D) and the presence of heavy metals like chromium (Cr), copper (Cu), nickel (Ni) and lead (Pb) were substantially reduced or within the accepted limits which makes the treated water safe for discarding and industrial use.. The research revealed that clay from the sampled locations are good for wastewater treatment.

Keywords: wastewater, cation exchange capacity, contaminants, determination and clay

**BALANCING DIFFERENCES: CHALLENGES AND OPPORTUNITIES FOR
HARMONIZING SCIENCE AND RELIGION**

Annisatul Fadilah

UIN KH. ABDURRAHMAN WAHID PEKALONGAN

Abstract

Science and religion are often seen as two opposing entities that are difficult to reconcile. However, the two can actually complement each other and provide great benefits for humanity. Balancing the differences between the two is both a challenge and an opportunity to achieve mutually beneficial harmonization.

This research uses a literature study (research library) with a qualitative descriptive approach. The data collection technique in this research uses literature exploration or references from journals and books. Then it is analyzed using three techniques: data production, data presentation, and drawing conclusions. The results of this research show that, based on the previous discussion, Islam and science are basically one. This means that even without integration, the two are already integrated from the origin. If there is a difference between Islam and science, as in the Islamic world, this is caused by a misunderstanding of the universal values of Islamic teachings (kaafah). In recent years, various ideas, concepts, and movements have emerged in the Islamic world to catch up with the West. In science and technology. For example, Ismail Al-Faruqi put forward the idea of Islamicizing science. According to him, the Islamization of science is the Islamization of scientific disciplines, or more specifically, the production of textbooks for universities, bringing modern scientific disciplines back to an Islamic perspective after a critical study of Islamic and Western knowledge systems.

It can be concluded that the harmonization of science and religion has both opportunities and challenges in its implementation. The following are the main conclusions: Opportunities: There is a desire among many parties to build constructive dialogue and mutual understanding between scientists, theologians, and religious leaders. There is common ground and similarities between scientific findings and religious teachings that can be explored further. There are more and more efforts to integrate issues of science and religion into the education system. The development of technology pays more attention to spiritual values and religious ethics. The growth of public awareness of the importance of harmonizing science and religion.

Challenges: There are still conflicting views between science and religion in certain circles. Lack of deep understanding of the complex relationship between science and religion. Difficulty in translating religious principles into the practice of science and technology. Potential for conflicts of interest between religious groups and scientists. There are limited resources and institutional support to encourage harmonization systematically. To overcome these challenges, planned, collaborative, and sustainable efforts are needed. By taking advantage of existing opportunities and looking for creative solutions to challenges, the harmonization of science and religion can be increasingly realized and make a positive contribution to the comprehensive progress of human civilization.

Key words: balancing differences, challenges, opportunities, harmonization, science, religion

**A FRACTIONAL-ORDER TV MODEL BASED-BILEVEL LEARNING APPROACH FOR
IMAGE PROCESSING**

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Abstract: In this study, we propose a novel approach to image denoising using a bilevel framework that incorporates fractional order derivatives. The key innovation is the formulation of a bilevel problem that integrates total fractional order variations. To evaluate the performance of our method, we carry out numerical experiments on images with different characteristics and varying noise levels. We highlight the sensitivity of fractional order derivatives using established metrics. Our numerical results show that the proposed approach outperforms existing models in terms of efficiency and robustness against noise.

Keywords: Bilevel; Image denoising; fractional derivative; descent gradient.

ALTERNATİF YEM HAMMEDDESİ OLARAK SOYA FASULYESİ YERİNE BEZELYE PROTEİNİ KULLANIMI

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ÖZET

Ruminant hayvanlarda olduğu gibi kanatlı hayvan yetiştiriciliğinde işletmesinin %70 maliyetini yem giderleri oluşturur. Az gelişmiş yada gelişmekte olan birçok ülkede gittikçe önemi artan, elde edilmesi güç olan ve daha da maliyeti pahalı hale gelen yem giderleri aile işletmesi şeklindeki küçük işletmelerin kapasitesinin azaltılmasına ve kapanmasına ve kanatlı hayvan üretiminin toplam maliyetinin yükselmesi gibi sonuçlarla karşılaşabilmektedir. Yem fiyatlarının artması yem ham maddelerin üretimi, maliyeti ve pazarlanması ile ilişkilidir. Kanatlı rasyonları başta olmak üzere birçok hayvan yetiştiriciliğindeki en önemli yem hammaddelerinden biri olan Soya fasulyesinin, yem ham maddesinin maliyetini artması ve üretimin yetersiz olması gibi nedenlerle yem fiyatlarını artırmakta ve bu da üretici yetiştiricilerin bu bitkinin kullanımını zorlaştırmaktadır. Yem masraflarını minimize etmek ve kanatlı hayvanlardan alınan ürünlerin maliyetini düşürmek için alternatif yem hammadde arayışı içerisinde olunmalıdır. Besin içeriği bakımından soya fasulyesine yakın yada alternatif olabilecek bitkilerin yem rasyonlarında soya fasulyesinin yerini alması alternatif ürün olarak olanak haline gelmiştir. Son zamanlarda bezelye proteini kullanımı da besin maddede içeriği bakımından soya ile eş değer bir yem bitkisidir. Bezelye proteini soya fasulyesine göre protein içeriği düşük ve nişasta içeriği yüksek, ADF İLE NDF içeriği daha yüksek yem maddesidir. Yapılan bazı çalışmalarda etlik piliçlerde rasyona %17 düzeyinde bezelye eklenmesinin etlik piliçlerin performansını olumsuz yönde etkilemediği belirtilmiştir. Yeme %15 düzeyinde ilave edilmesinin yem tüketimini azalttığını fakat performans kriterlerini etkilemediği bildirilmiştir. Bezelye ürünlerinin kullanımı ile ilgili akademik çalışmalar sınırlı kalmış olup kanatlı hayvan yetiştiriciliği başta olmak üzere ruminant hayvanlarda kullanımı ile ilgili çalışmaların yapılması önerilmektedir. Bu çalışmanın amacı bezelye ürünlerinin rasyonlarda soya bitkisinin yerine kullanımının mümkün olup olmayacağı hususu ve belirli seviyelerde kullanımının kanatlı hayvanların performans üzerindeki etkisini belirlemektir.

Anahtar Kelimeler: Bezelye proteini, rasyon, alternatif yem hammadde, soya fasulyesi, verim kriterleri

ABSTRACT

As in ruminant animals, feed costs represent approximately 70% of the total cost of poultry farming. In numerous underdeveloped or developing countries, the rising costs of feed, which are becoming increasingly important, difficult to obtain and more costly, may result in the reduction and closure of the capacity of small enterprises in the form of family businesses and an overall increase in the total cost of poultry production. The rise in feed prices is attributable to the production, cost, and marketing of feed raw materials. Soya bean, a crucial feed ingredient in numerous animal breeding operations, particularly in poultry rations, has contributed to the escalation of feed prices due to factors such as the surge in the cost of feed raw materials and a dearth in production, which has made it challenging for producers to utilize this plant. In order to reduce the cost of poultry products, it is necessary to identify alternative feed raw materials that can be used in place of those currently in use. With regard to the nutritional composition of the diet, it has become possible to substitute plant products that are similar or analogous to soybeans in feed rations. Pea protein is now regarded as a nutritionally equivalent feed

plant to soy in terms of its nutrient content. Pea protein is a feed material with a lower protein content and a higher starch content, as well as a higher ADF and NDF content than soybeans. In certain studies, it was observed that the incorporation of 17% peas into the diet of broiler chickens did not result in any adverse effects on the performance of these chickens. It was observed that the incorporation of 15% into the diet resulted in a reduction in feed intake, yet this did not impact the performance criteria. The existing body of academic literature on the use of pea products is limited. Consequently, further studies are recommended on their use in ruminant animals, with a particular focus on poultry farming. The objective of this study was to ascertain the feasibility of utilizing pea products as a substitute for soy in poultry rations and to evaluate the impact of varying levels of pea incorporation on poultry performance.

Keywords: Pea protein, ration, alternative feed ingredients, soybean, yield criteria

**THE IMPACT OF ARTIFICIAL INTELLIGENCE WITH THE INTERNET OF THINGS
AND MACHINE LEARNING IN THE MODERN WORLD**

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ABSTRACT

This topic excavates into the cooperative and systematic AI in corresponding with the IOT and ML in modern world. By examining the combining ability of AI algorithms with IOT devices and ML techniques, the study survey how this technique reshapes various portions of our regular lives and informational industries.

Moreover, this study range over the transformative potential of integrated AI with ML techniques. With the analysis of applications, it explains how it leads to clearer decision-making, predictive analytics, and customize the usability. The study explores the importance of tackling these technologies to promote regular development with the help of a broad analysis of modern movement and today research theory, the study provides intuition into the evolving landscape of AI, IoT, and ML, highlighting the importance of embracing those advancements to thrust industries forward and meet the changing needs of modern society. To promote a better development in social as well as technical field we need to focus on these current trends. These combinations are very effective to solve all the problems in scientific way & makes customer delightful. The compressive study provide solution for autonomous vehicles, networks of computer, security in data, medical healthcare etc.

In conclusion, this study focuses on the transformative side of integrating AI, IoT, and ML technologies, advancing the way for a smarter, efficient and more reliable modern world.

MACHİAVELLİ VE SAVAŞIN MEŞRULAŞTIRILMASI: TARTIŞMALI BİR KONU
MACHIAVELLI AND THE LEGITIMATION OF WAR: A CONTROVERSIAL ISSUE

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Abstract

Niccolò Machiavelli, one of the important philosophers of the Renaissance period, made important contributions to political philosophy, especially with his work "The Prince." However, Machiavelli not only had important thoughts on politics, but also on war. Machiavelli puts forward the idea that war is a tool that can be used to maintain and expand the power of a state. He argues that war is an art and that this art must be learned. He states that war is inevitable and that those who rule the state must accept this fact, therefore a statesman must have knowledge of military matters in order to develop a successful war strategy. For Machiavelli, war is not only an act of violence but also a political tool. The political views put forward by Niccolò Machiavelli in works such as "The Prince" and "The Art of War" (Dell'arte Della Guerra) have been debated for centuries. His thoughts, especially on war, continue to be discussed today. While some criticize Machiavelli's ideas, which are often considered a moral contradiction, for serving to legitimize war, others argue that he, as a realistic politician, accepted the inevitability of war. In summary, according to Machiavelli, war is a powerful tool in the hands of a statesman, but this tool must be used carefully and strategically. Machiavelli's thoughts on war are an important subject that politicians and military strategists carefully analysis today. Machiavelli's thoughts on war may be considered contradictory in terms of modern moral values. However, the issue will be better understood when evaluated in its historical and cultural context. While he accepts the inevitability of war, he does not ignore its moral consequences. The fact that his ideas do not always align with today's moral and political values should not lead to the conclusion that he is a thinker who serves to legitimise war. Rather, Machiavelli should be viewed as a political philosopher who emphasized the difficulties a statesman might face and the importance of a realistic political approach.

Keywords: Machiavelli, War, Legitimation of War

Özet

Rönesans döneminin önemli filozoflarından biri olan Niccolò Machiavelli, özellikle "Prens" adlı eseriyle siyaset felsefesine önemli katkılarda bulunmuştur. Ancak Machiavelli'nin sadece siyaset değil, aynı zamanda savaş üzerine de önemli düşünceleri bulunmaktadır. Machiavelli savaşın bir devletin gücünü koruması ve genişletmesi için kullanılacak bir araç olduğu düşüncesini öne sürer. Savaşın bir sanat olduğunu ve bu sanatın öğrenilmesi gerektiğini savunur. O savaşın kaçınılmaz olduğunu ve devleti yönetenlerin bu gerçeği kabul etmesi gerektiğini dolayısıyla bir devlet adamının, başarılı bir savaş stratejisi geliştirebilmek için askeri konularda bilgi sahibi olması gerektiğini belirtir. Machiavelli için savaş, sadece bir şiddet eylemi değil, aynı zamanda politik bir araçtır. Niccolò Machiavelli'nin "Prens" ve "Savaş Sanatı" gibi eserleriyle ortaya koyduğu siyasal görüşler, yüzyıllardır tartışılmaktadır. Özellikle savaş konusundaki düşünceleri günümüzde de tartışılmaya devam etmektedir. Sıklıkla ahlaki bir çelişki olarak değerlendirilen düşünceleri kimilerince Machiavelli'nin

savaşın meşrulaştırılmasına hizmet ettiği yönünde eleştirilirken, diğerleri ise onun gerçekçi bir politikacı olarak savaşın kaçınılmazlığını kabul ettiğini savunmaktadır. Özetle, Machiavelli'ye göre savaş, bir devlet adamının elinde güçlü bir araçtır. Ancak bu aracın dikkatli ve stratejik bir şekilde kullanılması gerekmektedir. Machiavelli'nin savaş hakkındaki düşünceleri, günümüzde de politikacıların ve askeri stratejistlerin dikkatle incelediği önemli bir konudur. Machiavelli'nin savaş hakkındaki düşüncelerinin modern ahlaki değerler açısından çelişkili olduğu düşünülebilir. Ancak konu tarihsel ve kültürel bağlamı içinde değerlendirildiğinde, daha iyi anlaşılacaktır. O savaşın kaçınılmazlığını kabul ederken, ahlaki sonuçlarını da göz ardı etmez. Onun düşüncelerinin günümüzün ahlaki ve siyasi değerleriyle her zaman uyum sağlamaması, onu sadece savaşın meşrulaştırılmasına hizmet eden bir düşünür olarak değerlendirmek sonucunu doğurmamalıdır. Machiavelli, daha ziyade, bir devlet adamının karşılaşılabileceği zorlukları ve gerçekçi bir politik yaklaşımın önemini vurgulayan bir siyasal filozof olarak görülmelidir.

Anahtar kelimeler: Machiavelli, Savaş, Savaşın Meşruluğu

MIXED LIGAND METAL COMPLEXES WITH SCHIFF BASE AND 1,10-PHENANTHROLINE SYNTHESIS AND CHARACTERIZATION
SCHIFF BAZI VE 1,10-FENANTROLİN İLE MIXED LİGAND METAL KOMPLEKSLERİ
SENTEZİ VE KARAKTERİZASYONU

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Abstract

Schiff bases are one of the most important steps in the development of coordination chemistry. Schiff bases; imine (C=N-, azomethine), with the help of nitrogen and carbonyl groups in their structure, form stable and various metal complexes. Since it forms stable equilibrium reactions with the formation and dehydrolysis of azomethine (imine), it is frequently seen in biological activities. Schiff bases are of increasing interest in various fields as enzymes and catalysts in anticancer, antifungal, Alzheimer's, antibacterial, antibacterial, dyestuff and biological activities.

In this study, Schiff base ligand was synthesized from 2-hydroxy-3-methoxy-5-nitrobenzaldehyde and 2-aminophenol compounds. Mixed ligand complex compounds were synthesised from the obtained Schiff base and 1,10-phenanthroline ligands and some transition metal salts. The structures of the synthesized mixed ligand complex compounds were elucidated by spectroscopic methods such as NMR (for ligand), UV-Vis and FT-IR, and by measurements such as elemental analysis, and electrolytic conductivity.

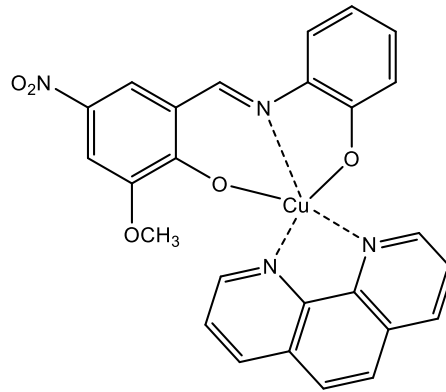


Figure. Structure of synthesized complexes

Keywords: Schiff base, Mixed ligand complexes, Characterization, Synthesis

Özet

Schiff bazlar koordinasyon kimyasının gelişmesindeki çok önemli basamaklardan biridir. Schiff Bazlar; imin (C=N-, azometin), yapılarındaki azot ve karbonil grupları yardımıyla, kararlı ve çeşitli metal kompleksleri oluşturur. Azometin(imin) oluşumu ve dehidroliz olmasıyla kararlı denge tepkimeleri oluşturduğundan biyolojik aktivitelerde sıkça görülmektedir. Schiff bazları antikanser, antifungal, Alzheimer, antibakteriyel, boyar madde ve biyolojik aktivitelerde enzim ve katalizör olarak çeşitli alanlarda gittikçe artan ilgisiyle göz doldurmaktadır.

Bu çalışmada, 2-hidroksi-3-metoksi-5-nitrobenzaldehit ve 2-aminofenol bileşiklerinden Schiff bazı ligandı sentezlenmiştir. Elde edilen Schiff bazı ve 1,10-fenantrolin ligandı ile bazı geçiş metal tuzlarından karışık ligand kompleks bileşikler sentezlenmiştir. Sentezlenen karışık ligand kompleks bileşiklerinin yapıları NMR (ligand için), UV-Vis ve FT-IR gibi spektroskopik yöntemlerin yanı sıra elementel analiz ve elektrolitik iletkenlik gibi ölçümlerle aydınlatılmıştır.

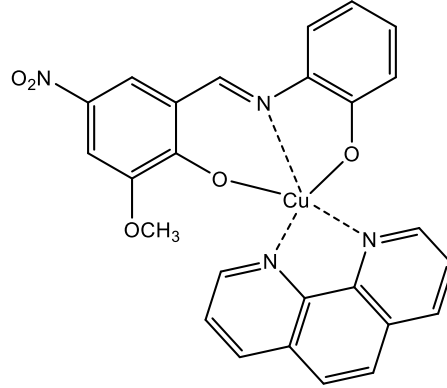


Figure. Structure of synthesized complexes

Anahtar kelimeler: Schiff baz, karışık ligand kompleksler, karakterizasyon, sentez

**THE IMPORTANCE OF ENVIRONMENTAL MONITORING IN THE MINING SECTOR
AND THE IMPACT OF THE USE OF ARTIFICIAL INTELLIGENCE**

**MADENCİLİK SEKTÖRÜNDE ÇEVRESEL İZLEMENİN ÖNEMİ VE YAPAY ZEKA
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Abstract

Environmental monitoring in the mining sector is crucial for ensuring the sustainability of mining activities and minimizing the ecological footprint. The significant impact of mining on air, water, land, and biodiversity underscores the need for continuous monitoring to protect natural ecosystems and surrounding communities. Real-time monitoring of environmental changes in mining activities, early detection of pollution, and necessary measures are imperative. Regulatory standards are essential to protect natural resources and reduce risks to public health. With advancing technology and global concerns, the integration of artificial intelligence in environmental monitoring is gaining momentum. The role of AI in enhancing the efficiency and accuracy of environmental monitoring is a reassuring development, promising safer and more responsible mining practices.

Environmental monitoring in the mining sector can be done using artificial intelligence (AI) and the Internet of Things (IoT) [1-4]. For instance, IoT sensors can be used to monitor different gas levels, smoke, temperature, humidity, light, pressure, and dust concentration in mining areas. These sensors can then feed the data to AI algorithms, which can analyze the information and trigger emergency alerts or system shutdowns if necessary. Such a system can be particularly useful in underground mines with high levels of toxic, flammable, and dangerous gases. For example, CH₄, NO₂, CO₂, SO₂, NH₃ gases in the mine, smoke, etc. can be measured using Internet of Things (IoT) sensors and measures can be taken with artificial intelligence algorithms [5].

Artificial intelligence algorithms and the Internet of Things have benefits as well as challenges. One of the main technical challenges in applying artificial intelligence (AI) for environmental monitoring in the mining sector is real-time data processing and analysis. It is argued that the impact of factors such as air and water quality, degradation of tailings and residue storage areas, or noise pollution on environmental monitoring and real-time data processing while mining activities are ongoing is possible with AI models. The delay and scalability of data inputs due to activities are the main challenges. Latency challenges to be solved are real-time data processing process (i), data transfer rate (ii), processing time (iii), while scalability challenges are data volume (i), model generalization (ii) and infrastructure (iii).

This study delves into the challenges that the mining sector may face in terms of environmental monitoring with the aid of artificial intelligence. While the potential solutions hold promise for near-term mining applications, they are not without their hurdles, particularly in remote areas with limited infrastructure. The issues of data latency and scalability are significant, and it is crucial to address them. To overcome these challenges, it is imperative to invest in and build more robust IT infrastructures and network systems, underscoring the urgency of this task.

Keywords: Mining Operations; Environmental Monitoring; Artificial Intelligence; Data Processing

Özet

Madencilik sektöründe çevresel izleme, madencilik faaliyetlerinin sürdürülebilir olmasını ve hatta ekolojik ayak izini en aza indirmek konusunda oldukça elzemdir. Madencilik hava, su, kara ve biyolojik çeşitlilik üzerinde etkisi oldukça fazladır. Bu da doğal ekosistemleri ve çevredeki toplulukları korumak için sürekli denetimi kritik hale getirir. Madencilik faaliyetlerinde çevresel değişikliklerin gerçek zamanlı izlenmesi ve kirliliğin erken tespiti ve gerekli önlemlerin alınması gerekmektedir. Doğal kaynakların korunabilmesi ve halk sağlığına yönelik risklerin azaltılabilmesi amacıyla düzenleyici standartların olması gerekmektedir. Gelişen teknoloji ve küresel endişeler ile çevresel izlemeye yapay zekanın dahil olması oldukça gündemdedir. Çevresel izlemenin verimliliğini ve doğruluğunu artırmadaki rolü, sürdürülebilir ve sorumlu madencilik uygulamalarında yapay zeka kullanımının etkisi yeni bir çalışma alanı olarak gündeme gelmektedir.

Madencilik sektöründe yapay zeka (AI) ve nesnelerin interneti (IoT) kullanılarak çevresel izleme yapılabilir [1-4]. Farklı gaz seviyeleri, duman, sıcaklık, nem, ışık, basınç, toz konsantrasyonu gibi faktörler nesnelerin interneti (IoT) sensörleri kullanılarak ve yapay zeka (AI) algoritmaları ile raporlanarak ardından acil durum uyarıları verilerek gerekli sistem kapatma işlemleri yapılabilir. Böyle bir sistem özellikle insanlar için zehirli, yanıcı ve tehlikeli olabilecek birçok gaz türüne sahip yeraltı madenlerinde kullanılabilir. Örneğin madende bulunan CH₄, NO₂, CO₂, SO₂, NH₃ gazlar duman vb nesnelerin interneti (IoT) sensörleri kullanılarak ölçülebilir ve yapay zeka algoritmaları ile önlemler alınabilir [5].

Yapay zeka algoritmalarının ve nesnelerin internetinin faydaları olduğu gibi zorlukları da mevcuttur. Madencilik sektöründe çevresel izleme için yapay zeka (AI) uygulanmasındaki başlıca teknik zorluklardan biri gerçek zamanlı veri işleme ve analizidir. Madencilik faaliyetleri devam ederken hava ve su kalitesinin, atık ve artık depolama alanlarında bozulmaların ya da gürültü kirliliği gibi faktörlerin çevresel izleme ile gerçek zamanlı veri işleme yönteminde etkisinin yapay zeka modelleri ile mümkün olabileceği tartışılmaktadır. Faaliyetlerden kaynaklanan veri girişlerinin gecikmesi ve ölçeklenebilmesi başlıca zorluklardandır. Gecikme ilgili çözülmesi gereken gerçek zamanlı veri işleme süreci (i), veri aktarım hızı (ii), işlem süresi (iii) iken ölçeklenebilirlik zorlukları ise veri hacmi (i), model genellemesi (ii) ve alt yapı (iii) olarak sıralanabilir.

Bu çalışma ile madencilik sektöründe çevresel izlemenin yapay zeka yardımıyla yapılması hususunda karşılaşılabilecek zorluklar irdelenmiştir. Olası çözüm yollarının yakın dönem madencilik çözümlerinde kullanılabilirliği olmasına rağmen özellikle sınırlı altyapıya sahip uzak bölgelerde veri gecikmesi ve ölçeklenebilirlikle ilgili zorluklarla karşı karşıya olduğu gözden kaçırılmamalıdır. Bunların üstesinden gelmek amacıyla daha sağlam bilişim alt yapılarının ve ağ sistemlerinin kurulmasının önemli olduğu görülmüştür.

Anahtar kelimeler: Madencilik Faaliyetleri; Çevresel İzleme; Yapay Zeka; Veri İşleme

THE CONTRIBUTION OF DATA ON OTTOMAN WEAPON TECHNOLOGY TO OTTOMAN ARCHAEOLOGY

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Abstract

Since its foundation, the Ottoman army lived a life intertwined with weapons and won victories against its enemies with the weapons it used from the XIVth century to the XIXth century. It kept pace with the developments in weapon technologies over a period of six centuries, and even in certain periods, it was ahead of its time, especially in cannon technologies. The Ottomans continued to use traditional Turkish weapons such as arrows and swords since their foundation and easily incorporated new weapons that emerged over time. It is known that firearms began to be used in China as early as the late 13th century and were introduced into the Ottoman army in the mid-14th century. Among these weapons, the most remarkable ones were the cannons that determined the outcome of the battle on the battlefields. Firearms, which were newly developed in countries such as Europe and Venice, began to be used in the Ottoman army before the end of the century. The reason behind the Ottomans' rapid adoption of these new weapon technologies lies in the fact that they were a nation that attached great importance to warfare and knew that superior weapon technologies were as important as courage and heroism. Therefore, while some Islamic states such as the Mamluks and Safavids tried to prevent the spread of firearms, this was not the case in the Ottoman Empire. During the Ottoman period of decline, while questioning the reasons for the decline, the Ottoman Empire preferred to innovate in the army. In this context, the change in the Ottoman army was carried out by taking the methods accepted in the West as an example since the late 18th century. The institutions and channels supporting the army were also affected by the modernization process and irreversible reforms during the Mahmud II period spread from the army to other institutions. During this period, the Harbiye School, which was established to meet the Ottoman army's need for modern officers, became the symbol of military modernization and made cadet officers the pioneers of the innovation movement. In addition, modern military education institutions, especially with the establishment of engineering schools, experienced significant developments and teachers brought from Europe were utilized for education. The aim of the state was to modernize the Ottoman army while reducing foreign dependency. One indication of this effort was the rifle factory established in 1836 under the leadership of Abdülaziz Agah Efendi, the Building Commander of the Vapors Ebniyesi. In this paper, the six-century story of weapon culture in the Ottoman Empire is discussed in general.

Keywords: Ottoman, Weapon, Army, Reform, Culture

OSMANLI SİLAH TEKNOLOJİSİNE İLİŞKİN VERİLERİN OSMANLI ARKEOLOJİSİNE KATKILARI

Özet

Osmanlı ordusu, kuruluşundan itibaren sürekli silahlarla iç içe bir yaşam sürmüştür ve XIV. yüzyıldan XIX. yüzyıla kadar kullandığı silahlarla düşmanlarına karşı zaferler kazanmıştır. Altı asırlık süre içinde yaşanan silah teknolojilerindeki gelişmelere ayak uydurmuş ve hatta belirli dönemlerde özellikle top teknolojilerinde çağının ilerisinde olmuştur. Osmanlılar, kuruluş yıllarından itibaren ok, kılıç gibi geleneksel Türk silahlarını kullanmaya devam etmiş ve zamanla ortaya çıkan yeni silahları

kolaylıkla bünyelerine dâhil etmişlerdir. Ateşli silahların 13. yüzyılın sonlarından itibaren Çin'de kullanılmaya başlandığı ve 14. yüzyılın ortalarından sonra Osmanlı ordusunda da yer aldığı bilinmektedir. Bu tür silahlar arasında en dikkat çekici olanlar, savaş meydanlarında mücadelenin sonucunu belirleyen toplar olmuştur. Avrupa ve Venedik gibi ülkelerde yeni gelişen ateşli silahlar, yüzyılın sonuna gelmeden Osmanlı ordusunda da kullanılmaya başlanmıştır. Osmanlıların bu yeni silah teknolojilerini hızla benimsemelerinin arkasında, savaşa büyük önem veren ve üstün silah teknolojilerinin cesaret ve kahramanlık kadar önemli olduğunu bilen bir millet olmaları yatmaktadır. Bu nedenle, Memlukler ve Safeviler gibi bazı İslam devletleri ateşli silahların yayılmasını engellemeye çalışırken, Osmanlı Devleti'nde böyle bir durum yaşanmamıştır. Osmanlı gerileme döneminde gerilemenin nedenlerini sorgularken öncelikle yeniliği Orduda yapmayı tercih etmiştir. Bu bağlamda; Osmanlı ordusundaki değişim, 18. yüzyılın sonlarından itibaren Batı'da kabul gören yöntemler örnek alınarak sürdürülmüştür. Yapılan yeniliklerle orduyu destekleyen kurum ve kanallar da modernleşme sürecinden etkilenmiş ve II. Mahmud döneminde geri dönüşü olmayan reformlar ordudan diğer kurumlara yayılmıştır. Bu dönemde Osmanlı ordusunun modern subay ihtiyacını karşılaması amacıyla kurulan Harbiye Mektebi, Askerî modernleşmenin simgesi haline gelmiş ve Harbiyeli subayları da yenilik hareketinin öncüsü yapmıştır. Ayrıca açılan modern askeri eğitim kurumları, özellikle mühendishanelerin kurulmasıyla birlikte önemli gelişmeler yaşanmış ve eğitim için genellikle Avrupa'dan getirilen hocalardan faydalanılmıştır. Devletin amacı, Osmanlı ordusunu modernleştirirken dışa bağımlılığı da azaltmaktır. Bu çabanın bir göstergesi, 1836 yılında Vapurlar Ebniyesi Bina Emmini Abdülaziz Agah Efendi'nin öncülüğünde kurulan tüfek fabrikasıydı. Bu bildiride genel olarak Osmanlı'da silah kültürünün 6 asırlık hikâyesi ele alınmıştır.

Anahtar kelimeler: Osmanlı, Silah, Ordu, Reform, Kültür

**BALKAN PAKTI VE ATATÜRK DÖNEMİ TÜRK DIŞ POLİTİKASI
THE BALKAN PACT AND TURKISH FOREIGN POLICY IN THE ATATURK ERA**

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Abstract

Turkish foreign policy during the Atatürk era was shaped with the sensitivity of preventing the intervention of Western imperialist states in regional affairs in order to protect the sovereignty of Turkey and neighboring countries. To this end, Turkey pioneered alliances such as the Balkan Treaty in the west and the Sadabat Pact in the east, which brought the countries of the region together. While the idea of such a pact had not yet fully developed in the West, it was formed under the leadership of Atatürk and generally in the Ottoman balance geography. Bulgaria wanted to be included in the Balkan Pact, but was blocked by the USSR. Albania wanted to be included. It faced the obstacle of Italy. Syria wanted to be included in the Sadabad Pact but was blocked by France. It is an undeniable fact that if Atatürk had lived another 10 years, these pacts would have strengthened and created a positive impact in the region and influenced World War II. The fact that the Turkish War of Independence was the first national liberation struggle to defeat the imperialist Western powers, and that Turkey modernized without colonization and without making concessions to the West, caused the country's regional policies to have a global impact. The years following the War of Independence witnessed the struggles for independence of what Atatürk defined as "*oppressed nations*". Turkey was able to pursue a more active foreign policy in international politics as it resolved the problems left over from Lausanne. For this reason, Turkey was not only concerned with issues concerning itself, but also with general foreign policy issues in order to preserve world peace. Between 1932 and 1938, Turkey played an important role in international politics in both economic and political dimensions. Turkey's signing of the Balkan Treaty with Greece, Yugoslavia and Romania in 1934 and the Sadabad Pact with Iran, Iraq and Afghanistan in 1937 are concrete examples of the foreign policy pursued. International balances had an impact on the press as well as Turkey's domestic politics. In this direction, Turkey tended to strengthen its relations with the Balkan states and joined the Balkan Press Union, which convened on February 15, 1937, and made efforts to introduce the Turkish press to the Balkan states in the cultural field. In this study, it has been tried to provide information about Turkey's policy in the Balkans and Turkish foreign policy during the Atatürk period.

Keywords: Balkan Pact, Sadabad Pact, Atatürk, Foreign Policy, Cooperation

Özet

Atatürk dönemi Türk dış politikası, Türkiye ve komşu ülkelerin egemenliklerini koruyabilmeleri amacıyla, Batılı emperyalist devletlerin bölge meselelerine müdahalesini engelleme hassasiyetiyle şekillenmiştir. Bu doğrultuda Türkiye, batıda Balkan Antantı ve doğuda Sadabat Paktı gibi bölge ülkelerini bir araya getiren ittifaklara öncülük etmiştir. Henüz Batıda tam olarak böyle bir pakt fikri gelişmemişken Atatürk'ün öncülüğünde ve genel olarak Osmanlı bakiyesi coğrafyada teşekkül etmiştir. Bulgaristan Balkan Paktına dâhil olmak istemiş SSCB'nin engeliyle karşılaşmıştır. Arnavutluk dâhil olmak istemiş. İtalya'nın engeliyle karşılaşmıştır. Sadabad Paktı'na ise Suriye dâhil olmak istemiş ve Fransa'nın engeline takılmıştır. Atatürk bir 10 sene daha yaşamış olsaydı bu paktlarının güçlenerek bölgede pozitif bir etki yaratacağı ve 2 nci Dünya Savaşı'na tesir edeceği yadsınamaz bir gerçek olarak karşımıza çıkmaktadır. Türk Ulusal Kurtuluş Savaşı'nın, Emperyalist Batılı Devletleri yenilgiye uğratan ilk ulusal kurtuluş mücadelesi olması ve Türkiye'nin

sömürgeleşmeden Batıya taviz vermeden modernleşmesi, ülkenin bölgesel politikalarının küresel bir etki yaratmasına sebep olmuştur. Kurtuluş Savaşı'nı izleyen yıllar, Atatürk'ün "*mazlum milletler*" olarak tanımladığı coğrafyanın bağımsızlık mücadelelerine sahne olmuştur. Türkiye, Lozan'dan kalan sorunları çözüme kavuşturduğu için uluslararası siyasette daha aktif bir dış politika izleyebilir hale gelmiştir. Bu nedenle Türkiye, yalnızca kendisini ilgilendiren konularla değil, dünya barışını koruma amacıyla genel dış politika meseleleriyle de ilgilenmekten geri kalmamıştır. 1932-1938 yılları arasında Türkiye, uluslararası siyasette hem ekonomik hem de siyasi boyutlarıyla önemli bir rol oynamıştır. Türkiye'nin 1934'te Yunanistan, Yugoslavya ve Romanya ile Balkan Antantı'nı, 1937'de ise İran, Irak ve Afganistan ile Sadabad Paktı'nı imzalaması, izlenen dış politikanın somut örneklerindedir. Uluslararası dengeler, Türkiye'nin iç politikasının yanı sıra basın üzerinde de etkili olmuştur. Bu doğrultuda Türkiye, Balkan devletleriyle ilişkilerini güçlendirmeye yönelmiş ve 15 Şubat 1937'de toplanan Balkan Basın Birliği'ne katılarak Türk basınına kültürel alanda Balkan devletlerine tanıtmak için çalışmalar yapmıştır. Bu çalışmada, Türkiye'nin Balkanlar'da izlediği politika ve Atatürk dönemi Türk dış politikası hakkında bilgi sunulmaya çalışılmıştır.

Anahtar kelimeler: Balkan Paktı, Sadabad Paktı, Atatürk, Dış Politika, İşbirliği

**INNOVATING EARLY CHILDHOOD EDUCATION: A PLAY-BASED LEARNING
APPROACH WITH TECHNOLOGY INTEGRATION**

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ABSTRACT

This research delved into the transformative potential of play-based learning in Early Childhood Education, with a central focus on the infusion of innovation and technology. The study investigated the synergistic effects of play-based methodologies and technological integration on cognitive development, aiming to illuminate the multifaceted benefits derived from this dynamic educational approach. Utilizing a robust methodology, the research conducted an extensive review of recent literature, empirical studies, and practical implementations, by examining the intersections of play-based learning and technology, the study sought to uncover insights into cognitive, social, and emotional growth, providing a comprehensive understanding of how educators can leverage innovation to optimize Early Childhood learning environments. A pivotal aspect of the research was the deliberate incorporation of technology to enhance the educational experience. The strategic integration of technology was positioned as a catalyst for innovation, promising a redefined and enriched learning landscape for young minds. The study aims to identify practical applications and effective strategies that educators can employ to seamlessly integrate technology into play-based learning, fostering a holistic and forward-looking educational paradigm. The findings of this research offered not only implications for curriculum development and instructional strategies but also insights into how innovation and technology can be harnessed to promote holistic development in young learners. It was concluded that, by embracing a holistic approach that included play-based learning and technological innovation, educators can pave the way for a more engaging and effective Early Childhood Education experience. It was recommended that, this research should contributed to the ongoing dialogue on the evolution of pedagogical approaches, emphasizing the importance of combining play, innovation, and technology for the optimal development of young mind.

KEYWORDS: Play-Based Learning, Early Childhood Education, Cognitive Development, Technology Integration and Holistic Learning.

**COMPARATIVE ASSESSMENT OF GROUNDWATER AND SURFACE WATER QUALITY
IN GWANTU TOWN, KADUNA STATE**

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ABSTRACT

This study presents a comparative assessment of groundwater and surface water quality conducted in Gwantu, Sanga Local Government Area, Kaduna State, where a total of thirty (30) samples were collected from wells, boreholes and stream water sources using purposive sampling technique and analyzed for key parameters. The results show significant variations across water sources. Stream water had the highest pH (7.39), colour (21.54 TCU), turbidity (13.71 NTU), faecal coliform count (29 cfu/100ml), and total coliform count (62.4 cfu/100ml), making it unsafe for consumption. In contrast, borehole water exhibited lower contamination, with faecal coliform count at 0.3 cfu/100ml and total coliform count at 2 cfu/100ml. Groundwater sources also demonstrated higher mineral content: wells had the highest total dissolved solids (687.5 mg/l), total hardness (516.68 mg/l), and electrical conductivity (351.06 μ S/cm). Chloride levels were highest in boreholes (42.63 mg/l), while calcium (17.35 mg/l) and magnesium (17.77 mg/l) were also elevated. These findings indicate that borehole water generally meets WHO and NSDWQ standards, while stream water poses significant health risks due to microbial contamination. The study emphasizes the need to prioritize monitoring efforts, community engagement, and stakeholder collaborations to address emerging water quality challenges and ensure the sustainable management of water resources. Additionally, promoting public awareness and implementing targeted interventions to mitigate pollution sources are crucial steps towards safeguarding public health and environmental integrity.

**ANTHROPOMETRIC ANALYSIS OF EAR BIOMETRY AND DIGITO-PALMAR
DERMATOGLYPHICS OF YORUBA ETHNIC GROUP OF NIGERIA**

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Abstract

Humans have a vast spectrum of biological differences, which distinguishes us from one another. This variations can be seen in fingerprint patterns, palmar angles, ear shapes, and ear biometrics of an individual and can be a viable tool of identification. A total of 380 individuals (190 males and 190 females) of Yoruba ethnic group of Nigeria took part in this study aimed at investigating ear biometric and palmar dermatoglyphic characteristics of the study population. The respondent's bio data was captured using questionnaires, their palm prints were recorded using a Canon palm print scanner, and the palmar angles were determined using AUTOCAD software. Ear biometrics and lobule attachment were measured using a vernier calliper. Results obtained showed that atd angle was significantly higher ($p < 0.05$) in females than in males. The right tragus length, left ear breadth, right concha length, left concha length and left concha breadth were significantly higher ($p < 0.05$) in males than in females. Oval ear shape was significantly higher in males (54.2%) than in females (39.5%). Conclusively, this study revealed that variations in palmar angles and ear biometry demonstrate sexual dimorphism and may be used as ancillary factors in gender identity and differentiation in the study population.

Key words: atd angle, dat angle, dermatoglyphics, ear biometry, ear shape.

EFFECT OF *THYMUS FONTANESII* BOISS. & REUT. EXTRACTS (LEAF) ON THE LIPID PROFILE OF HYPERLIPIDEMIC MOUSE.

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Abstract

Hyperlipidemia is one of the biggest risk factors contributing to the severity of cardiovascular disease. The treatment of hyperlipidemia involves the control of diet and the use of lipid-lowering drugs. However, some patients can't tolerate the side effects of these medications, so modern medicine is turning its attention to traditional medicine for the search for new therapeutic agents.

The present study was undertaken to investigate the effect of aqueous and hydro-alcoholic extracts of *Thymus fontanesii* administered orally at a dose of 200 mg / kg body weight on lipid profile (TC (total cholesterol), TG (triglycerides), LDL (low density lipoproteins), VLDL (very low density lipoproteins) and HDL (high density lipoprotein) hyperlipidemic mice.

The phytochemical study of *Thymus fontanesii* extracts revealed the presence of chemical groups such as polyphenols, flavonoids, tannins etc., and the determination of lipid parameters after 30 days of treatment show a significant decrease in the level of TC, TG , LDL and VLDL with a non-significant increase in the HDL level. These results demonstrated that extracts of *Thymus fontanesii* have hypo-lipid activity and could be used for the prevention of associated disorders of hyperlipidemia.

Key words: hyperlipidemia, hydroalcoholic extract, aqueous extract, *Thymus fontanesii*, flavonoids, hypo-lipid activity.

**EMPOWERING HEALTH THROUGH IOT-DRIVEN PREDICTIVE MONITORING FOR
COST-EFFICIENT CARE**

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II YEAR ECE
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Abstract:

Health technology rapidly grows, aiding illness prediction and swift medication access. Researchers enhance disease prediction systems. Remote health monitoring, crucial for elders, is simplified by IoT devices, preventing serious issues. Modern health technology rapidly advances, prioritizing prompt illness prediction and medication access, bypassing the time-consuming and costly doctor visits and tests. Researchers actively contribute to developing new disease prediction systems or enhancing existing ones. Daily tasks involve challenging continuous monitoring of home patients, crucial for aging individuals, necessitating occasional health updates to doctors for potential life-saving interventions. Widespread health monitoring issues persist due to the lack of suitable solutions, leading to serious medical complications for individuals. To address this, numerous IoT devices, such as AD8232, MAX30102, ball tilt sensor, and ESP8266, automatically monitor patient health, offering a cost-effective and accessible healthcare solution. IOT based patient health tracking system effectually monitors the health status of patient and save their survives on schedule.

EFFECT OF AFRICAN WALNUT SHELL (*TETRACARPIDIUM CONOPHORUM*) ON THE PHYSICO-MECHANICAL PROPERTIES OF MODIFIED AND UNMODIFIED NATURAL RUBBER.

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Natural Rubber (NR) in its natural state is soft and weakly linked together. It is relatively easy to pull apart, which account for its stretchy and elastic nature. Walnut shell (WS), being a biodegradable agricultural waste was chosen in anticipation of reinforcing the blends thereby helping to improve the strength and mechanical properties of the NR. Two different samples of NR were prepared through chemical modification via depolymerization and epoxidation. Depolymerized Natural Rubber (DNR) was produced by depolymerization of natural rubber latex using nitrobenzene and Epoxidized Natural Rubber (ENR) was produced by reaction with performic acid. Walnut was de-shelled, washed, dried, milled, sieved and were characterized by determining the moisture content, Ash content, volatile matter, pH measurement and Loss on Ignition. The NR, DNR and ENR composites filled with WS at three ratios of 100/0, 50/50 and 0/100 were prepared and labeled as mixes A to C. The physico-mechanical properties and solubility parameters of solvents into the different vulcanizates were studied. It was observed that the tensile strength of the modified natural rubber was higher than that of the unmodified natural rubber. For Mix A, there was 50% increase from NR to DNR and 54% increase from NR to ENR; for Mix B, there was 37% increase from NR to DNR and 60.5% increase from NR to ENR; for Mix C, there 49.1% increase from NR to DNR and 64.2% increase from NR to ENR. The values for the elongation @ break point and the hardness also increased with the addition of the WS into the modified NR composites with values higher than that of the unmodified NR. However, it was observed that there was a reduction in the compression set from the unmodified NR to the modified NR, which is due to modification which increased the stiffness of the composite.

Key Words: Biodegradable, Blends, Depolymerise, Epoxidize, Vulcanisate, Composite.

INVOLVEMENT IN ADVERTISING: EXAMINING THE EFFECT OF IDENTIFICATION THEORY CHARACTERISTICS – CASE STUDY: BEIRUT BEER ADS BETWEEN 2015 AND 2024

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Abstract:

Advertising, as part of Integrated Marketing Communications, is a crucial practice that connects the brand to its customers. When brands aim to reach their target audience effectively and try to retain customer loyalty, their advertisements need to reflect and mirror valuable aspects of the viewers. In the Lebanese context, many companies merge elements that resonate with their target audience or a category of people to try to strengthen their customer retention such as identification characteristics that might seem unnoticed to viewers. Beirut Beer, which directly competes with famous and similar companies in the Lebanese beer market, uses identification elements in its advertisements to try and resonate with a specific category of people that it aims to target and retain. This study analyzes and studies identification theory elements and practices that are included in Beirut Beer ads (2015-2024), examines why they were chosen, and how they affect the viewers' choice in light of the Identification Theory, Social Identity Theory, and Reference Group Theory. Our findings show that the identification elements used by Beirut Beer are chosen by taking into consideration their direct competitor and specifically choosing the opposite target audience. Therefore, instead of riskily trying to compete with older and more important companies in the Lebanese beer market and putting itself at risk, Beirut Beer's main strategy is to target its competitor's opposite audience by using identification characteristics in its ads.

Keywords: Identification, Social Identity, Reference Group, Target Audience, Lebanon, Advertising

PLATELET CONCENTRATE UTILIZATION TRENDS IN A TERTIARY CARE HOSPITAL: A COMPREHENSIVE ANALYSIS

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ABSTRACT

Objective: The objective of the study was to determine frequency of the appropriate utilization of platelet concentrates in a tertiary care hospital.

Material and Methods: It was a descriptive cross-sectional study that was conducted in Diagnostic & Research Laboratory Liaquat University Of Medical and Health Sciences Jamshoro from January 2022 to June 2022. Patients of both genders, above five years of age receiving platelets transfusions during the study period were included in this study. An informed consent was obtained from the patients. The data was collected on a predesigned form that included patient demographic and clinical details. All patients were categorized whether the platelet transfusion was appropriate or inappropriate according to the mentioned definitions. T test was applied to find statistical difference between appropriate and inappropriate transfusions.

Results: Out of total 165 patients, 85 (52%) were females while 80 (48%) were males. Mean age was 41.45 years with a range of 6-81 years. Single donor platelet units were transfused to 27 (16.4%) patients while rest 138 (83.6%) patients received random donor platelets. 149 (90.9%) had appropriate transfusion while 16 (9.1%) patients received blood transfusion due to inappropriate indications. ($p < 0.0001$).

Conclusion: From this study it was concluded that a considerable number of patients in hospital setting receive inappropriate platelet transfusions.

Key Words: Appropriate Utilization, Platelet concentrates, Tertiary Care Hospital

**TEKSTİL ve HAMMADDELERİ SEKTÖRÜNDE ULUSLARARASI
TİCARET: GAZİANTEP ÖRNEĞİ
INTERNATIONAL TRADE IN THE TEXTILE AND RAW MATERIALS SECTOR: THE
CASE OF GAZİANTEP**

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Abstract

As one of the traditional and largest sectors of the Turkish economy, the textile sector maintains its status as an essential branch of industry, driven by the product diversity achieved as a natural consequence of technological developments. The sector has a wide range of products, including technical textiles, woven fabrics, home textiles, yarn, fiber, knitted fabrics, and the ready-to-wear sub-industry, and also plays a significant role in the macroeconomic indicators of our country because it supports various kinds of industries.

On a global scale, the world population of more than eight billion, a relatively increasing level of prosperity, urbanization, rising disposable income allocated to fashionable clothing, and growing demand for quality products and innovative designs are considered among the main drivers of growth in the sector. The future situation of the sector in the coming years depends on companies producing more sustainable and eco-friendly products to reduce their carbon footprint and minimize the global textile waste problem, and, as well as, the adoption of new consumption behaviors by consumers, in parallel with rising global climate change concerns.

On the other hand, when looking at the global export figures of the textile and raw materials market, whose future growth prospects are mostly positive, it is seen that approximately 344 billion dollars worth of exports were recorded in 2023, a decrease of 10.5% compared to the previous year. Türkiye has a share of 3.4% in world textile exports, with 5.84 billion dollars in the same year, maintaining the country's position as the fifth-largest exporter in the ranking, where EU-27 is taken as a single block. As of 2023, Istanbul accounts for 42.3% of Turkey's total textile and raw materials exports and is followed by Gaziantep with a share of 15.3% and exports of 1.45 billion dollars. In this study, the success story of Gaziantep, which has an inspiring profile within the framework of components such as raw material abundance, infrastructure, and facilities, geographical location, industrial suitability, support and incentive mechanisms, target market strategies, and labor market, which are considered among the determining factors in shaping textile and raw materials exports, is examined in light of current data and key global trends. In this way, it is intended to create a reference study for other world provinces with similar characteristics to Gaziantep, especially in the TRB and TRC Regions of Türkiye.

Keywords: Textile and raw materials, Gaziantep, Global trade, Economic growth, TRB and TRC Regions

Özet

Türkiye ekonomisinin geleneksel ve en büyük sektörlerinden olan tekstil sektörü günümüzde teknolojik gelişmelerin doğal bir sonucu elde edilen ürün çeşitliliğinin de etkisiyle önemli bir sanayi kolu olma özelliğini korumaktadır. Teknik tekstil, dokuma kumaş, ev tekstili, iplik, elyaf, örme kumaş ve konfeksiyon yan sanayi gibi oldukça geniş bir ürün grubuna sahip olan sektör çok çeşitli endüstrileri desteklemesinden dolayı ülkemiz makroekonomik göstergeleri için de büyük önem taşımaktadır.

Küresel ölçekte sekiz milyarı aşan dünya nüfusu, görece artan refah seviyesi, kentleşme, moda konseptine uygun kıyafetler için harcanabilir gelirin yükselmesi, kaliteli ürünlere ve yenilikçi tasarıma yönelik talebin artması sektördeki büyümenin temel itici güçleri arasında değerlendirilmektedir. Sektörün önümüzdeki yıllardaki gidişatı ise artan küresel iklim değişikliği kaygıları paralelinde firmaların karbon ayak izlerini azaltmak ve tekstil atık sorununu minimum seviyeye indirmek için daha

sürdürülebilir ve çevre dostu ürünler üretmesine ve elbette tüketicilerin bu doğrultuda yeni tüketim davranışları benimsemesine bağlı görülmektedir.

Öte yandan, gelecek büyüme beklentileri ekseriyetle pozitif yönlü açıklanan tekstil ve hammaddeleri pazarının küresel ihracat değerlerine bakıldığında 2023 yılında %10,5 oranında bir düşüş ile 344 milyar dolar olarak gerçekleştiği görülmektedir. Ülkemiz ise aynı yıl 5,84 milyar dolar ihracat ile dünya tekstil ihracatından %3,4'lük pay almış olup, AB-27'in tek blok alındığı sıralamada beşinci en büyük ihracatçı ülke pozisyonunu korumuştur. 2023 yılında Türkiye'nin toplam tekstil ve hammaddeleri ihracatının %42,3'ünü İstanbul ilk sırada karşılarken, onu %15,3 pay ve 1,45 milyar dolar ihracat ile Gaziantep takip etmektedir. Bu çalışmada tekstil ve hammaddeleri ihracatının şekillenmesinde belirleyici unsurlar arasında kabul edilen hammadde zenginliği, alt yapı ve tesisler, coğrafi konum, endüstriyel uygunluk, destek ve teşvik mekanizmaları, hedef pazar stratejileri, emek piyasası gibi bileşenler çerçevesinde kesinlikle ilham verici bir profile sahip Gaziantep'in sektördeki başarı hikâyesi güncel veriler ve küresel ana trendler ışığında irdelenmektedir. Böylelikle TRB ve TRC başta olmak üzere benzer özellikler taşıyan diğer dünya kentleri açısından referans bir çalışma oluşturulması hedeflenmiştir.

Anahtar kelimeler: Tekstil ve hammaddeleri, Gaziantep, Küresel ticaret, Ekonomik büyüme, TRB ve TRC Bölgeleri

FACTORS RESPONSIBLE FOR AGGRESSIVE BEHAVIOR AMONG SECONDARY SCHOOL STUDENTS IN

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Abstract

This article addresses factors responsible for aggressive behavior among secondary school students. The study adopted a descriptive survey design. Respondents were drawn from 6 public senior secondary schools in Obio/Akpor Local Government of Rivers State. Simple random sampling technique and observation were employed to get a sample size of 117 students. Three research questions and three hypotheses guided the study. The instrument for data collection was a researcher-structured questionnaire titled: factors responsible for Aggressive Behavior among Secondary School Students (FRABSSS). The questionnaire was structured using a Likert type of response with Strongly Agree (SA), Agree (A) Disagree (D), and Strongly Disagree (SD) options respectively. The instrument was validated by experts in measurement and evaluation. A reliability of 0.86 was obtained using Cronbach Alpha formula. Data were analyzed using mean, standard deviation, and t-test. A mean of 2.50 and above was accepted as an indication of agreement while a mean of 2.49 and below indicated disagreement for the section on aggression. The Findings reveal that boys use abusive and foul language and are involved in destructive activities as compared to girls who were rarely observed in abusive language or physical fights. Negative home and family environment (broken and divorced parents and family problems), unfriendly parents' behavior, authoritative and dishonest behavior of teachers, poor teacher-student interaction, pressure of studies, unfriendly relationships with peers, and injustice in society are the major causes of aggressive behavior of students at secondary level in students. It was recommended among others that there is a need to address the aggressive behavior among students at schools on a top priority basis by arranging counseling services for students at the school level to provide them psychotherapy for relaxation from aggressive behavior.

Keywords: aggression, aggressive behavior, factors responsible for aggressive behavior,

**PROSTAT ADENOKARSİNOMLARINDA YENİ NESİL DİZİLEME İLE SAPTANAN
MUTASYON PROFİLİNİN DEĞERLENDİRİLMESİ VE HİSTOPATOLOJİK
PARAMETRELERLE İLİŞKİSİ
EVALUATION OF MUTATION PROFILE DETECTED BY NEXT GENERATION
SEQUENCING IN PROSTATE ADENOCARCINOMAS AND ITS RELATIONSHIP WITH
HISTOPATHOLOGICAL PARAMETERS**

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Abstract

Introduction: Prostate cancer is a common carcinoma in men and also a cause of mortality. Multiple genetic factors play a role in the pathogenesis of prostate cancer. Since prostate cancer is a heterogeneous disease group, its clinical course is quite variable. With the development of Next Generation Sequencing (NGS) methods, there have been significant developments in terms of personalized treatments and predicting prognosis. In this study, we aimed to determine the diversity and frequency of somatic mutations detected in patients with prostate adenocarcinoma and to evaluate their relationship with histopathological parameters.

Materials And Methods: A total of 53 adenocarcinoma prostate fine needle biopsies, whose DNAs were isolated from paraffin blocks and studied with the NGS system at the Molecular Pathology Laboratory of Aydın Adnan Menderes University between 2023-2024, were included in the study. Age, Gleason score, grade group, cribriform structure, tumor percentage, prostatic intraepithelial neoplasia, perineural invasion, lymphovascular invasion, tumor focality, necrosis and a total of 13 cancer-related gene mutations in the panel of the NGS system were recorded. Data were analyzed using the IBM Statistical Package for Social Sciences(SPSS) 27 package program.

Results: Pathogenic mutations were detected in 19(35.8%) of 53 cases in PTEN, 13(24.5%) in TP53, 9(17%) in AR, and 9(17%) in BRCA2 genes. Mutations were observed in more than one gene in some cases. Pathogenic mutations were also detected in the BRCA2 gene in 5(55.5%) of 9 cases in which pathogenic mutations were detected in the AR gene. Cribriform structure, high Gleason score, high tumor percentage and bilaterality were observed in most cases with pathogenic mutation.

Conclusion: Cribriform structure, which shows an aggressive course, and high Gleason score and perineural invasion may be clues for somatic mutations, and these parameters must be specified in the report. Analysis of the mutation profile in laboratories where NGS can be performed and combining it with existing histopathological parameters are important for determining prognosis and possible treatment targets.

Key words: Prostate adenocarcinoma, cribriform structure, mutation, NGS

Özet

Amaç: Prostat kanseri, erkeklerde sık izlenen ve aynı zamanda mortaliteye sebep olan bir karsinomdur. Prostat kanseri patogeneğinde multipl genetik faktörler rol oynamaktadır. Prostat kanseri heterojen bir hastalık grubu olduğundan klinik seyri oldukça değişkenlik göstermektedir. Yeni Nesil Dizileme (YND) yöntemlerinin gelişmesiyle kişiye özgü tedaviler ve prognozu tahmin etmek açısından son dönemde önemli gelişmeler olmuştur. Bu çalışmada prostat adenokarsinomlu hastalarda saptanan somatik mutasyonların çeşitliliğinin ve sıklığının belirlenmesi ve bunların histopatolojik parametrelerle ilişkisinin değerlendirilmesi amaçlanmıştır.

Gereç ve Yöntem: 2023-2024 yılları arasında, Aydın Adnan Menderes Üniversitesi Moleküler Patoloji Laboratuvarında, parafin bloklarından DNA'ları izole edilerek, YND sistemiyle çalışılan toplam 53 adenokarsinom tanılı prostat ince iğne biyopsileri çalışmaya alındı. Olguların yaş, gleason skor, grade grup, kribriform yapı, tümör yüzdesi, prostatik intraepitelyal neoplazi, perinöral invazyon, lenfovasküler invazyon, tümör fokalitesi, nekroz ile YND sistemine ait panel içerisinde yer alan toplam 13 adet kanser ilişkili gen mutasyonu kaydedildi. Veriler IBM Statistical Package for Social Sciences (SPSS) 27 paket programı kullanılarak analiz edildi.

Bulgular: 53 vakanın 19'unda (%35,8) PTEN, 13'ünde (%24,5) TP53, 9'unda (%17) AR, 9'unda (%17) BRCA2 geninde patojenik mutasyon saptandı. Bazı vakalarda birden fazla gende mutasyon izlendi. AR geninde patojenik mutasyon saptanan 9 olgunun 5'inde (%55,5) BRCA2 geninde de patojenik mutasyon mevcuttu. 46 vakada (%86,8) kribriform yapı, 38 vakada (%71,7) bilateralite, 27 vakada (%50,9) perinöral invazyon, 8 vakada (%15,1) prostatik intraepitelyal neoplazi, 3 vakada (%5,7) lenfovasküler invazyon, 3 vakada (%5,7) nekroz gözlemlendi. Ayrıca patojenik mutasyon izlenen vakaların çoğunda kribriform yapı, yüksek gleason skor, yüksek tümör yüzdesi ve bilateralite izlendi.

Sonuç: Agresif gidişatı gösteren kribriform yapı başta olmak üzere; yüksek gleason skor ve perinöral invazyon somatik mutasyonlar açısından birer ipucu olabilir, ve bu parametrelerin raporda mutlaka belirtilmesi gereklidir. YND çalışılabilen laboratuvarlarda mutasyon profilinin analiz edilmesi ve mevcut histopatolojik parametrelerle kombine edilmesi, prognoz tayini ve olası tedavi hedefleri açısından önemlidir.

Anahtar Kelimeler: Prostat adenokarsinomu, kribriform yapı, mutasyon, YND

İŞ TATMİNİ LİTERATÜRÜNÜN BİBLİYOMETRİK BİR ANALİZİ BIBLIOMETRIC ANALYSIS of JOB SATISFACTION LITERATURE

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Abstract

Given the significant amount of time employees dedicate to their work lives, it is evident that job satisfaction holds great importance at both individual and organizational levels. Job satisfaction, a concept representing the emotional and mental fulfillment employees derive from their work, has a direct impact on performance, motivation, and overall well-being. Although job satisfaction is a crucial element in shaping an individual's role and perception within an organization, the majority of research has centered on organizational behavior and human resources. In this context, the aim of this study is to determine the evolution over time of scientific studies on job satisfaction, prevalent research themes, the most cited articles, leading authors, influential journals, and countries using bibliometric analysis. Because bibliometric analysis is necessary to handle and analyze large volumes of data, and it provides insights into information gaps and future research opportunities. This study presents a comprehensive evaluation of research on job satisfaction through a bibliometric analysis of 891 publications in the Web of Science database. Data analyzed using the bibliometric mapping method reveals research trends, popular topics, gaps, and future research directions in the field of job satisfaction. The evaluation, conducted using metrics such as publication count, authors, institutions, countries, keywords, and citations, provides a detailed overview of the current state and shortcomings of the field. Notably, the high level of co-citation among different studies underscores the significance of this topic and the interaction between different disciplines. Based on the findings, this comprehensive analysis offers new perspectives and strategies for future research in the field of job satisfaction. This study is expected to make a substantial contribution to the comprehensive review of the existing literature and the establishment of research priorities. In conclusion, this bibliometric analysis of job satisfaction serves as a valuable resource for both the academic community and the business world.

Keywords: Employees, Job satisfaction, Bibliometric analysis, Web of Science

Özet

Çalışanların iş yaşamlarına ayırdıkları zaman dilimi göz önüne alındığında, iş tatmininin hem bireysel hem de örgütsel düzeyde büyük bir öneme sahip olduğu aşikârdır. İş tatmini, çalışanların işleriyle ilgili duygusal ve zihinsel doyumu ifade eden bir kavram olup, performans, motivasyon ve genel refah üzerinde doğrudan etkilidir. Ayrıca, iş tatmini, bireyin iş yerindeki konumunu ve örgüt içerisindeki algısını şekillendiren kritik bir unsur olmakla birlikte, yapılan çalışmaların çoğunlukla örgütsel davranış ve insan kaynakları alanlarına odaklandığı görülmektedir. Bu bağlamda çalışmanın amacı, iş tatmini üzerine yapılan bilimsel çalışmaların zaman içerisindeki gelişimini, yaygın araştırma temalarını, en çok atıf alan makaleleri, önde gelen yazarları, etkili dergileri ve ülkeleri bibliyometrik analiz ile belirlemektir. Çünkü bibliyometrik analiz büyük hacimli veri yığınlarını ve bulmak ve çözümlmek için gerekli olup bilgi boşluklarını ve gelecekteki araştırma fırsatları hakkında bilgiler sunacaktır. Bu çalışmada, Web of Science veri tabanında yer alan 891 yayın üzerinden gerçekleştirilen bibliyometrik analiz ile iş tatmini alanındaki araştırmaların kapsamlı bir değerlendirmesi yapılmıştır. Bibliyometrik haritalandırma yöntemi ile analiz edilen veriler, iş tatmini alanındaki araştırma eğilimlerini, popüler konuları, boşlukları ve geleceğe yönelik araştırma yönlerini ortaya koymaktadır. Yayın sayısı, yazarlar, kurumlar, ülkeler, anahtar kelimeler ve atıflar gibi ölçütler kullanılarak yapılan değerlendirme, alanın mevcut durumunu ve eksikliklerini detaylı bir şekilde sunmaktadır. Özellikle, farklı çalışmalar arasında

gözlenen yüksek düzeyde ortak atıf, bu konunun önemini ve farklı disiplinler arasındaki etkileşimi vurgulamaktadır. Bu kapsamlı analiz, elde edilen bulgular ışığında, iş tatmini alanındaki gelecek araştırmalar için yeni perspektifler ve stratejiler sunmaktadır. Mevcut literatürün derinlemesine incelenmesi ve araştırma önceliklerinin belirlenmesi açısından bu çalışmanın önemli bir katkı sağlayacağı düşünülmüştür. Sonuç olarak, iş tatmini üzerine yapılan bu bibliyometrik analiz hem akademik camia hem de iş dünyası için değerli bir kaynak niteliğindedir.

Anahtar kelimeler: Çalışanlar, İş Tatmini, Bibliyometrik Analiz, Web of Science

**PATLATMA FAALİYETLERİNDE TOZ OLUŞUMU, DEĞERLENDİRME YÖNTEMLERİ
VE KONTROLÜ**
**DUST FORMATION, ASSESSMENT METHODS, AND CONTROL IN BLASTING
ACTIVITIES**

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Abstract

Blasting is widely used in industries such as mining and quarrying due to its technical and economic advantages. However, in addition to the high operational speed and cost benefits of blasting, it also has environmental drawbacks such as dust generation, air shock, and vibrations. While air shock and vibrations have the potential to cause physical damage to nearby structures and psychological effects on living organisms, particulate matter has direct health impacts. Furthermore, different particulate matter (dust) fractions have varying effects. Suspended Particulate matters in the air, larger than 10 microns in size, is trapped in the upper respiratory system, whereas very small particles can enter the bloodstream through lung alveoli. This study addresses the characteristics of the dust generated during blasting, including parameters such as size and fractions, factors influencing the dust, and methods for dust measurement and mitigation. Additionally, national and international regulations on dust control and management are reviewed, with a focus on key issues specific to mining activities. Determining the formation mechanism, characteristics, size fractions, dispersion, and attenuation mechanisms of the dust generated by blasting activities through appropriate methods, and effectively controlling and managing the resulting particulate matter, is critical for minimizing environmental impacts.

Keywords: blasting, particulate matter, dust generation

Özet

Patlatma, madencilik ve taşocakçılığı gibi sektörlerde teknik ve ekonomik avantajları nedeniyle yaygın olarak kullanılmaktadır. Ancak, patlatmanın yüksek çalışma hızı ve maliyet avantajlarına ek olarak, toz oluşumu, hava şoku ve titreşim gibi çevresel olumsuz etkiler de söz konusudur. Hava şoku ve titreşimler çevredeki yapı birimlerinde fiziksel hasar ve canlılar üzerine psikolojik etkiler oluşturma potansiyeline sahipken, partikül maddelerin doğrudan sağlık üzerine etkisi vardır. Ayrıca, Farklı partikül madde (toz) fraksiyonları farklı etkilere sahiptir. Havada askıda kalabilen partikül maddelerden 10 mikrondan büyük boyut aralığındakiler dış solunum sisteminde tutulduğu gibi çok küçük partiküller akciğer alveolleri yoluyla kana karışabilmektedir. Bu çalışma, patlatma sırasında oluşan tozun özelliklerini, çap ve fraksiyon gibi parametrelerini, tozun etkilendiği faktörleri, toz ölçüm ve bertaraf yöntemlerini ele almaktadır. Ayrıca, toz kontrolü ve yönetimi konusunda geçerli ulusal ve uluslararası düzenlemeler incelenerek, madencilik faaliyetleri özelindeki önemli hususlar detaylandırılmaktadır. Patlatma faaliyetleri etkisinde oluşan tozun oluşum mekanizması, karakteristiği, boyut fraksiyonları yayılım ve sönümlenme mekanizmalarının uygun yöntemlerle belirlenmesi, meydana gelen partikül maddelerin etkili bir şekilde kontrol edilmesi ve yönetilmesi, çevresel etkilerin en aza indirilmesi açısından kritik öneme sahiptir.

Anahtar kelimeler: patlatma, partikül madde, toz oluşumu

**DİKENLİ İNCİR TOHUM EKSTRAKTININ YUMUŞAK ÇELİĞİN ASİDİK ORTAMDAKİ
KOROZYON DAVRANIŞI ÜZERİNE ETKİSİ
THE EFFECT OF PRICKLY PEAR SEED EXTRACT ON THE CORROSION BEHAVIOR
OF MILD STEEL IN ACIDIC ENVIRONMENTS**

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Abstract

In the industrial field, the use of acids as cleaning agents and the presence of mild steel in these areas create significant corrosion problems. Therefore, to prevent the corrosion of the used mild steel, the acid solution needs to be inhibited. In this regard, prepared inhibitors are known as anti-corrosion agents. The primary function of these substances is to cover the metal surface, thereby increasing the resistance of the metal/environment interface. It is known that organic substances used as corrosion inhibitors are particularly effective under acidic conditions. Among these inhibitors, the use of environmentally friendly "green inhibitors" is becoming more common. There are many studies in the literature where various plant roots, leaves, and fruits have been used to reduce metal corrosion. In this study, an extract obtained from prickly pear seeds, which has not been studied for inhibition performance until now, was used as a natural inhibitor in an acidic environment. For this purpose, a quantity of seeds was added to 0.5 M HCl and continuously stirred at 85°C for 1 hour. The inhibition performance of this extract was investigated in the presence of mild steel in a 0.5 M HCl environment with different inhibitor concentrations. Tafel polarization curves and electrochemical impedance spectroscopy (EIS) methods were used for this examination. The measurement of the Tafel polarization curves showed that as the extract concentration increased, the corrosion current decreased. EIS measurements indicated that with increasing concentration of prickly pear seed extract in the acidic solution, the charge transfer resistance increased and the double-layer capacitance decreased. Based on these results, it was determined that as the amount of inhibitor increased, the corrosion rate of mild steel decreased. The time-dependent anti-corrosion performance of the extract used in daily measurements was examined. This revealed that the inhibitor-protected environment effectively prevented corrosion of mild steel for 24 hours. Additionally, scanning electron microscopy was used to observe the surface morphology of mild steel exposed to both inhibitor and non-inhibitor environments, and EDX was employed for elemental analysis of the new structures formed on the surface.

Keywords: Prickly Pear, corrosion, mild steel

Özet

Endüstriyel alanda asitlerin temizleyici olarak kullanılması ve kullanılan alanlarda yumuşak çeliğin varlığı korozyon açısından büyük problemler yaratmaktadır. Bu nedenle kullanılan yumuşak çeliğin korozyonun önlenmesi için asit çözeltisinin inhibe edilmesi gerekmektedir. Bu amaç doğrultusunda hazırlanan inhibitörler anti korozyon ajanları olarak bilinmektedir. Bu maddelerin temel işlevi metal yüzeyini kapatarak metal/ortam ara yüzeyinin direncini arttırmaktır. Korozyon inhibitörleri olarak kullanılan organik maddelerin özellikle asidik koşullarda etkin olduğu bilinmektedir. Bu inhibitörler arasında yeşil inhibitörler olarak adlandırılan çevre dostu inhibitörlerin kullanılması yaygınlaşmaktadır. Literatürde çeşitli bitkilerin kök, yaprak ve meyvelerinin metal korozyonunu azaltma amacıyla kullanıldığı pek çok çalışma mevcuttur. Bu çalışmada bugüne kadar inhibisyon performansı incelenmemiş olan dikenli incir tohumlarının asidik ortamdaki ekstraktı sonrasında elde edilen özüt doğal inhibitör olarak kullanılmıştır. Bunun için 0,5 M HCl içerisine alınan bir miktar tohum 1 saat boyunca 85 °C sıcaklığında sürekli karıştırılmıştır. Bu ekstraktın inhibisyon performansı 0,5 M HCl ortamında farklı inhibitör konsantrasyonlarında yumuşak çelik varlığında incelenmiştir. Bu

inceleme için Tafel polarizasyon eğrisi, elektrokimyasal impedans spektroskopisi (EIS) yöntemleri kullanılmıştır. Tafel polarizasyon eğrileri incelendiğinde ekstrakt konsantrasyonunun artması ile korozyon akımının düştüğü gözlenmiştir. EIS ölçümleri, asit çözeltisinde dikenli incir tohumu ekstraktının artan konsantrasyonuyla yük transfer direncinin arttığını ve çift tabaka kapasitesinin azaldığını göstermiştir. Bu sonuçlar doğrultusunda İnhibitör miktarının artması ile birlikte yumuşak çeliğin korozyon hızının azaldığı belirlenmiştir. Günlük ölçümlerde kullanılan ekstraktın zamana bağlı anti-korozyon performansı incelenmiştir. Bu sonuçla birlikte 24 saat boyunca inhibitörlü ortamın yumuşak çeliği korozyondan koruduğu anlaşılmıştır. Ayrıca inhibitörlü ve inhibitörsüz ortamda bekletilen yumuşak çeliğin yüzey morfolojisini gözlemek için Taramalı elektron mikroskopu, yüzeyde oluşan yeni yapıların elementel analizi için EDX kullanılmıştır.

Anahtar kelimeler: Dikenli incir, Korozyon, Yumuşak çelik

BIOACTIVE COMPOUNDS IN BUTANOLIC EXTRACT OF MUNG BEAN (*Vigna radiata*) ROOT.

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Abstract: The mung bean plant (*Vigna radiata*), renowned for its seeds and sprout's nutritional and medicinal properties recorded by many researchers round the globe, has prompted the exploration of the therapeutic potentials of its root, as it is a lesser researched part of the plant that may harbour untapped bioactive compounds. It is a newly introduced plant in Nigeria yet globally cultivated and utilized. In the present study, mung bean root (MBR), harvested from the farm of Bioresources Development Centre, Abagana, Anambra State, Nigeria, was identified at the Advanced Crop Science laboratory, National Biotechnology Development Agency, Abagana, Anambra State, Nigeria. The harvested root was rinsed with distilled water to remove sand and dust particles, air dried for 3 weeks and processed into flour. Butanolic extraction of the bioactive compounds present in the root flour sample was done using Soxhlet apparatus and the butanolic extract was subjected to GC-MS assay to investigate and quantify the phytochemical content that might attribute to potential health benefits, thereby giving the waste product a value. The GC-MS spectrum obtained from the butanolic extract of Nigerian *Vigna radiata* Root (BENVrR) flour generated 62 observable peaks and when matched with MassHunter\Library\NIST14.L spectral database, revealed the presence of 35 bioactive compounds with 27 repeated elutions. 1-Docosene, eluted six times with summed relative abundance of 17.05%, has the highest peak on the spectrum at RT 37.710 but the major bioactive compound contained in BENVrR, eluted eight times, was identified as 13-Docosenoic acid, methyl ester with summed relative abundance of 19.23%. These compounds revealed in this analysis have reported medicinal values like anti-inflammatory, antimicrobial, antioxidant, wound healing and skin conditioning effects that can be incorporated in the formulation of novel potent drugs and in cosmeceuticals hence giving value and optimizing the use of mung bean root as an important bioresource.

Keywords: Mung bean, Butanolic-extracts, Gas chromatography-Mass spectrometry, Bioactive Compounds.

**TEK KULLANIMLIK HİJYENİK BEZLERDE GERİ ISLATMA TESTİNİN PNÖMATİK
SİSTEME UYARLANMASI
ADAPTATION OF BACKWET TEST ON DISPOSABLE HYGIENIC CLOTHES TO
PNEUMATIC SYSTEM**

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Abstract

The hygienic products industry can be sustained as a sector that constantly renews and improves itself. Consumption indexed 21st century. Innovations are increasing day by day in the usage, which is the only stop for the purpose of attracting attention in the world. Single baby features are an important product group in the parenting journey. It is a very necessary consumable in the process from birth to the continuation of toilet training. As a disposable diaper manufacturer, optimum quality products are produced in order to provide high comfort to the users, and a series of steps including quality controls for breaks are expected to be carried out under the assurance of the produced product. Quality control tests and their development are important at every stage. With these, it is aimed to follow today's technology by reflecting it in an advanced way in product quality control analyses. Basically, diapers are one-piece products combining different surfaces. These products are created by combining nonwoven, rubber and film layers with the pulp and the absorbent core (core) region called the handle, with the help of glues. When the diaper structure is simply examined; Urine is first rapidly absorbed from the protective layer called the topsheet and transmits the liquid downwards. This also helps protect the baby's skin from wetness. Urine is then rapidly absorbed in the ADL (receiving and distributing surface) part and transmitted to the absorbent (core) layer. The polyester fibers found here ensure urine flow and transfer the liquid equally to the absorbent area along the fiber lengths. In the absorbent region, there are pulp (wood pulp) and SAP (super absorbent polymers) distributed homogeneously between two different nonwoven surfaces. This region resembles an hourglass shape and the function of trapping the main liquid takes place here. Interpretation of the liquid release of the absorbent area on human skin, leakage and raw material quality is carried out by the rewet test. It is aimed to obtain stable analysis results by reducing the dependence on manpower in the rewet test, which is one of the quality tests of the absorbent part of the final products coming from high-tech baby diaper production lines. The newly developed system pneumatic rewet device will lift and lower the weights and stretch the cloth with the help of air pressure.

Keywords: Pneumatic, Diaper, Nonwoven, Rewet

Özet

Hijyenik ürünler sektörü sürekli kendini yenileyen ve geliştiren bir sektör olarak karşımıza çıkmaktadır. Tüketim endeksli yaşanan 21 yy. dünyasında tüketicinin ilgisini çekmek amacı ile tek kullanımlık olarak geçen kullan-at ürünlerinde yenilikler gün geçtikçe artmaktadır. Tek kullanımlık bebek bezleri ebeveynlik yolcuğunda önemli bir ürün grubudur. Doğumdan tuvalet eğitimini tamamlayana kadar olan süreçte en çok ihtiyaç duyulan tüketim malzemesidir. Tek kullanımlık bebek bezi üreticisi olarak kullanıcılarda yüksek memnuniyet sağlama amacıyla optimum kalitede ürün üretilmekte, üretilen ürünlerin güvence altında tutulması için kalite kontrol süreçlerinin yer aldığı bir dizi adımın gerçekleştirilmesi gerekmektedir. Kalite kontrol testleri ve bunların geliştirilmesi ise her aşamada önem

arz etmektedir. Bunlarla birlikte son ürün kalite kontrol analizlerine yenilikçi yüzünü yansıtarak, günümüz teknolojisi takip edilmesi amaçlanmaktadır. Temel olarak bebek bezi farklı yüzeylerin bir araya getirilmesiyle oluşturulan tek kullanımlık ürünlerdir. Bu ürünler nonwoven, lastik ve film tabakalarının pulp ve sap diye tabir edilen emici kor (core) bölgeyle tutkallar yardımıyla birleştirilmesiyle oluşturulmaktadır. Basit olarak bebek bezi yapısı incelendiğinde; idrar önce üst yüzey (topsheet) adı verilen koruyucu katmandan hızlı bir şekilde emilerek sıvıyı aşağı doğru iletir. Bu aynı zamanda bebeğin cildini ıslaklıktan korumayı sağlar. İdrar daha sonra ADL (alıcı ve dağıtıcı yüzey) kısmında hızlı bir şekilde emilerek emici (core) tabakaya iletilir. Burada bulunan polyester fiberleri idrar akışını sağlayarak lif uzunlukları boyunca sıvıyı eşit şekilde emici bölgeye aktarır. Emici bölgede iki farklı nonwoven yüzey arasında homojen olarak dağıtılmış pulp (odun hamuru) ve SAP (süper emici polimerler) bulunmaktadır. Bu bölge kum saati şekline benzetilip esas sıvıyı hapsedme görevi burada gerçekleşmektedir. Emici bölgenin insan cildinde sıvı bırakması, sızıntı ve hammadde kalitesinin yorumlanması rewet testi ile gerçekleştirilmektedir. Yüksek teknolojik bebek bezi üretim hatlarından çıkan son ürünlerin emici bölgesinin kalite testlerinden biri olan rewet testinde insan gücüne bağlılığı azaltarak, stabil analiz sonuçlarının elde edilmesi hedeflenmektedir. Geliştirilen yeni sistem pnömatik rewet cihazı, hava basıncı yardımı ile ağırlıkların kaldırılıp indirilmesi ve bezin gerdirilme işleminin yapılması gerçekleşecektir.

Anahtar kelimeler: Pnömatik, Bebek Bezi, Nonwoven, Rewet

**2023 KAHRAMANMARAŞ DEPREMİ SONRASI ORTAOKUL ÖĞRENCİLERİNİN
“DEPREM” KAVRAMINA YÖNELİK BİLİŞSEL YAPILARININ VERİ ÇEŞİTLEMESİ
YOLUYLA İNCELENMESİ: HATAY İLİ ÖRNEĞİ**

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Özet

Bu araştırmanın amacı, 2023 Kahramanmaraş depremi sonrası Hatay ilinde depremi yaşamış öğrenimine devam eden ortaokul 5. 6. 7. ve 8. Sınıf öğrencilerinin “Deprem” kavramına yönelik bilişsel yapılarının veri çeşitlemesi yoluyla incelenmesidir. Çalışma grubu, 6 Şubat 2023 Kahramanmaraş merkezli depremi yaşayan ve 2023-2024 eğitim-öğretim yılı bahar döneminde Hatay ili Antakya, Samandağ, Yayladağı ve Reyhanlı ilçesinde beş farklı ortaokulda öğrenimine devam eden toplam 460 (n5.sınıf = 94, n6.sınıf = 108, n7.sınıf = 108, n8.sınıf = 150) öğrenciden oluşmaktadır. “Deprem” konusunda ortaokul öğrencilerinin bilişsel yapılarının veri çeşitlemesi yoluyla belirlendiği bu çalışmada nitel ve nicel araştırma yöntemlerinin bir arada yer aldığı yakınsak paralel karma yöntem deseni kullanılmıştır. Bu çalışmada araştırmanın nicel verileri, “Depreme Yönelik Tutum Ölçeği” ile; nitel verileri ise, deprem kavramı kelime ilişkilendirme testi ve öğrenci çizimleri ile toplanmıştır. İlk aşamada öğrencilerden “Deprem” ölçeğine cevap vermeleri istenmiştir. İkinci aşamada ise, “deprem” konusunda kelime ilişkilendirme testine cevap vermeleri, devamında çizim yaparak ya da görselleştirerek desteklemeleri istenmiştir. Araştırmanın nicel verileri SPSS istatistik programı ile nitel verileri ise, içerik analizi yöntemi kullanılarak analiz edilmiştir. Araştırmanın nitel verilerinden elde edilen sonuçlara göre, “Deprem” kavramı ile ilgili kelime ilişkilendirme testi sonuçlarına göre, 4 farklı tema belirlenmiştir. Bu temalar: “duygu olarak deprem”, “doğal afet olarak deprem”, “kayıp olarak deprem”, “destek olarak deprem”. Bütün sınıf düzeylerinde deprem; en çok kayıp olarak deprem temasındaki kelimelerle ilişkilendirdikleri görülmüştür. Öğrencilerin büyük kısmı depremi yaşadıkları can kayıpları, enkazlar ve yıkım olarak nitelendirirken deprem sonrası yaşamlarını anlatan çadır, konteyner ve yardımlardan da söz etmişlerdir. Katılımcıların çizimleri incelendiğinde ise tüm sınıf seviyelerinde depremi, enkaz, ölüm ve çadır şeklinde resmettikleri belirlenmiştir. Araştırmanın nicel verilerinden elde edilen sonuçlara göre, öğrencilerin depreme yönelik tutumlarının depremde hasar görmeyen ilçeler ve depremde hasar gören ilçelerde sınıf seviyesine göre değişkenlik gösterdiği dikkat çekmiştir.

Anahtar Kelimeler: Deprem, bilişsel yapı, ortaokul öğrencileri.

Abstract

The purpose of this research is to examine the cognitive structures of 5th, 6th, 7th and 8th grade secondary school students who experienced the earthquake in Hatay province after the 2023 Kahramanmaraş earthquake, regarding the concept of "Earthquake", through data triangulation. The study group consists of a total of n = 460 (n5th grade = 94, n6th grade = 108, n7th grade = 108, n8th grade = 150) who experienced the February 6, 2023 Kahramanmaraş-centered earthquake and are attending five different secondary schools in Antakya, Samandağ, Yayladağı and Reyhanlı districts of Hatay province in the spring semester of the 2023-2024 academic year. It consists of students. In this study, in which the cognitive structures of secondary school students on the subject of "Earthquake" were determined through data triangulation, a convergent parallel mixed method design, combining qualitative and quantitative research methods, was used. In this study, the quantitative data of the research were collected with the "Attitude Scale towards Earthquakes"; Qualitative data were collected with the earthquake concept word association test and student drawings. In the first stage, students were asked to answer the "Earthquake" scale. In the second stage, they were asked to answer the word association test on the subject of "earthquake" and then support it by drawing or visualizing. The quantitative data of the research were analyzed using the SPSS statistical program and the qualitative

data were analyzed using the content analysis method. According to the results obtained from the qualitative data of the research, 4 different themes were determined according to the word association test results related to the concept of "Earthquake". These themes are: "earthquake as emotion", "earthquake as natural disaster", "earthquake as loss", "earthquake as support". Earthquake at all grade levels; It was observed that they mostly associated words with the earthquake theme as loss. While most of the students described the earthquake as the loss of life, debris and destruction they experienced, they also talked about tents, containers and aid describing their lives after the earthquake. When the drawings of the participants were examined, it was determined that they depicted the earthquake as debris, death and tents at all grade levels. According to the results obtained from the quantitative data of the research, it was noted that students' attitudes towards the earthquake varied according to grade level in the districts that were not damaged by the earthquake and in the districts that were damaged by the earthquake.

Keywords: Earthquake, cognitive structure, secondary school students.

**SUSTAINABLE SOLUTIONS TO GLOBAL AND REGIONAL ENERGY CHALLENGES:
THE IMPACT OF ALTERNATIVE ENERGY AND POLICY REFORM**

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Abstract

The study investigates the profound impacts of oil crises on global energy systems, emphasizing the urgent need for a transition towards sustainable and renewable energy sources. The study identifies critical factors affected by oil crises, including global energy shortages, price fluctuations, geopolitical tensions, and environmental concerns. By examining the consequences of oil dependency, the presentation underscores the necessity of investing in alternative energy sources such as solar, wind, and hydroelectric power. These investments are essential not only to reduce reliance on oil but also to mitigate the economic and environmental impacts of energy crises.

Using Pakistan as a regional case study, the presentation highlights the nation's significant energy challenges, including dependence on oil imports, inadequate infrastructure, and inefficient energy use. It explores potential solutions, such as enhancing investment in alternative energy, implementing energy-efficient policies, and upgrading infrastructure. The study also advocates for integrated strategic management frameworks that can guide global and regional energy policies towards sustainability.

By addressing both global and regional perspectives, this research provides a comprehensive analysis of the strategies needed to achieve energy security and sustainability. It calls for coordinated efforts among policymakers, industry leaders, and stakeholders to develop and implement policies that promote renewable energy and efficient energy use, ultimately fostering economic growth and environmental preservation.

Keywords: *Economic Impact, Energy, Energy Efficiency, Energy Infrastructure, Environmental Concerns, Geopolitical Tensions, Global Energy Systems*

**DÜZENLİ EGZERSİZ YAPAN GENÇ BİREYLERİN ANTROPOMETRİK ÖZELLİKLERİ
VE GÜÇ PARAMETRELERİNİN İNCELENMESİ
INVESTIGATION OF ANTHROPOMETRIC CHARACTERISTIC AND EXPLOSIVE
POWER PARAMETERS OF YOUNG INDIVIDUALS PERFORMING REGULAR
EXERCISE**

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Abstract

Upper-limb muscular power is crucial in various sports and athletic activities which this maximal power reflecting an athlete's capacity to generate force rapidly (Parry et al., 2021).

Evaluating an athlete's upper-limb power is essential to gain insight into their present performance. Coaches rely on assessments of athletes' upper-limb power to develop strategic training programs, tracking progress, and identifying talent (Parry et al., 2020).

Advanced techniques exist for assessing upper-limb power, such as utilizing force plates (McLellan et al., 2011).

The aim of this study was to determine whether there are differences between the anthropometric characteristics and explosive power parameters of individuals who have been exercising regularly three days a week for at least two years and healthy individuals who have not exercised.

Five physically active male athletes and five male sedentary subjects (physically active group: 19.4 ± 1.52 years, 1.79 ± 0.08 height, 71.24 ± 9.20 body mass, 22.04 ± 1.42 body mass index; sedentary group: 26.8 ± 3.70 years, 1.8 ± 0.07 height, 86.56 ± 20.33 body mass, 26.64 ± 4.99 body mass index). Subjects performed 3 repetitions of maximal effort plyometric push-ups on Kistler force plates in a single testing session. Force-time curve data were used to calculate and analyze peak force, mean force, flight time and rate of force development.

All data were saved on the computer as an excell file and analyzed with the SPSS for Windows 22 program. Mean and standard deviation were at the mated such as age, height, weight and body mass index. Since the number of data in the groups was small, Mann Whitney-U test, one of the nonparametric tests, was used to compare the two groups. A significance level of 0.05 was taken as a criterion for interpreting whether the values obtained were significant or not.

Flight time, peak force, mean force, rise time and rate of force development did not show a significant difference between the groups ($p > 0.05$).

The study about the effects of exercise on the human organism will help training science to develop new theories and to prepare more efficient and more accurate training programs for individuals doing sports at all levels (Kose et al., 1997)

Regular exercise increases muscle mass and positively affects strength parameters (Kadı et al., 2021). Evaluation of muscle strength and power is important for training programs and skill determination (Wang et al., 2017).

The limitation of this study is the small numbers of the participants. Therefore, there may not have been a significant difference between the strength parameters of the groups.

Keywords: Plyometric push-up, explosive power, Kistler force platform

Özet

Sporcuların spor ve atletik aktivitelerde hızlı bir şekilde kuvvet üretme kapasitesine ve maksimal güce ulaşmasında üst uzuv kas gücünün önemi büyüktür (Parry vd.,2021).

Bir sporcunun üst uzuv gücünü değerlendirmek, mevcut performansı hakkında fikir edinmek için çok önemlidir. Antrenörler, stratejik antrenman programları geliştirmek, ilerlemeyi takip etmek ve yetenekleri belirlemek için sporcuların üst uzuv gücünün değerlendirilmesine başvurur (Parry vd., 2020)

Üst uzuv gücünü değerlendirmek için kuvvet plakaları kullanmak gibi gelişmiş teknikler mevcuttur (McLellan vd., 2011).

Bu çalışmanın amacı en az iki yıldır haftada üç gün düzenli egzersiz yapan bireyler (fiziksel olarak aktif) ile egzersiz yapmayan sağlıklı bireylerin (sedanter) antropometrik özellikleri ve patlayıcı güç parametreleri arasında farklılıklar olup olmadığını ortaya çıkarmaktır.

Çalışmaya fiziksel olarak aktif beş erkek sporcu ve beş erkek sedanter olmak üzere toplam on kişi (fiziksel olarak aktif grup: 19,4±1,52 yaş, 1,79±0,08 boy, 71,24±9,20 vücut kütlesi, 22,04±1,42 vücut kütle indeksi; sedanter grup: 26,8±3,70 yaş, 1,8±0,07 boy, 86,56±20,33 vücut kütlesi, 26,64±4,99 vücut kütle indeksi) katılmıştır. Denekler tek bir test seansında Kistler kuvvet plakaları üzerinde 3 tekrar maksimal eforlu pliometrik sınav denemeleri gerçekleştirmiştir. Kuvvet-zaman eğrisi verileri; zirve kuvveti, ortalama kuvveti, uçuş süresini ve kuvvet gelişim oranını hesaplamak ve analiz etmek için kullanılmıştır.

Tüm veriler excell dosyası olarak bilgisayara kaydedilmiş ve SPSS for Windows 22 programı ile analiz edilmiştir. Yaş, boy, kilo ve vücut kütle indeksi gibi verilerde ortalama ve standart sapma değerleri kullanılmıştır. Gruplardaki veri sayısı az olduğu için iki grubun karşılaştırılmasında parametrik olmayan testlerden Mann Whitney-U testi kullanılmıştır. Elde edilen değerlerin anlamlı olup olmadığının yorumlanmasında 0.05 anlamlılık düzeyi ölçüt olarak alınmıştır.

Uçuş süresi, tepe kuvveti, ortalama kuvvet, yükselme süresi ve kuvvet gelişim hızı gruplar arasında anlamlı bir farklılık göstermemiştir ($p>0,05$).

Egzersiz insan organizması üzerindeki etkilerinin incelenmesi hem antrenman biliminin yeni teoriler geliştirmesine hem de her derecede spor yapan bireylere daha verimli ve daha doğru çalışma programları hazırlamakta yardımcı olacaktır (Köse, 1997).

Düzenli egzersizin, kas kütlesini artırdığı ve bu artışın güç parametrelerini olumlu yönde etkilediği bilinmektedir (Kadı, 2021)

Kas gücü ve kuvvetinin değerlendirilmesi antrenman programları ve yetenek belirleme açısından önemlidir (Wang vd., 2017).

Bu çalışmanın sınırlılığı olarak az sayıda katılımcının ölçülmesini gösterebiliriz. Bu nedenle grupların kuvvet parametreleri arasında farklılık çıkmamış olabilir.

Anahtar Kelimeler: Pliometrik sınav, patlayıcı güç, Kistler kuvvet platformu

A FORGOTTEN PHILOSOPHICAL PROBLEM: THE HARMFULNESS OF HOPE

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The malevolent, destructive valence of hope has been noted on several occasions, from the disapproval of any attachment in Buddhism and Stoicism to the ambiguous butterfly at the bottom of Pandora's moth box and from the pessimism of Ecclesiastes to that of Schopenhauer or Eminescu. In all these cases, of course, hope is deconsecrated in the context of individual soteriological attempts, where salvation can only be achieved through a prior detachment from the world. The disavowal of hope and the disavowal of 'the world' - in Buddhism, Stoicism, Ecclesiasticism and modern pessimism - go hand in hand, which seems to confirm a strong connection between hope and 'the world'. The profound object of hope is 'the world' - whether this here or a future world (the afterlife) - and the 'liberated' by hope is also liberated from the world that hope grounds or promises.

We propose to deconstruct the concept of hope to get its "essence" at once alluring and destructive, generative and destructive, incipient and terminal. What the hope-healers promise is the detemporalization of consciousness, living in a timeless present unaffected by the flow and passage of time, detached from the crushing con- hold (Ananke) of the immensity of past and future, whose infinite non-being feeds on the frail thread of blood of the now. Indeed, we know it since Augustine, both the past (what is no more) and the future (what is not yet) need the present of my consciousness - which makes them be, appear, phenomenalyze themselves through recollection, memory, expectation and hope, respectively.

By freeing ourselves from hope, we can presentify the present, we can grasp the eternal dynamics of actuality, we can free the present from the perspective in which it is no longer a moment among other moments, but is by itself, neighboring itself, endless duration "flowing" in itself. The liberators of hope (and of time) reveal to us the profoundly temporal, historical nature of the world that hope proposes and imposes! Indeed, the world revealed by hope, the world as it is phenomenalized by hope is historical, it is temporal, it is the world given in and through expectation, the world at the end of a journey, the world as a goal, a promised land. In our presentation we aim to explore the historical, anthropological, philosophical and psychological foundations of the culture of (mundane) hope in comparison with those cultures in which hope is either devalued or given a transmundane valence.

**REPURPOSING THE ANTIHYPERTENSIVE DRUG FENFLURAMINE AS AN
ANTIPILEPTIC AGENT**

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Fenfluramine is used as an immediate cure to treat appetite loss that potentially results from distress, anxiety and related disorders and has a high therapeutic potency to treat epileptic seizures. Fenfluramine is taken orally and has relatively high potency among other SSRIs. The present study was designed to determine the efficacy of fenfluramine in the treatment of epileptic seizures. Twenty four male Albino-Wistar rats were assigned to four groups; control (0.9% saline), fenfluramine (5mg/Kg), fenfluramine (10 mg/Kg) and fenfluramine (15mg/Kg) . After 30 min of oral drug administration behavioral performance was monitored using forced swim test, object recognition test, Skinner's Box, Light-dark boxes and open field test to assess motor function of rats. Results showed that administration of fenfluramine has improved epileptic seizures. So, it can be suggested that fenfluramine has a positive impact on motor functions and can be used as a potential candidate for epileptic disorders. These findings suggest fenfluramine's potential as an antiepileptic agent particularly at the 10mg/kg dose. Further research is needed to validate these effects and explore optimal dosing strategies for therapeutic applications in epilepsy and anxiety-related conditions

COMPREHENDING SUBCONSCIOUS CONSUMER BEHAVIOR IN THE DIGITAL AGE VIA NEUROMARKETING¹

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ABSTRACT

The method of examining a consumer's psychological and brain cues to determine their preferences and comprehend how they make decisions is known as neuromarketing. A wide range of procedures connecting neurology and marketing practices are included in neuromarketing. Its primary function is the conversion of brain impulses into patterns of consumer behaviour. Utilizing a variety of tools, neuromarketing strategies follow the brain's and body's initial subconscious response to an advertisement, packaging, or content. Among the tools that are most often used for the needs of neuromarketing research, the following stand out: Functional MRI (fMRI), Electroencephalogram (EEG), Electrocardiogram (ECG) (which are also used in neuroscience), but also tools such as Eye-tracking, Galvanic skin response (GSR) and Facial coding (FC). Pricing decisions and branding enhancements in advertisements, graphics, packaging, and content are made based on test results. The prejudice present in the research is among the field's weaknesses. Many of the people who criticize neuromarketing do not think the information, which is obtained from research in this area, is reliable because it is still in its infancy. The use of data gained from brain imaging raises ethical concerns for marketers, as some of them strive to limit our awareness of their genuine intentions, and some activities lack transparency. Possible ethical dilemmas arising from neuroscience applications encompass customers' awareness, consent, and comprehension of what can be perceived as a violation of their right to privacy. New technologies have been integrated with and major improvements made to the tools used for this type of research recently. With devices placed on the head and hands to monitor customers' responses and changes in muscle control over an extended period of time, neuromarketing techniques have already been incorporated into immersive technology. The introduction of AI into neuromarketing is a significant development that will improve the accuracy, speed, and breadth of consumer insights obtained via neuromarketing tools.

Keywords: Neuromarketing, Consumer Behaviour, New Technologies

¹ The paper presents findings of a study developed as a part of the research project "Serbia and challenges in international relations in 2024", financed by the Ministry of Science, Technological Development and Innovation of the Republic of Serbia, and conducted by Institute of International Politics and Economics, Belgrade during year 2024.

ANALYSIS OF RELATIONSHIP BETWEEN THE USE OF MEDICINAL AND AROMATIC PLANTS BY PEOPLE IN AIN CHKEF AREA (NORTH CENTRAL MOROCCO) DURING THE PANDEMIC COVID-19 AND THEIR SOCIO-DEMOGRAPHIC FEATURES

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Ethnobotanical data obtained from several surveys carried out in different regions worldwide plays a pivotal role in the evolution of ethnopharmacology. However, the analysis of relationships between people use or not of medicinal and aromatic plants (MAPs) and their socio-demographic characteristics (Age, Educational level, Gender, Marital status, Socio-economic status) is also interesting, since it can help to understand people's features that drives them to use traditional herbal remedies instead of modern medicines or the opposite case. Thus, the objectif of our study is to explore relationships between the use or not of MAPs by people in Ain Chkef area (North Central Morocco) during the pandemic COVID-19, and their socio-demographic characteristics, so that to obtain conclusions about the factors that lead these people either use traditional herbal treatments or rely on moderne medicine. Multiple component analysis was the statistical test applied for this analytical investigation, and the statistical mean used in order to conduct this study was XLSTAT software. Our results showed that people without any utilization of MAPs (MAPs zero use) characterized by: Male gender, Medium age, are married, and have primary educational level. Moreover, people with low use of MAPs (MAPs used < 3) are characterized by: female gender, Low age, are single, and have a secondary educational level. Besides, people using MAPs moderately (4 to 7) are characterized by: female gender, high age, are married and illiterate. These results enable to understand how the scoco-demographic features of the studied population impacts their use of MAPs for healing purposes.

Key words: medicinal and aromaic plants, multiple component analysis, COVID-19, Ain Chkef, socio-demographic.

PHASES IN THE HISTORICAL DEVELOPMENT OF CULTURAL DIPLOMACY

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The evolution of cultural diplomacy in modern times has been marked by three paradigmatic phases which mirror salient developments of both the vocabulary and practices of the field. By and large, the early modern phase was characterized by institutionalization and professionalization of cultural diplomacy properly, the emergence of cultural institutes for diplomacy and the issuing of cultural policies per se. The second phase of development of late modernity took place within the context of ideological 'battles' between cultures and the deeply impregnated environment of cultural propaganda. The postmodern phase in the evolution of cultural diplomacy, in the aftermath of the cold war, has been characterized by soft power politics and the augmentation of policies in the areas of international cultural relations, cultural exchanges and cultural tourism, within the more and more decentralized and democratic-type of practices corresponding to what has been termed 'citizen diplomacy'. The present paper aims to unveil the historical narrative of the above-mentioned phases of development with a view to explain how and to what extent certain important accomplishments have impacted upon the present-day meanings and practices associated with the field of cultural diplomacy.

WOMEN MOTORCYCLISTS – SOCIOLOGICAL INSIGHTS

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Abstract

Sociology is a science in search of the foundations of society/societies. In order to identify the building blocks of a society at a given time/period it needs to remain well grounded into the micro, mezzo and macro levels of social reality. In its early years sociology studied mostly social problems, but in time it became also interested in unproblematic realities with the purpose of discovering how a reality emerged and what role it plays in a society. This view could be also seen replicated at micro level, in the case of motorcycling the focus was first on deviant subcultures, outlaws, and, as the practice changed, on the meaning of it in the main culture. In this presentation, using the case of motorcycle studies on women motorcyclists, we will present the ways in which we could improve our sociological understanding at the macro level by frequently revisiting the micro level.

Keywords: motorcycling, mobility, moto-mobility

SOCIETY, ENERGY AND DIGITAL TRANSITION

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Abstract:

On 25 September 2015, at the United Nations Sustainable Development Summit, it was adopted the 2030 Agenda for Sustainable Development. The document was developed by United Nations as a 'blueprint' for the present and future of people and the planet. Through this agenda by all UN member states there are 17 goals, 169 global targets and 232 indicators for measuring the progress in achieving the targets. The goals cover all human existence in its social and environmental interdependences, from economic well-being to gender equality, from individual production and use of energy to industry and economic growth. Focusing on the 7th goal – 'affordable and clean energy' – this presentation will highlight the social sustainability of a pushing for a green future that should be achieved by 2030.

Keywords; social sustainability, energy, future

A LINK BETWEEN GUT MICROBIOTA AND ALZHEIMER'S DISEASE: IMPACT OF NEUROPOLEN

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Background

Disturbances along the brain-gut-microbiota axis may significantly contribute to the pathogenesis of neurodegenerative disorders. Alterations in the gut microbiota composition induce increased permeability of the gut barrier and immune activation leading to systemic inflammation, which in turn may impair the blood-brain barrier and promote neuroinflammation, neural injury, and ultimately neurodegeneration. Nutrition is known to play an important role in the pathogenesis of Alzheimer's disease. In addition, the use of nutraceuticals can be part of a comprehensive approach to delay neurodegeneration.

Objective

There is a strong link between Alzheimer's disease and chronic inflammation. Modification of the gut microbiota composition by nutraceuticals may create new preventive and therapeutic options in Alzheimer's disease. To arrive at these observations, the authors examined how Neuropolen and diet delay neurodegeneration.

Materials and methods

Imbalances in the gut microbiota can be also associated with the neurodegeneration. There is increasing interest in the role of the peripheral immune system in Alzheimer's disease pathology. We are currently assessing whether indoles can also stimulate formation of neurons in Alzheimer's disease.

Results

It has now been shown that microbiota affects brain functions through various metabolites with potentially positive or, conversely, toxic properties. The immune system has a prominent role in Alzheimer's disease pathogenesis with both innate and adaptive immunity in the central nervous system.

Conclusion

Alzheimer disease is a neurodegenerative disorder characterized by a progressive decline in memory and thinking severe enough to interfere with daily life. Existing evidence suggests that dietary lifestyle changes may affect cognitive function.

Keywords: Alzheimer disease, gut microbiota, brain-gut-microbiota axis, Neuropolen

SPECIES COMPOSITION AND STRUCTURE OF JUNIPERUSETA-ELYTRIGIASETUM-TRIFOLIOSUM FORMATION IN THE MOUNTAIN XEROPHYTE (FRIGANA) VEGETATION OF AZERBAIJAN

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The research findings revealed that the mountain-xerophyte or phrygana vegetation in Azerbaijan's natural plant communities consists of 1 vegetation type, 3 formation classes, 6 formation groups, and 7 associations, which often group with legumes.

It was determined that the Juniperuseta-Elytrigiasetum-Trifoliosum formation group found in mountain gray-brown soils in the territory of Khizi region consists of one association: *Juniperuseta foetidissima* - *Elytrigiasetum repens* - *Trifoliosum canescens*.

During the conducted research, 28-32 species were recorded in the plant community. It was determined that the vegetation coverage is 70-80%. The studied vegetation includes *Trifolium canescens* Willd. with an abundance of 3 points, and the subdominant is *Elytrigia repens* (L.) Nevsky, with an abundance of 2-3 points. Additionally, *Juniperus foetidissima* Willd. was evaluated with an abundance of 2 points.

The research data indicates that the *Juniperuseta-Elytrigiasetum-Trifoliosum* formation in the mountain xerophyte or phrygana vegetation of Azerbaijan differs from previous formations in its vegetation structure. This formation has a higher abundance of fodder plants, with short grass cover averaging 10-50 cm in height. It is also a suitable grazing area for livestock due to the widespread presence of grasses and legumes.

We must mention that heavy juniper, short juniper, etc. bushes prevent soil compaction and erosion on slopes. Therefore, it is crucial to protect and efficiently use shrubs, dense grass-forming cereals, and legumes for implementing surface improvement measures. The species composition of the recorded formation is rich in fodder plants, including other valuable plants, and its preservation and protection is one of the urgent issues.

Key words: juniperus, frigana, vegetation, xerophyte

THE TRADITIONAL USE OF MEDICINAL PLANTS IN THE TREATMENT OF ORAL DISEASES AND THE INHERENT RISKS OF INTOXICATION: CASE OF THE CENTRAL MIDDLE ATLAS-MOROCCO

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This study, carried out in the Moroccan central Middle Atlas, aims to compile an inventory of medicinal plants used to treat oral diseases and to document the risks of intoxication associated with their use. A total of 58 practitioners of traditional medicine in the region were interviewed using semi-structured questionnaires to gather ethnomedical information on the plants involved in the preparation of traditional remedies. Analysis of the data reveals that 29 plant species, divided into 15 families, are commonly used. The Asteraceae dominate with 7 species, followed by the Lamiaceae with 6 species. The most frequently used plants include *Marrubium vulgare* L., *Ruta montana* L., *Atractylis gummifera* L., *Olea europaea* L., *Artemisia herba-alba* Asso, *Laurus nobilis* L., and *Juglans regia* L.. These plants are mainly used to treat common oral ailments such as cavities, gingivitis and mouth ulcers. However, several species, including *Marrubium vulgare* L., *Atractylis gummifera* L., *Anacyclus pyrethrum* L., *Ruta montana* L. and *Peganum harmala* L., were identified as potentially toxic by all the practitioners questioned. Although these plants have recognised medicinal properties, their potential toxicity calls for greater caution in their therapeutic use.

Keywords: Oral disorders, Medicinal plants, Traditional medicine, Toxicity, Moroccan central Middle Atlas

**VERBASCUM TÜRLERİNİN TIBBİ VE VETERİNERLİKTE KULLANIMI:
ETNOBOTANİK BİR İNCELEME
MEDICAL AND VETERINARY USE OF VERBASCUM SPECIES: AN ETHNOBOTANICAL
REVIEW**

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Abstract

Verbascum species are considered important medicinal plants that are widely used worldwide. This study aims to review the ethnobotanical studies conducted in countries where *Verbascum* species occur naturally and to compile the medical, veterinary and other uses of these species. A total of 46 *Verbascum* species have been identified as medicinal plants used in folk medicine. The most frequently referenced species are *V. thapsus*, *V. cheiranthifolium*, *Verbascum* sp., *V. speciosum*, *V. sinuatum*, *V. phlomoides* and *V. lasianthum*. The most frequently cited countries include Turkey, Italy, Pakistan, Spain, Iraq, Bosnia and Herzegovina and India.

The most used parts of these medicinal plants are their flowers (38%) and leaves (36%). Methods of preparation are predominantly internal, with infusions and decoctions used for respiratory diseases, while external applications include poultices, powders, and direct applications for hemorrhoids and wounds. This review highlights the potential therapeutic effects of *Verbascum* species in the treatment of respiratory disorders, hemorrhoids, wounds and burns. However, further preclinical and clinical studies are needed to prove these activities.

Keywords: *Verbascum*, Ethnobotany, Folk medicine, Mullein

Özet

Verbascum türleri dünya çapında yaygın olarak kullanılan önemli şifalı bitkiler olarak kabul edilmektedir. Bu çalışmanın amacı, *Verbascum* türlerinin doğal olarak bulunduğu ülkelerde yapılan etnobotanik çalışmaları gözden geçirmek ve bu türlerin tıbbi, veterinerlik ve diğer kullanım alanlarını derlemektir. Halk hekimliğinde kullanılan şifalı bitkiler olarak toplam 46 *Verbascum* türü tespit edilmiştir. En sık başvurulan türler *V. thapsus*, *V. cheiranthifolium*, *Verbascum* sp., *V. speciosum*, *V. sinuatum*, *V. phlomoides* ve *V. lasianthum*'dur. En sık alıntı yapılan ülkeler arasında Türkiye, İtalya, Pakistan, İspanya, Irak, Bosna Hersek ve Hindistan yer alıyor.

Bu şifalı bitkilerin en çok kullanılan kısımları çiçekleri (%38) ve yapraklarıdır (%36). Hazırlama yöntemleri ağırlıklı olarak dahili olup, solunum yolu hastalıkları için kullanılan infüzyonlar ve kaynatmalardan oluşurken, harici uygulamalar arasında lapalar, tozlar ve hemoroit ve yaralar için doğrudan uygulamalar yer alır. Bu derlemede *Verbascum* türlerinin solunum bozuklukları, hemoroid, yara ve yanık tedavisindeki potansiyel terapötik etkileri vurgulanmaktadır. Ancak bu etkinliklerin kanıtlanması için daha ileri klinik öncesi ve klinik çalışmalara ihtiyaç vardır.

Anahtar kelimeler: *Verbascum*, Etnobotanik, Halk hekimliği, Sığırkuyruğu

IDENTIFICATION AND CHARACTERIZATION OF LIMESTONE FORMATIONS USING ELECTRICAL TOMOGRAPHY IN THE OULED ABOU REGION (SW OF CASABLANCA, MOROCCO)

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Abstract: The study aims to geoelectrically characterize the Lower Devonian limestone formations located within the Ouled Abbou synclinal structure using electrical resistivity tomography. The objective is to determine their geometry and the nature of their substratum. To achieve significant investigation depths, a pole-pole configuration was adopted with an electrode spacing of 5 meters over a total length of 115 meters, allowing exploration down to approximately 50 meters. Nine profiles were conducted both within and around a quarry where the limestone formations outcrop, ensuring precise geological control during data inversion. The results reveal diverse formations exhibiting different geometries depending on their orientations, influenced by brittle tectonics, and displaying lateral variations in facies. These variations lead to differences in depth, with the intrusion of barren formations (pelites) within the limestones, delineated by faults, complicating their extraction. Identifying the geometry and spatial arrangement of the exploitable limestone formations, as well as the barren formations (pelites), has allowed for an assessment of the studied areas in terms of economic potential. Indeed, this geometric analysis will facilitate the development of a limestone extraction plan while avoiding areas where extraction would be prohibitively costly.

IMPACT OF DEBT AND DIVIDEND POLICY ON FIRM PERFORMANCE: EMPIRICAL INSIGHTS FROM ETHIOPIA

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Abstract: Debt and dividend policies are crucial financial decisions for a firm because these decisions significantly impact a firm's performance. The study aims to investigate whether debt and dividend payout decisions affect firm performance in the context of developing markets. A balanced panel data from 24 Ethiopian microfinance institutions from 2012 to 2021 was analyzed using the generalized method on moments (GMM) model to address endogeneity issues. The study found mixed results regarding the relationship between debt ratio and firm performance. Specifically, the study found that debt ratio has a significant positive correlation with firm performance, as measured by ROA, while it has no significant correlation with firm performance if ROE is used as a performance indicator. The study also found that the dividend payout ratio has a statistically significant positive relationship with firm performance, as measured by ROE and ROA. This implies that paying dividends has resulted in enhancing firm performance. Again, decision-makers of microfinance institutions should consider variables such as firm age, size, and growth in their financial decisions since they can significantly affect firm performance. Given the overall significance of corporate financial decisions, this study provides implications for shareholders, decision-makers, and regulatory bodies to reformulate the debt and dividend payout ratio level so that firms promote their financial decisions and, in turn, improve firm performance.

Keywords: debt ratio, dividend payout ratio, return on equity, return on assets, firm performance, corporate financial policy

**SUBSTANCE ABUSE AND GENDER-BASED VIOLENCE: IMPACT OF MALE
ADDICTION ON DOMESTIC CONFLICTS**

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Abstract

This study explores the intersection of substance abuse and gender-based violence (GBV), focusing on the dynamics of domestic conflict triggered by male addiction. Through interviews with family members of individuals in rehabilitation programs, particularly spouses, the research reveals that men with alcohol addiction often resort to violence when denied financial support for their drinking habits or when pressured to fulfill household responsibilities. The findings highlight how such individuals emotionally and physically abuse less dominant family members, particularly their wives, in response to resistance. Emotional manipulation, coercion, and economic abuse were identified as common strategies used by the addicted individuals to obtain money or avoid responsibilities. The interviews also revealed that many marriages are on the brink of collapse, with several participants expressing that their relationships are strained or in the process of divorce due to the constant violence and emotional torture. This study emphasizes the need for integrated approaches in addressing both substance abuse and GBV in vulnerable households, advocating for better support systems for affected families.

SPIRULINA: A NUTRIENT-PACKED POWERHOUSE FOR TODAY'S HEALTH NEEDS

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Spirulina, a blue and green alga, is a well-known superfood due to its highly nutritious profile. It is often referred to as one of the world's healthiest foods and boasts an exceptionally high concentration of nutrients. For instance, research has shown that spirulina is rich in essential amino acids, fatty acids, vitamins, and minerals, including vitamin B12, iron, and calcium. Furthermore, spirulina is an excellent source of iron, calcium, and other essential minerals, making it a valuable dietary supplement for addressing nutritional deficiencies. The presence of these essential vitamins and minerals in spirulina underscores its potential as a functional food and dietary supplement for promoting overall health and addressing specific nutritional needs. Spirulina's primary active ingredient is phycocyanin. It has potent anti-inflammatory and antioxidant qualities. Spirulina has various advantages, including supporting the immune system, increasing energy, and having antioxidant properties. High in protein, essential amino acids, and iron, spirulina can be added to the diet to improve nutritional intake and overall human health. The versatility of spirulina as a dietary supplement makes it feasible to incorporate spirulina into different diets by simply adding it to a smoothie, salad, or supplement. Spirulina is an alternative for people who want to optimize their health conveniently and sustainably.

Keywords: Spirulina; Superfood; Health benefits

**A NEW LABORATORY PARAMETER IN DIFFERENTIAL DIAGNOSIS OF
THROMBOCYTOPENIC PATIENTS: PLATELETECRIT**

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ABSTRACT

The most valid diagnostic method to distinguish hypoproliferative (e.g. AML, ALL, MDS) and hyperdestructive thrombocytopenia (e.g. ITP) is bone marrow examination. However, bone marrow examination is a highly invasive method and is not recommended in some studies for the diagnosis of hyperdestructive thrombocytopenia such as ITP. In some studies conducted in recent years, it has been suggested that platelet parameters such as Platelet Test (PCT) can be used in the differential diagnosis of thrombocytopenia. Plateletcrit is the ratio of the volume formed by platelets to the total blood volume. Our aim in this study was to investigate the effectiveness of these parameters in the differential diagnosis of thrombocytopenia.

Our study included 20 Idiopathic Thrombocytopenic Purpura (ITP), 10 acute myeloid leukemia (AML), 2 acute lymphoblastic leukemia (ALL), and 7 myelodysplastic syndrome (MDS) patients who were followed up in the Hematology outpatient clinic. ITP patients were classified as hyperdestructive group (20 patients) and the others were classified as hypoproliferative group (19 patients). Blood samples were taken from the patients at the time of diagnosis and their hemogram and platelet parameters were automatically determined on the Beckman-Coulter device.

There was no difference between the two groups in terms of gender and age ($p>0.05$). Serum hemoglobin and white blood cell levels were found to be lower in the hypoproliferative group than in the other group ($p<0.001$). There was no difference between the two groups in terms of platelet count ($p = 0.444$). PCT value was lower in the hyperdestructive group ($p<0.039$). In this study, it was determined that PCT, one of the platelet parameters, is a very easy, cheap and safe method to evaluate in the differential diagnosis of thrombocytopenia.

Key Words: Thrombocytopenia, plateletcrit, diagnosis

**TROMBOSİTOPENİK HASTALARIN AYIRICI TANISINDA YENİ
BİR LABORATUVAR PARAMETRESİ : PLATELETEKRİT**

Hipoprolüktif (örn: AML, ALL, MDS) ve hiperdestrüktif trombositopeninin (örn: ITP) ayırımında en geçerli tanı yöntemi kemik iliği incelemesidir. Ancak kemik iliği incelemesi oldukça invaziv bir yöntem olup ITP gibi hiperdestrüktif trombositopeninin tanısında yapılması bazı çalışmalarda önerilmemektedir. Son yıllarda yapılan bazı çalışmalarda Plateletekrit (PCT) gibi platelet parametrelerinin trombositopeninin ayırıcı tanısında kullanılabileceği ileri sürülmüştür. Plateletekrit trombositlerin oluşturduğu hacmin toplam kan hacmine oranıdır. Bu çalışmada amacımız bu parametrelerin trombositopeninin ayırıcı tanısındaki etkinliğini araştırmaktır.

Çalışmamıza Hematoloji polikliniğinde takip edilen 20 İdiopatik Trombositopenik Purpura (ITP), 10 akut myeloid lösemi (AML), 2 akut lenfoblastik lösemi (ALL), ve 7 myelodisplastik sendrom (MDS) hastası dahil edildi. ITP hastaları hiperdestrüktif grupta (20 hasta), diğerleri ise hipoprolüktif grupta (19 hasta) olacak şekilde sınıflandırıldı. Hastaların tanı anındaki kanları alınarak hemogram ve trombosit parametreleri, Beckman-Coulter cihazında otomatik olarak belirlendi.

Cinsiyet ve yaş açısından iki grup arasında herhangi bir farklılık izlenmedi ($p>0,05$). Hipoprolüktif grupta serum hemoglobin ve beyaz küre düzeyi diğer gruba göre daha düşük olduğu saptandı

($p < 0,001$). Trombosit sayısı açısından iki grup arasında herhangi bir farklılık yoktu ($p = 0,444$). PCT değerinin hiperdestrüktif grupta daha düşük olduğu ($p < 0,039$).

Bu çalışmada trombositopeninin ayırıcı tanısında trombosit parametrelerinden biri olan PCT' nin değerlendirilmesi oldukça kolay,ucuz ve güvenli bir yöntem olduğu saptanmıştır.

Anahtar Kelimeler: Trombositopeni, plateletkrit, tanı

**GAZİANTEP’TE 1950’LERİN MODERN MİMARİ ÖRNEĞİ OLARAK “NİL KAHVESİ”
 (“THE NİL COFFEE HOUSE” AS AN EXAMPLE OF MODERN ARCHITECTURE OF THE
 1950s IN GAZİANTEP)**

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Özet

Kahve; kökboyasigiller familyasından bir bitkidir. Bol yağış alan, soğuk ve kurak ortamı sevmeyen, ekvatora yakın yerlerde yetişir. Kahvenin kökenine dair bilgiler muğlaktır ve ne zaman, nasıl bir içeceğe dönüştüğü hakkında kesin bir bilgi bulunmamaktadır. Ancak kahvenin 16. yüzyılda altın çağını yaşadığı söylenebilir. Kahve, yerel bir tat olmaktan çıkarak; Hicaz bölgesi, Arabistan Yarımadası, Kahire, İskenderiye, Bağdat, Şam, Halep ve oradan İstanbul’a, Osmanlı İmparatorluğu’na yayılarak yaygın bir içecek haline gelmiştir (Aksoy, M., Türk, E., Gökmen, U., 2014, s.29). Kısa zamanda kahve, içilen bir içeceğin ötesinde, alınıp satılan değerli bir meta haline gelmiştir. Devletler için de önemli vergi kalemlerinden birisi olmuştur (Gürsoy, 2011, s.9). Ancak; konukseverlik simgesi olan ‘kahve’nin gündelik hayata katılması o zamanlar bazı tartışmaları da beraberinden getirmiştir. Din adamlarınca kahvenin haram olup olmadığı, hekimlerce bir uyuşturucu olup olmadığı hakkında büyük tartışmalar yaşanmıştır. Yine de kısa zamanda benimsenerek saray mutfağında yerini almış, saraydan konaklara, konaklardan evlere girmiş, İstanbul’da kısa zamanda, halkın vazgeçemediği bir içecek haline gelmiştir. Kahve ve onun içildiği mekan olan kahvehaneler, zamanla sosyal hayatın bir bütünü haline gelmiştir. Böylece dünyada yeni bir içecek “kültürü” doğmuştur. Alkol içermeyen, uyuşturucu özelliği olmayan bir içecek olan kahve, Osmanlı’ların gündelik hayatına kısa sürede girmiştir. İstanbul’da ilk kahvehane, Tahtakale semtinde açılmıştır. Tahtakale’deki bu ilk kahvehane, dönemin ünlü kişilerinin ve bilginlerin toplanma ve sohbet mekanı olmuştur. Akabinde başta İstanbul olmak üzere, birçok şehirde kahvehane açılmaya başlamış, yeni bir sosyal yaşam başlamıştır (Özkoçak, 2009, s.4). Bunların bazıları literatürde detaylı olarak incelenmiştir. Bu çalışmada Güneydoğu Anadolu’da, Gaziantep’te 1955’te kurulan Nil Kahvesi binasının mimarlık tarihindeki yerinin incelenmesi amaçlanmıştır. Yapı, kentsel hafızada kentliler için çok önemli bir hafıza mekanı olmuştur ve yapının modern mimarisi ilgi çekicidir. Yapı, kentte yeni yeni yapılan 1950’lerin modern mimari dilini ve mimarisini yansıtan önemli bir örnek olarak değerlendirilmektedir.

Anahtar Kelimeler: Gaziantep, Modern Mimari, Kahvehane, Nil Kahvesi

Abstract

Coffee is a plant from the madder family. It grows in places close to the equator that receive plenty of rainfall and do not like cold and dry environments. Information about the origin of coffee is vague and there is no definitive information about when and how it was transformed into a drink. However, it can be said that coffee experienced its golden age in the 16th century. Coffee ceased to be a local taste and became a widespread beverage, spreading to the Hejaz region, the Arabian Peninsula, Cairo, Alexandria, Baghdad, Damascus, Aleppo and from there to Istanbul and the Ottoman Empire (Aksoy, M., Türk, E., Gökmen, U., 2014, p.29). In a short time, coffee became more than just a drink, it became a valuable commodity that was bought and sold. It was also one of the important tax items for the states (Gürsoy, 2011, p.9). However; the inclusion of ‘coffee’, a symbol of hospitality, in daily life brought about some debates at the time. There were great debates among the clergy about whether coffee was illicit or not, and among the doctors about whether it was a drug. Nevertheless, it was quickly adopted and took its

place in the palace kitchen, entered the palaces and mansions, and from the mansions to the houses, and in a short time in Istanbul, it became an indispensable drink for the people. Coffee and the places where it was consumed, coffeehouses, have become an integral part of social life over time. Thus, a new beverage “culture” was born in the world. Coffee, a non-alcoholic and non-narcotic beverage, quickly entered the daily lives of the Ottomans. The first coffee house in Istanbul was opened in the Tahtakale district. This first coffee house in Tahtakale became a place for the famous people and scholars of the period to gather and chat. Subsequently, coffeehouses began to open in many cities, especially in Istanbul, and a new social life began (Özkoçak, 2009, p.4). Some of these have been examined in detail in the literature. This study aims to examine the place of the Nil Kahvesi (The Nil Coffee house) building, which was built in 1955 in Gaziantep, Southeastern Anatolia, in architectural history. The building has become a very important place of memory for the city dwellers in urban memory and its modern architecture is interesting. The building is considered as an important example reflecting the modern architectural language and architecture of the 1950s, which was newly built in the city.

Keywords: Gaziantep, Modern Architecture, Coffee house, The Nil Coffee house

STRATEGIES FOR INTERNALIZING RELIGIOUS MODERATION VALUES

Najwatul Istiqomah, Isnaeni Mutiara
UIN K.H. Abdurrahman Wahid Pekalongan

Abstract

The background of this paper is based on the urgency to overcome the challenges of religious polarization and conflict that are increasingly tapering in various parts of the world. In this context, a deep understanding of religious moderation is essential to building a harmonious and tolerant society. This research uses a literature study (library research) with a descriptive-qualitative approach. Data collection techniques in this study were used through literature browsing and then analyzed using three techniques: data reduction, data presentation, and drawing conclusions. The results of this study show that moderation is like a pendulum clock that moves from the edge and always tends towards the center or axis (centripetal); it never stays static.

Keywords: strategy, internalization, moderation, religion

TYPES OF NATURAL TOXINS IN VEGETABLES AND WAYS TO REDUCE THEM

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Abstract

Inherent plant toxins are naturally occurring components in plants that are toxic and have a negative effect on the bioavailability of nutrients. These toxins are often known as anti-nutritional agents and include glycoalkaloids, glucosinolates, Cyanogen, mushroom hydrazine, mycotoxins, etc.

In vegetables, a series of anti-nutritive and toxic substances for humans are naturally produced, and in fact, these compounds are substances that are produced as a result of the defense and protective mechanism of that plant against environmental stress and pests and insect attacks.

In this research, we will examine the types of natural toxins produced in vegetables and ways to reduce them and prevent them from entering the human body during consumption and preventing their absorption by the digestive system.

These natural toxins produced by vegetables can have dangerous and serious side effects for consumers and may cause heavy damage in the health field. Therefore, investigating the types of these poisons and ways to reduce them is considered one of the necessities of the field of health and food safety.

Keywords: Natural Toxins, Vegetables, Reduction, Food safety, Health, Plant toxins, Anti-nutritional

**TOXINS IN MAIZE AND WAYS TO REDUCE THEM AND ITS IMPORTANCE IN
HEALTH AND FOOD SAFETY**

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Abstract

Maize or Corn (*Zea mays L.*) crop provides 19.5% of global caloric intake from all sources. Furthermore, it has also become an important industrial commodity. Corn nutrients and phytochemicals include vitamins (A, B, E, and K), minerals (Mg, P, and K), phenolic acids (ferulic acid, coumaric acid, and syringic acid), carotenoids and flavonoids (anthocyanins), and dietary fiber. Actually, it has starch, at 62%, protein and fiber (19%), water (15%), and oil (4%).

Due to having a large amount of nutrients, corn is susceptible to contamination by molds and pathogenic microorganisms and may be attacked by these pathogens during the storage period from the time of harvesting to the time it reaches the consumer and produce poison inside them, which is extremely harmful to human health.

In this research, we investigate the toxins in corn and the microorganisms that cause its spoilage and the techniques and ways to reduce it in the food industry. This research helps the growth of food industry and export and the improvement of economic conditions for farmers and consumers. It also guarantees the health of consumers against the consumption of corn.

Keywords: Toxin, Maize, Food Safety, pathogenic microorganisms, mold, reduction, Health, agriculture

PHENOTYPIC CHARACTERIZATION OF GOATS IN EBONYI STATE, SOUTH EAST NIGERIA

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Abstract

The objective of this study was to phenotypically characterize goats in Ebonyi State, Southeast Nigeria based on some measured traits and derive a regression equation for predicting body weight from linear body measurements. Records were taken on a total of 372 goats (151 males and 221 females) kept by traditional farmers, covering six out of the thirteen Local Government Areas (LGA), two from each of the three senatorial districts of the State. In each LGA, 15 farmers were selected at random and measurements taken of a random sample of 2-5 goats depending on the flock size. Categorical traits scored were coat type and texture, coat colour, presence or absence of horn, horn type and orientation, presence or absence of wattle, presence or absence of supernumerary teat, sex and age of each animal were also recorded. Body weight and linear body measurements were recorded for each animal. Categorical traits were analyzed using simple percentages. Linear body measurements were correlated with body weight and with each other. Regression equation for predicting body weight from linear body measurements were estimated for sex and ages of the goats. The categorical traits studied conform to the breed characteristics of the WAD goats. The predominant coat color was all black/predominantly black (43.55%) the coat type was the stiff short and straight type. There were no incidence of polledness among the goat population. Only 5.9% of goats in Ebonyi State had wattle. The body measurements of the goat population in the study area were within the reported ranges for WAD goats by several authors. There was high, positive and highly significant ($P < 0.01$) correlation between body weight and linear body measurements and among linear body measurements. Highly significant ($P < 0.01$) coefficient of determination were recorded for the three regression models used. The relationship between body weight and linear body measurements was best described by the quadratic equation. The R was better in adult goats than in the kids. The R value for the male was higher than that of the female goats. A stepwise multiple linear regression equation showed that heart girth, height at withers and body length could be used to predict body weight. Heart girth was the only single linear body measurement that can be used to predict body weight with high degree of reliability. Hip width was shown as not good enough for prediction of body weight from linear body measurements.

**OPTIMIZED PRODUCTION OF BIODIESEL VIA BASE-CATALYZED
TRANSESTERIFICATION FROM NON-EDIBLE (*TAMARINDUS INDICA*) SEED OIL**

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Abstract

Biodiesel is a clean burning non-petroleum based diesel fuel and has received dire attention over the past decade as an alternative to fossil fuels. Due to favorable characteristics, biodiesel is now widely accepted as a viable alternative to petroleum-derived diesel fuel. However, the higher production costs, which are largely due to the use of expensive food-grade vegetable oils as raw materials, is a major obstacle to its economic viability. The current study aims to scrutinize the potential of *Tamarindus indica* seed oil for biodiesel synthesis through alkali-catalyzed transesterification. Output parameters such as the molar ratio of alcohol to oil, the amount of catalyst, and reaction time were optimized by using Taguchi method. The fatty acid contents of both oil and biodiesel were determined by GC. The optimal conditions for obtaining 93.5% biodiesel were found to be a 6:1 alcohol to oil molar ratio, 1.5% wt/wt catalyst, and 2 h reaction time. The 'molar ratio of alcohol to oil' (75.9%) had the highest % contribution, followed by the amount of catalyst (20.7%). The major fuel properties of *Tamarindus* methyl esters formed under ideal conditions were found to be within the defined limits of ASTM D6751 for biodiesel, suggesting that it could be used as a potential petro diesel substitute.

Key words: *Tamarindus* methyl esters, biodiesel, base-catalyzed, transesterification

**STUDY OF THE EFFECTS OF NATURAL BIOSTIMULANTS ON THE LAWN
GERMINATION GRASS.**

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GHELAMALLAH^a, Fodil Mustafa KAMEL, Bengharbi ZINEB^a, Nardjess BENAMAR^a**

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Abstract

Grass is considered an essential part of our environment; however, it can face various challenges and pressures that negatively affect it. Bio stimulants help improve non-biological pressures. This study was conducted within the LPPA/INES laboratory, where the effectiveness of treatment with plant-derived bio stimulants was monitored, and its importance and impact on the growth and development of grass were presented. To assess this impact, we compared extracts from three plants (ortie, rosemary, azolla) with each group divided into three different concentrations: horsetail, rosemary, and azolla extracts in 30 pots, measuring the length of leaves, roots, stems, and germination rate. Samples taken from different plants were analyzed in the laboratory, where we studied the content of polyphenols (3.95 ± 0.400), flavonoids (82 ± 3.95), and chlorophyll (48.23 ± 0.22), as well as the protein level (2.13 ± 27.50). Revised morphological measurements showed that the application of these products stimulates plant growth, increases chlorophyll levels (1.02 ± 48.81), and improves grass quality. According to the results obtained, each treatment has a specific effect on different parts of the plants. Therefore, it is necessary to implement a combination of these treatments to maximize their benefits.

Keywords: Bio stimulants, Grass, ortie, azolla, rosemary.

THE WAYS TO PREVENT RELAPSES IN PATIENTS WITH NON-SPECIFIC ULCERATIVE COLITIS

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The aim of our study was to improve outcomes by improving complex therapy in patients with non-specific ulcerative colitis.

Materials and methods: From 2008 to 2023, there were 281 patients diagnosed with non-specific ulcerative colitis under our control, of whom 191 were women and 90 were men. The age of the patients ranged from 16 to 68. 65 patients had total colitis, 90 patients had left-sided lesions, 126 patients had proctitis and proctosigmoiditis. In the complex treatment of these patients, anti-inflammatory drugs - aminosalicylates - sulfasalazine or salofalk, corticosteroids; immunodepressants were used. Salofalk was used as a suppository during proctitis, as a microenema in left-sided lesions, and in general form as a tablet. Metipred was used during complex therapy as a corticosteroid. Hydrocortisone is prescribed in the form of rectal drops or microenemas in the case of distal localized lesions and I-II degree lesions. 6-mercaptopurine and azathioprine were mainly used in the complex therapy of immunodepressants. Elimination of the acute phase and remission was achieved in the majority of patients who received this treatment regimen. In 11 patients with left-sided ulcerative colitis, emergency surgery, subtotal resection of the colon and colostomy were performed due to perforation of the large intestine. From 6 months to 2 years after surgery, the preserved part of the large intestine was rehabilitated with candles and microenemas, topical mesalazine, metronidazole, and hormones such as intestinal antiseptics. Then, in the second stage of the operation, an operation to restore intestinal permeability was performed with the cancellation of the colostomy. Acute toxic dilatation was observed in 14 patients with left-sided ulcerative colitis. In 8 patients with toxic dilatation, the condition was stabilized with conservative therapy, and in the other 6 patients, because conservative therapy did not work, surgery was performed - subtotal resection of the large intestine, ileostomy was performed. Hormones, local mesalazine, metronidazole, suppositories and intestinal antiseptics in the form of microenemas were injected into the preserved part of the large intestine in these patients between 6 months and 2 years after the operation. Then, in the second stage of the operation, an operation to restore intestinal permeability was performed by canceling the ileostomy. In 7 patients with total colitis, conservative treatment did not work, stools were bloody and mucous 14-16 times a day, the disease was aggravated by pseudopolyposis, radical surgery was performed. From 6 months to 2 years postoperatively, patients were treated conservatively, mainly with hydrocortisone as rectal drops and microenemas, according to the above effect. As a result, the process in the rectum was completely canceled and the patients underwent an operation to restore intestinal permeability by closing the ileostomy. Against the background of treatment, favorable results were obtained in 100% of patients with proctitis.

Conclusion: According to our observations, complex therapy with anti-inflammatory aminosalicylates sulfasalazine or salofalk, corticosteroids and immunodepressants in patients with non-specific ulcerative colitis was a favorable method that led to rapid activation of patients, quick elimination of the acute period, early discharge from the hospital and a significant reduction of relapses, complications and during the surgery performed on time allows patients to get a positive result. Positive results are achieved in 70-80% of cases after the operation. Annual preventive examination is recommended.

Key words: ulcerative colitis, toxic dilatation, surgical treatment

65 YAŞ ve ÜZERİ Tip 2 DM'li BİREYLERDE KOR STABİLİZASYON EGZERSİZLERİNİN MOBİLİTE ÜZERİNE ETKİSİ

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Abstract

The aim of this study is to determine the effects of core stabilization exercises on mobility in individuals aged 65 and over with Type 2 DM. Sixty-one subjects with Type 2 DM who applied to the Geriatrics Outpatient Clinic of Gaziantep University Faculty of Medicine were included in the study. The inclusion criteria were being 65 years or older, having an HbA1c level > 6.5%, fasting blood glucose > 126 mg/dl, being able to walk independently, and being willing to exercise at least 2 days a week as part of the research. Individuals with a diagnosis of Type 1 DM, those who had experienced diabetic ketoacidosis coma, those with orthopedic problems preventing walking and exercise, individuals with any neurological disorders, and those with cardiac, pulmonary, or systemic diseases that would contraindicate exercise were excluded from the study. The patients were randomly divided into two groups. The mean age of the patients included in the study was 71.13 years, and the mean duration of DM was 10.902 years. The mean BMI was 27.087 in the exercise group and 27.829 in the control group. The control group (n=31) received moderate-intensity aerobic exercise (50-70% of maximum heart rate), 2 days a week for eight weeks, totaling 150 minutes. The exercise group (n=30) received moderate-intensity core stabilization exercise training 2 days a week for 8 weeks. Participants' waist circumference was measured using a tape at the level of the iliac crest, and their mobility was assessed using the Timed Up and Go Test (TUG). Thirty-eight women (62.3%) and 23 men (37.7%) participated in the study. The groups were found to be similar in terms of variables other than gender and smoking (p>0.05). In both groups, mobility improved after the exercise training (p<0.001). There was no statistical difference between the groups that received core stabilization and aerobic exercise training (p=0.516). After core stabilization training, 27 individuals in the exercise group showed a decrease in TUG values, 2 showed an increase, and 1 showed no change. In the control group, 28 individuals showed a decrease in TUG values, while 3 showed no change. According to the findings, both core stabilization and aerobic exercises can be used to improve mobility. It is recommended that future studies compare the long-term effects of different exercise types on mobility.

Keywords: Mobility, TUG, Diabetes Mellitus, Core stabilization

Özet

Bu çalışmanın amacı 65 yaş ve üzeri Tip 2 DM'li bireylerde kor stabilizasyon egzersizlerinin mobilite üzerine etkilerini belirlemektir. Çalışmamıza Gaziantep Üniversitesi Tıp Fakültesi Geriatri Polikliniğine başvuran ve Tip 2 Dm'si olan 61 olgu dahil edildi. Çalışmaya dahil edilme kriterleri; 65 yaş ve üzerinde olmak, HbA1c değeri > %6,5 olmak, açlık kan glukozu >126 mg/dl olmak, bağımsız olarak yürüyebilmek, araştırma kapsamında haftada en az 2 gün egzersiz yapmaya gönüllü olmak olarak belirlendi. Tip 1 DM tanısı alanlar, diyabetik ketoasidoz komasına girmiş olanlar, yürüme ve egzersiz yapmayı engelleyecek ortopedik problemi olanlar, herhangi bir nörolojik hastalığa sahip olanlar, egzersiz için kontrendikasyon yaratacak kardiyak, pulmoner veya sistemik hastalığa sahip olanlar çalışma dışı bırakıldı. Hastalar randomize kontrollü olarak iki gruba ayrıldı. Çalışmaya alınan hastaların yaş ortalaması 71,13 olup DM durasyonu ortalaması 10,902 yıl olarak görüldü. VKİ ortalaması çalışma

grubunda 27,087, kontrol grubunda 27,829'di. Kontrol grubuna (n=31) sekiz hafta, orta şiddette (maksimum kalp hızının %50-70'i kadar), haftada 2 gün, toplam 150 dakika aerobik egzersiz verildi. Çalışma grubuna (n=30) ise 8 hafta süresince haftada 2 gün orta şiddette kor stabilizasyon egzersiz eğitimi verildi. Katılımcıların, bel çevresi mezura kullanılarak iliak krista hizasından ölçüldü, mobiliteleri zamanlı kalk yürü testi ile (ZKYT) değerlendirildi. Çalışmamıza 38 kadın (%62,3), 23 erkek (%37,7) katılımcı dahil edildi. Cinsiyet ve sigara kullanımı dışındaki değişkenler açısından gruplar benzer olduğu bulundu ($p>0,05$). Her iki grupta egzersiz eğitimi sonrası bireylerin mobilitelerinde artış belirlendi ($p<0,001$). Eğitim sonrası kor stabilizasyon ve aerobik egzersiz eğitimi verilen gruplar arasında istatistiksel fark saptanmadı ($p=0,516$). Kor stabilizasyon eğitim sonrası çalışma grubundaki bireylerin 27'sinde ZKYT değerinde düşüş olurken, 2 hastada artış oldu, 1 hastada ise değişim görülmedi. kontrol grubundaki bireylerin 28'inde ZKYT değerinde düşüş olurken, 3 hastada ise bir değişim olmadı. Elde edilen bulgulara göre; hastaların mobilitelerinin artması için hem kor stabilizasyon egzersizleri hem de aerobik egzersizlerin kullanılacağı belirlendi. Yapılacak diğer çalışmalarda, farklı egzersiz tiplerinin mobilite üzerindeki uzun vadeli etkilerinin karşılaştırılması önerilmektedir.

Anahtar kelimeler: Mobilite, ZKYT, Diabetes Mellitus, Kor stabilizasyon

**İNTRAVİTREAL ENJEKSİYON UYGULANAN HASTALARDA GÖRME İŞLEVİNE BAĞLI
OLASI RUHSAL DEĞİŞİKLİKLERİN DEĞERLENDİRİLMESİ
EVALUATION OF POTENTIAL MENTAL CHANGES RELATED TO VISUAL FUNCTION
IN PATIENTS RECEIVING INTRAVITREAL INJECTIONS**

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Özet

Görme kaybının tedavisinde, kortikosteroidler veya endotelial büyüme faktörü etkin biçimde, lokal olarak göz içine enjeksiyon şeklinde uygulanmaktadır. Direkt olarak göz içine yapılan enjeksiyon bireylerde farklı düzeylerde kaygıya yol açabilmektedir. Bu çalışmada, intravitreal enjeksiyon uygulanan hastalarda görme işlevine bağlı yaşam kalitesi, kaygı, depresyon ve ilişkili diğer faktörlerin belirlenmesi amaçlandı. Araştırma, tanımlayıcı-kesitsel desende plânlandı. Çalışmanın evreni bir eğitim ve araştırma hastanesi göz kliniğine, göz içi iğne uygulaması için başvuran hastalardı. Etik kurul izni alınan çalışmada, gönüllü ve çalışmaya katılmaya engel ruhsal bir rahatsızlığı bulunmayan 117 hasta çalışmanın örneklemini oluşturdu. Veriler Görüşme Formu, Ulusal Göz Sağlığı Enstitüsü Görme İşlevi Ölçeği, Durumluk-Sürekli Kaygı Envanteri ve Beck Depresyon Envanteri ile toplandı. Verilerin analizinde tanımlayıcı ve ileri düzey testler kullanıldı. Yaş ortalaması 63,80±9,56 yıl olan katılımcıların %53,8'i kadındı. İşlem nedeniyle endişe yaşayanların oranı %70,1'di. Endişenin nedenleri arasında ilk sıralarda; “iğnenin uygulandığı dönemde iğne korkusu” (%34,2), “iğnenin dolaylı kör olma korkusu” (%31,6), “iğne sonrası ağrı ve acı hissetme” (%30,8) bulunmaktaydı. Görme işlevine bağlı total yaşam kalitesi, depresyon ve kaygı puanlarının, hastaların bireysel özelliklerinden bazıları ve tedavi öncesi endişe yaşama ile anlamlı fark oluşturduğu bulundu. Ayrıca durumluk-kaygı ($r=-0,197$; $p=0,033$), sürekli-kaygı ($r=-0,401$; $p=0,000$) ve depresyon ($r=-0,404$; $p=0,000$) puanları azaldıkça, total yaşam kalitesi puanının arttığı tespit edildi. Görme işlevinin bozulması, bireylerin görme işlevine bağlı yaşam kalitesini etkilemektedir. İşlemin tekrarlayıcı olması ve tedavinin sonlanma sürecinin öngörülememesi, klinik düzeyde kaygı ve devamında depresyona yol açabilmektedir. Araştırma sonuçları doğrultusunda, hastalarda kaygının nedenlerine yönelik müdahaleler dikkatle ele alınmalıdır.

Anahtar kelimeler: Anksiyete, depresyon, göz içi enjeksiyon

Abstract

In the treatment of vision loss, corticosteroids or endothelial growth factors are effectively applied locally by injection into the eye. Injection directly into the eye may cause different levels of anxiety in individuals. In this study, we aimed to determine visual function-related quality of life, anxiety, depression, and other related factors in patients receiving intravitreal injections. The study was planned using a descriptive cross-sectional design. The population of the study included patients who applied to the eye clinic of a training and research hospital for intraocular injection. Ethics committee permission was obtained and 117 patients who volunteered and did not have a mental disorder that excluded them from participating in the study constituted the sample of the study. Data was obtained from the interview form, National Eye Health Institute Visual Function Questionnaire, State-Trait Anxiety Inventory, and Beck Depression Inventory. In the analysis of the data, descriptive and advanced tests were used. The mean age of the participants was 63.80±9.56 years and 53.8% were female. The rate of those who experienced anxiety due to the intervention was 70.1%. Some of the reasons for the anxiety were; “fear of needle during the injection application period” (34.2%), “fear of

being blinded by the needle” (31.6%), and “feeling pain and suffering after the injection” (30.8%). It was found that total quality of life, depression, and anxiety scores were made significant differences with some of the individual characteristics of the patients and pre-treatment anxiety. In addition, it was found that as state-anxiety ($r=-0.197$; $p=0.033$), trait-anxiety ($r=-0.401$; $p=0.000$), and depression ($r=-0.404$; $p=0.000$) scores decreased, total quality of life level increased. Disruption of visual function affects individuals' quality of life related to visual function. The recurring nature of the procedure and the unpredictability of the end of treatment may lead to clinical anxiety and then depression. According to the results of the research, the causes of anxiety in patients should be carefully evaluated.

Keywords: Anxiety, depression, intravitreal injection

TAZE DOKU İLE FFPE DOKULARDA qRT-PCR YÖNTEMİYLE DOĞAL KUDUZ VİRÜSÜ TESPİTİNİN KARŞILAŞTIRMASI*

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Abstract

Rabies disease is a neurotropic character in mammals and results in definitive death with the beginning of symptoms. The causative agent of the disease belongs to a family of RNA viruses called Lyssavirus genus Rhabdoviridae. Lyssavirus virions contain 5 important proteins. These are nucleoprotein (N), phosphoprotein (P), matrix protein (M), glycoprotein (G), and RNA dependent RNA polymerase (L) proteins. The infection of the disease is formed by the bite of the infected animal and the viruses in the saliva of the tissue integrity into the body. The fact that the disease results in 100 % mortality increases the importance of antemortem and postmortem diagnosis. Antemortem diagnosis, such as saliva, nape skin, such as clinical examples, removed hair follicles, tears, urine and brain spinal cord fluid (CSF), postmortem diagnosis and other samples obtained after death are used for viral nucleic acid detection techniques. The standard tissue used in the detection of the factor with neurotropic character is brain and cerebellum. Fluorescent antibody test (FAT), Real Time RT-PCR (qRT-PCR), Experimental animal in schooling (MIT), direct immunohistochemistry test (DRIT), rabies tissue culture infection (RTCIT), Conventional RT-PCR (RT-PCR) is used. In this study, the sensitivity of the qRT-PCR method was used to detect rabies viral nucleic acid in both fresh and formalin-fixed paraffin embedded (FFPE) tissues (brain, cerebellum) of 50 rabies positive animals with FAT. It is aimed to determine the effect of RNA's influence of FFPE samples from the preparation stages on the determination of rabies on qRT-PCR. It was analyzed with qRT-PCR by making RNA extraction from both fresh and ffpe tissue. In the diagnosis of rabies using the qRT-PCR method, the Ct values of 50 fresh tissue and the Ct values of 50 ffpe tissue were within the limits that reveal rabies positivity. Thus, it has been determined that the qRT-PCR method can be diagnosed with FFPE tissue. As a result, the method used can be achieved in the same reliability in the extent of reliability embedded tissues and fresh tissues with qRT-PCR, and the effective usability of a zoonotic disease such as rabies is supported by suspicious paraffin blocks.

Keywords: qRT-PCR, rabies, FFPE

*Doktora çalışmasının tamamlanan bir bölümünden alınmıştır.

Özet

Kuduz hastalığı, memelilerde nörotropik karakterde olup, semptomların görülmeye başlamasıyla kesin ölüm ile sonuçlanmaktadır. Hastalık etkeni, Lyssavirus cinsi Rhabdoviridae adı verilen bir RNA virüsleri ailesine aittir. Lyssavirus virionları 5 adet önemli protein içermektedir. Bunlar nükleoprotein (N), fosfoprotein (P), matriks proteini (M), glikoprotein (G), ve RNA bağımlı RNA polimeraz (L) proteinleridir. Hastalığın bulaşması, enfekte hayvanın ısırması ile salyasında bulunan virüslerin, doku bütünlüğü bozulan bölgeden vücuda girmesiyle oluşmaktadır. Hastalığın %100 mortalite ile sonuçlanması, antemortem ve postmortem teşhisin önemini arttırmaktadır. Antemortem tanıda tükürük, ense derisi gibi klinik örnekler kullanılarak, çıkarılan saç kökleri, gözyaşı, idrar ve beyin omurilik sıvısı (BOS), postmortem tanıda ense derisi ve ölümden sonra elde edilen diğer numuneler viral nükleik asit saptama teknikleri için kullanılmaktadır. Nörotropik karakterli olan etkenin tespitinde kullanılan standart doku beyin ve beyinciktir. Hastalığın tanısında etken tespitine dayalı yöntemler, Doğrudan Floresan Antikor Testi(FAT), Real Time RT-PCR(qRT-PCR), Deney Hayvanı İnokulasyonu(MIT), Doğrudan Hızlı İmmunohistokimya Testi(dRIT), Kuduz Doku Kültürü Enfeksiyon

Testi(RTCIT), Konvensiyonel RT-PCR(RT-PCR) kullanılmaktadır. Bu çalışmada, FAT ile kuduz pozitif 50 adet hayvana ait dokuda(beyin,beyincik), qRT-PCR yönteminin hassasiyetliđi kullanılarak hem taze hemde formalinle fikse edilmiş parafine gömülmüş(FFPE) dokularda kuduz viral nükleik asit tespiti yapılmıştır. RNA'nın FFPE örneklerinin hazırlanma aşamalarından etkilenmesinin, kuduzun qRT-PCR ile tespit edilmesine etkisinin belirlenmesi amaçlanmıştır. Hem taze hemde FFPE dokudan RNA ekstraksiyonu yapılarak qRT-PCR ile analiz edilmiştir. qRT-PCR yöntemi kullanılarak yapılan kuduz hastalığının teşhisinde, 50 taze dokunun Ct değerleri ile 50 FFPE dokunun Ct değerleri, kuduz pozitifliđi ortaya koyan sınırlar içinde olduđu görülmüştür. Böylelikle, qRT-PCR metoduyla FFPE dokudan kuduzun teşhisinin yapılabildiđi belirlenmiştir. Sonuç olarak, kullanılan yöntem qRT-PCR ile parafine gömülü dokularda ve taze dokularda aynı güvenilirlik ölçüsünde sonuçlar elde edilebilmesi, kuduz gibi zoonotik bir hastalığın şüpheli parafin bloklardan da etkin kullanılabilirliđi desteklenmektedir.

Anahtar kelimeler: qRT-PCR, rabies, FFPE

FEATURES OF SOIL PROCESSES IN HYDROMORPHIC SOILS

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ABSTRACT

It is highlighted the influence of hydromorphic soil formation on soils fertility under different moisturizing regimes, intensity of the development of gley-eluvial and redox processes. The dependence of trophic, redox and accumulative-migration functions of soils on hydromorphism and intensity of the development of gley processes are characterized. Hydromorphism can exist in soils with upsoil or subsoil types of water supply. It leads to the gleyzation of soil profile, to its differentiation by eluvial-illuvial type, to the formation of concretes in soils because of segregation of compounds that are typomorphic in hydromorphic conditions and also to peat accumulation.

It is determined that upsoil hydromorphism has a negative effect on the formation of phosphate state of acidic soils. As a result, the number of total and mobile forms of phosphate compounds decreases, the amount of iron and alumophosphate in the fractional composition of the mineral forms of phosphates is significantly increasing, and the phosphorus is firmly fixed in the solid phase of the soil.

Owing to the intensification of subsoil hydromorphism soil processes of gleyification and complete breakdown of plant residues (humification and mineralization) gradually change into their conservation and peat formation as well as organic carbon sequestration, increasing in the level of organic phosphorus content with simultaneous separation from the mineral rock of the growing peat mass.

Key words: hydromorphic soils, fertility, surface hydromorphism, subsurface hydromorphism, gley processes, behavior of fertility elements.

HUMOR IN SOCIOLOGICAL TALES

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In today's scientific environment the phrase on everyone's lips is "publish or perish", grants and promotions are obtained based on a consistent list of yearly publications and citations of the publication, each scientist is searching for ways in which he/she can communicate the results of their research in an appealing way, not only for the scientific community but also for the general public. In order to do so, scientists went outside the purely scientific way to present results in a serious tone and started using humour, colourful analogies and comparisons, thus infusing some of their charisma in their scientific stories. In this presentation, looking only at two types of texts – scientific articles published in scientific journals and scientific articles published in journals that have a broader audience, we will depict some of the ways in which sociologists use humor in their sociological tales.

Key-words: Humor, Sociology, Sociological tales

ENERGY CRISIS – MASS MEDIA COVEREGE

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Abstract

World economies have past through numerous depressions/ crises social, economical, political, military, ecological, energy, moral. In the light of the 2022 energy crisis the aim of our presentation is to analyze the ways in which this crisis has been mediatized in Romanian and interational mass media. The energy crisis of 2021-2022 is different from other crises, because, on the one hand, it follows a global health crisis, namely the COVID 19 pandemic. On the other hand, it is different from previous crises in its overall impact on activity of production and distribution worldwide not just locally or regionally. Having an exploratory character, our presentation aims to: (1) determin the specific particularities of the mediatization of the energy crisis (from its genesis to how it unfolds) and (2) make a typology of the narratives developed in the mass media with reference to the current energy crisis.

Key words: energy crisis, mass media coverage, jurnalism

CLIMATE CHANGE AND WOMEN PARTICIPATION IN CHICKPEA PRODUCTION IN LARKANA-SINDH-PAKISTAN

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Abstract

This research investigates **Climate Change and women participation in Chickpea Production in Larkana-Sindh-Pakistan**. In present scenario the tree association with regular Agriculture crops as seen as panacea to combat economic insecurity and imminent environmental threats. The changing crop patterns as Agroforestry Practice in farming is seen as adaptive solution against the food security and Soil fertility impairment. (Reference), In addition to Climate change repercussions the wood scarcity is our leading economic problem. The wood scarcity is contributing to the higher bills of timber imports. In such a critical situation it is dire need to enhance tree cover by adaptation of Agroforestry Practices. Now, the Agroforestry has been universally acknowledged as the best mean to mitigate climate change. Growing trees in association with the short rotational Agriculture crop gives monetary returns in a shorter time to meet the demands of livelihood. Where as, trees are considered as carbon sink with it's biological ability to convert emitted Carbon from other industrial emissions in the biomass of tree's trunk. Various physiological processes and biochemical reactions given the way to sequester Carbon by the nature. In addition to sequester Carbon trees belonging to the leguminous crops has a specialty feature to improve the fertility status of the the soil by converting atmospheric Nitrogen into the available nitrate form. This study is focussed around the areas where Agriculture crops were cultivated in association with Tree crops.

**WOMEN ENTREPRENEURSHIP AND HONOUR KILLING OF WOMEN IN SMES
BUSINESS: A CASE STUDY OF THULL DISTRICT JACOBABAD**

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Abstract

This research investigates Women Entrepreneurship in SMEs business and its impact on economy of Pakistan. The exceptional growth of Small and medium enterprises (SME) has been expected and executed in the development of the country economically since 1947. It has contributed to the GDP growth, employment generation and export. The SME sector has acquired an outstanding contribution in the socio-economic development of the country. The damaging factors in the development of this sector are low capital base, accessibility of technology, credit policy, inconsistent business services, quality human resources, low market awareness and infrastructural deficiency. The SME sectors are growth engine for economy in present scenario of globalization process. The Aim of this paper is to examine various issues in context of Pakistan economic condition. Because the SMEs account for more than 95 percent of the industrial units, approximately 40 percent of the industrial production, and about 36 percent of the total exports. There are more than 18 million persons employed in various SME units and about 3.2 million registered SME units in the country. The scope of the paper examines the growth of SMEs in global era and its performance in economy. It identifies contribution of SMEs in GDP growth.

**MORINGA PEREGRINA FIORI BITKISİNİN ETNOBOTANİK VE TIBBİ
KULLANIMLARINA GENEL BAKIŞ
OVERVIEW OF ETHNOBOTANICAL AND MEDICINAL USES OF MORINGA
PEREGRINA FIORI**

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Abstract:

The Moringaceae family includes 14 species such as *M. hildebrandtii*, *M. oleifera*, *M. stenopetala*, *M. pygmaea*, and *M. concanensis*, and all of the species have medicinal value. They are spread in mountainous areas and desert ecosystems. *Moringa peregrina* is widespread in the arid and semi-arid regions of Africa, the Arabian Peninsula and Asia. *M. peregrina* is a small tree with thin leaves, white flowers and long, woody fruits that can reach a height of 3-15 metres. Its deep roots increase drought resistance. Medically, the plant is known for its anti-inflammatory, antioxidant, and antimicrobial properties and is traditionally used to treat conditions such as rheumatism, digestive problems, and skin problems. While the oil extracted from its seeds is used for cooking and cosmetic purposes, it is used as a nutritious food because its leaves are rich in vitamins and minerals. The leaves can also be used as a dietary supplement by drying and pulverising. In some cultures, *M. peregrina* plays an important role in religious rituals and traditional ceremonies. The main bioactive components of the plant include vitamin C, flavonoids, phenolic acids, saponins and essential fatty acids, which support its medicinal and nutritional purposes. The antioxidant and essential nutrients of the plant further emphasises its importance in folk medicine and modern health practises. In this study, the traditional and medicinal uses of *M. peregrina* were discussed.

Keywords: *Moringa peregrina*, medicinal use, Moringaceae, traditional uses.

Özet:

Moringaceae familyası, *M. hildebrandtii*, *M. oleifera*, *M. stenopetala*, *M. pygmaea* ve *M. concanensis* gibi 14 tür içerir ve türlerin tamamı tıbbi değere sahiptir. Dağlık alanlarda ve çöl ekosistemlerinde yayılış gösterirler. *Moringa peregrina*, Afrika, Arap Yarımadası ve Asya'nın kurak ve yarı kurak bölgelerine yayılmıştır. *M. peregrina*, 3-15 metre yüksekliğe ulaşabilen, ince yapraklı, beyaz çiçekli ve uzun, odunsu meyveleri olan küçük bir ağaçtır. Derin kökleri, kuraklığa dayanıklılığını artırır. Tıbbi olarak, bitki antiinflamatuvar, antioksidan ve antimikrobiyal özellikleri ile bilinir ve geleneksel olarak romatizma, sindirim sorunları ve cilt problemleri gibi durumları tedavi etmek için kullanılır. Tohumlarından çıkarılan yağ, yemek pişirme ve kozmetik amaçlı kullanılırken, yaprakları vitamin ve mineraller açısından zengin olmasından dolayı besleyici bir gıda olarak kullanılır. Yapraklar kurutulup toz haline getirilerek diyet takviyesi olarak da kullanılabilir. Bazı kültürlerde, *M. peregrina* dini ritüellerinde ve geleneksel törenlerde önemli bir rol oynar. Bitkinin temel biyoaktif bileşenleri arasında C vitamini, flavonoidler, fenolik asitler, saponinler ve esansiyel yağ asitleri bulunur ve bu da tıbbi ve beslenme amaçlarını destekler. Bitkinin antioksidan ve esansiyel besin içeriği, halk tıbbında ve modern sağlık uygulamalarında önemini daha da vurgulamaktadır. Bu çalışmada, *M. peregrina*'nın geleneksel ve tıbbi kullanımları ele alınmıştır.

Anahtar Kelimeler: *Moringa peregrina*, tıbbi kullanım, Moringaceae, geleneksel kullanımlar.

**STUDY OF MECHANICAL PROPERTIES AND SUSTAINABLE PRACTICES IN
CONCRETE INCORPORATING RECYCLED MARBLE WASTE**

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Abstract

Due to the rapid expansion of infrastructure, urbanization, and industry, concrete is needed worldwide. However, the expansion of the concrete sector increases pressure on natural resources, endangering the balance of the ecosystem. Thus, it would be advantageous to meet current concrete needs without reducing production quality by incorporating recycled materials into concrete mixes. In this work, we investigate the mechanical characteristics of environmentally friendly concrete using recycled marble powder (WMP) partially replacing cement and marble coarse aggregates (MCA) as an alternative to natural coarse aggregates.

The qualities of the concrete were evaluated using a combination of destructive and non-destructive testing techniques. In our study, three series of mixes were prepared. The first series (S1) is composed of 100% natural coarse aggregates. In the second series (S2), 50% of the natural coarse aggregates are substituted for marble coarse aggregates, while the third series (S3) is composed of 100% marble coarse aggregates. In each of the three series, the Marble powder was used in place of cement at a percentage ranging from 5% to 20%, increasing by 2.5%. Concrete mixes were developed and evaluated with different levels of marble waste substitution to compare their compressive strengths and workability to those of traditional concrete made from 100% natural aggregates. Simultaneously, the strength characteristics were measured using the Schmidt hammer and ultrasonic velocity tests. As was mentioned, in the three series, when Cement is replaced with marble powder, the slump decreases, even though the incorporation of marble coarse aggregates tends to increase this workability, while the compressive strength shows an increase of 28.66% and 31.63% compared to the control mix for 50% and 100% substitute of natural coarse aggregates with marble coarse aggregates, respectively. It is also noteworthy that concrete containing marble waste exhibits normal ultrasonic velocity. For concrete mixtures of series (S1), (S2), and (S3), respectively, the velocity of ultrasonic pulses increased by 18.20%, 27.44%, and 27.98%, while the Schmidt Rebound Number increased by 10.13%, 14.52%, and 21.37%, respectively, in contrast to the values of the control mixture. Additionally, the reliability of the universal testing machine (UTM) results was validated through correlation analysis of compressive strength measurements obtained by various methods. The study's findings are intriguing and underscore the potential of employing marble waste as an alternative to natural aggregates.

Keywords: Marble replacement, Workability, Compressive Strength, Schmidt Hammer, Ultrasonic velocity.

ENDÜSTRİYEL TİP BOBİN SARMA MAKİNASININ YAPISAL ANALİZİ
STRUCTURAL ANALYSIS OF INDUSTRIAL TYPE COIL WINDING MACHINE

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Abstract

Eddy current method has an important place as one of the non-destructive material testing methods for the determination of wire defects. One of the important components in this method is properly wound coils. In this study, the design and structural analysis of an industrial type device that can perform fast and uniform winding in desired diameters and dimensions has been carried out. For the design, a 3D design of the device was made using Solidworks programme. The designed device consists of unloader, tensioner and winder sections. For the analyses, structural analyses of each part were carried out by taking into account the mechanical effects of these 3 separate parts in the operating state of the system. ANSYS Workbench programme using finite element method was used for the analyses. The system's stresses and deformations were carefully calculated, and the device's stress concentrations were estimated by calculating the safety factors under these loads. With the necessary structural modifications, the device was designed to operate safely and securely. The results obtained are presented in graphs and tables. This study provides important contributions to the design of more efficient, safe and durable winding machines, and the results have provided design improvements that will improve the performance of the machine.

Keywords: Coil Winding Machine ,Finite Element Analysis, Structural Analysis, Safety Factor, Stress Analysis

Özet

Tel kusurlarının belirlenmesi amacıyla tahribatsız malzeme muayenene yöntemlerinden biri olarak girdap akım yöntemi önemli bir yer tutmaktadır. Bu yöntemde önemli bileşenlerden biri de düzgün sarılmış bobinlerdir. Bu çalışmada endüstriyel tip hızlı ve istenilen çap ve boyutlarda düzgün sarım yapabilecek bir cihazın tasarımı ve yapısal analizi gerçekleştirilmiştir. Tasarım için Solidworks programı kullanılarak cihazın 3 boyutlu tasarımı yapılmıştır. Tasarımı yapılan cihaz boşaltıcı gergi ve sarıcı bölümlerinden meydana gelmektedir. Analizler için bu 3 ayrı kısım sistemin çalışması durumundaki mekanik etkiler dikkate alınarak her bir kısmın yapısal analizleri gerçekleştirilmiştir. Analizlerin gerçekleştirilmesi amacıyla sonlu elemanlar metodu kullanılan ANSYS Workbench programı kullanılmıştır. Sistem üzerindeki gerilme ve deformasyonlar detaylı olarak hesaplanmış, bu yükler altında güvenlik faktörleri belirlenerek cihazın gerilme yığılmaları tespit edilmiştir. Gerekli yapısal düzenlemeler ile birlikte cihazın güvenli ve emniyetli çalışabileceği tasarımı gerçekleştirilmiştir. Elde edilen sonuçlar grafik ve tablolarda sunulmuştur. Bu çalışma, bobin sarma makinelerinin daha verimli, güvenli ve dayanıklı bir şekilde tasarlanmasına yönelik önemli katkılar sunmakta olup, sonuçlar makinenin performansını artıracak tasarım iyileştirmeleri sağlamıştır.

Anahtar kelimeler: Bobin Sarma Makinası, Sonlu Elemanlar Metodu, Yapısal Analiz, Emniyet Katsayısı, Gerilme Analizi

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SEISMIC ANALYSIS OF MULTI-STORIED BUILDING RESTING ON HILLY REGIONS IN INDIA

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Abstract

In many countries, without exception to India, towns and cities are being developed nearby hilly regions also. Due to scarcity of plain terrains, constructions of multi-storied buildings are extended to hilly regions causing vertical irregularities in such buildings. During an earthquake, the dynamic behavior of the structures on hilly slopes will be different in terms of natural time periods and displacements compared to those constructed on plain regions. Examples of severe damages or collapse of buildings, witnessed during 2001 Bhuj, 2011 Sikkim and 2015 Nepal earthquakes, made researchers to study the response of structures standing on hilly regions. In the present study, a multi-storied building (G+5), resting on different slopes like 15° , 30° , 45° in hilly regions with stepped back configuration, is chosen for study. The response parameters like natural frequencies, time periods, base shears and displacements are worked out and the results are compared with those when similar building rests on plain region. The vertical irregularity of building causes short column effect particularly in lower parts of stories attracting more shears in columns, which influences the response of the building during an earthquake. The results obtained using "STAAD Pro" software are compared with those of results obtained from manual calculations and the variation is less.

Keywords: *Building on hilly regions, Natural frequencies, Time periods, Short column effect, Base shear, Displacements, and software (MAT LAB and STAAD PRO)*

**DOĞAL DİL İŞLEME VE YAPAY ZEKÂ DESTEKLİ MÜŞTERİ HİZMETLERİ
OTOMASYONU (ADA)
NATURAL LANGUAGE PROCESSING AND AI-POWERED CUSTOMER SERVICE
AUTOMATION (ADA)**

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Abstract

Traditional customer service can fall short due to heavy workloads, limited operating hours, and cost pressures. During periods of high demand, the inability to respond to customers in a timely manner can lead to dissatisfaction and loss of customers. Moreover, manual processes increase operating costs and reduce efficiency. To address these challenges, ADA, developed using artificial intelligence and natural language processing technologies, aims to digitize customer service, providing fast, efficient, and uninterrupted service. In this study, a systematic approach has been developed to accurately classify customer requests and provide the most appropriate responses. In the initial phase, a dataset of 20,000 emails and their responses was collected from our support channels. The collected data was processed as text data. During the data preprocessing steps, special characters, stop words, and unnecessary spaces were removed from the texts. Additionally, word stems were obtained and normalized using stemming and lemmatization techniques. After data preprocessing, feature extraction was performed using the Term Frequency-Inverse Document Frequency (TF-IDF) method. The extracted feature vectors were then split into training and testing datasets. Various machine learning classification models (Multinomial Naive Bayes Classifier, Decision Tree, Support Vector Machines, Random Forest) were trained to determine which of the five different topics (Technical Service Issues, Product and Stock Information Queries, Suggestions-Requests-Complaints, Account Operations, Post-Order Processes) the emails were related to. Following the machine learning modeling, the identified categories enabled the detailed and accurate preparation of intents in Google Dialogflow. As a result, the machine learning classification phase significantly improved the intent preparation process for the chatbot, allowing more effective responses to user requests and increasing success rates.

Keywords: Machine Learning, Chatbot, Natural Language Processing, Google DialogFlow

Özet

Geleneksel müşteri hizmetleri, yoğun iş yükü, sınırlı çalışma saatleri ve maliyet baskıları nedeniyle yetersiz kalabilmektedir. Özellikle yüksek talep dönemlerinde müşterilere zamanında yanıt verilememesi, memnuniyetsizlik ve müşteri kaybı gibi sorunlara yol açabilir. Ayrıca, manuel süreçler işletme maliyetlerini artırarak verimliliği düşürmektedir. Bu sorunların üstesinden gelmek için yapay zekâ ve doğal dil işleme teknolojileri kullanılarak geliştirilen ADA, müşteri hizmetlerini dijitalleştirerek hızlı, verimli ve kesintisiz bir hizmet sunmayı hedeflemektedir. Çalışma kapsamında, müşterilerden gelen taleplerin doğru bir şekilde sınıflandırılması ve en uygun yanıtın verilebilmesi için bir sistematik geliştirilmiştir. İlk aşamada destek kanallarımıza gelen e-posta ve bunlara verilen cevaplardan toplam 20.000 adetlik veri kümesi elde edilmiştir. Toplanan veriler metin verisi olarak işlenmiştir. Veri ön işleme adımlarında, metinlerden özel karakterler, durak kelimeler (stop words) ve gereksiz boşluklar temizlenmiştir. Ayrıca, kelime kökleri (stemming) elde edilmiş ve lemmatization yöntemleriyle normalize edilmiştir. Veri ön işleme sonrasında, Term Frequency-Inverse Document Frequency (TF-

IDF) yöntemi kullanılarak özellik çıkarımı yapılmıştır. Elde edilen özellik vektörleri eğitim ve test veri kümelerine ayrıldıktan sonra, farklı makine öğrenme sınıflandırma modelleri (Multinomial Naive Bayes Classifier, Decision Tree , Support Vector Machines, Random Forest) kullanılarak epostaların 5 farklı konudan (Teknik Servis Konuları , Ürün ve Stok Bilgisi Soruları, Öneri-Talep Şikayet, Hesap İşlemleri, Sipariş Sonrası Süreçler) hangisi ile ilgili olduğunun belirlenmesi için model eğitimi gerçekleştirilmiştir. Makine öğrenmesi modellemesi sonrasında belirlenen kategoriler, Google Dialogflow'da ilgili intentlerin detaylı ve doğru bir şekilde hazırlanmasına olanak tanımıştır. Bu sayede, makine öğrenme sınıflandırma aşaması, chatbot üzerindeki intent hazırlık sürecini önemli ölçüde iyileştirmiş, kullanıcı taleplerine daha etkili yanıtlar verilmesini sağlayarak başarı oranını arttırmıştır.

Anahtar kelimeler: Makine öğrenmesi, Chatbot, Doğal Dil İşleme, Google DialogFlow

FAZLA KİLOLU VE OBEZ BİREYLERDE KRONİK HASTALIK VARLIĞININ SOLUNUM KAS KUVVETİ ÜZERİNE ETKİSİ

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Özet

Bu çalışmanın amacı, fazla kilolu ve obez bireylerde kronik hastalık varlığının solunum kas kuvvetine olan olası etkilerini incelemektir. Araştırmaya vücut kitle indeksi (VKİ) 25 kg/m² ve üzeri olan, kronik hastalığı bulunan fazla kilolu ve obez 55 birey ile kronik hastalığı olmayan fazla kilolu ve obez 55 birey dâhil edilmiştir. Katılımcıların demografik ve klinik bilgileri toplanmış, solunum kas kuvvetleri ise maksimum inspiratuar basınç (MİP) ve maksimum ekspiratuar basınç (MEP) ölçümleri ile değerlendirilmiştir. Ayrıca, beklenen MIP ve MEP değerleri ile karşılaştırmalar yapılmıştır. Gruplar arasında anlamlı fark olup olmadığı bağımsız gruplarda t-testi ile analiz edilmiş ve anlamlılık düzeyi p:0.05 olarak belirlenmiştir. Çalışmada iki grup arasında yaş ve beden kitle indeksi açısından istatistiksel olarak anlamlı bir fark bulunmamıştır. Bununla birlikte, kronik hastalığı bulunan bireylerin MEP değerleri, kronik hastalığı olmayan bireylere kıyasla anlamlı derecede düşük bulunmuştur (p<0.05). Ancak MIP, beklenen MIP ve beklenen MEP değerleri açısından iki grup arasında anlamlı bir fark tespit edilmemiştir (p>0.05). Sonuç olarak, solunum sistemini de etkileyen obez bireylerde kronik hastalık varlığı, ekspirasyon kas kuvvetini olumsuz etkileyebilmekte, ancak inspirasyon kas kuvveti üzerinde benzer bir etki gözlemlenmemektedir. Beklenen solunum kas kuvvetleri açısından kronik hastalığı olan ve olmayan fazla kilolu ve obez bireyler arasında önemli bir fark bulunmamıştır. Bu bulgular, obez bireylerde solunum kas kuvvetinin korunmasında kronik hastalıkların rolüne dikkat çekmektedir.

Anahtar Kelimeler: Obezite, Kronik Hastalık, Solunum Kas Kuvveti

Abstract

The aim of this study is to examine the potential impact of chronic disease on respiratory muscle strength in individuals with overweight or obesity. A total of 110 individuals with a body mass index (BMI) of 25 kg/m² or higher were included in the study, comprising 55 overweight and obese individuals with chronic diseases and 55 without chronic diseases. The demographic and clinical data of the participants were collected, and the respiratory muscle strength was evaluated through the measurement of maximum inspiratory pressure (MIP) and maximum expiratory pressure (MEP). Furthermore, comparisons were made with the predicted MIP and MEP values. The existence of a significant difference between the groups was evaluated using an independent samples t-test, with a significance level set at p=0.05. No statistically significant difference was found between the two groups with regard to age and body mass index. However, the MEP values of individuals with chronic diseases were found to be significantly lower than those without chronic diseases (p < 0.05). In contrast, no statistically significant difference was detected between the two groups with regard to MIP, predicted MIP, and predicted MEP values (p > 0.05). In conclusion, the presence of chronic diseases in obese individuals, which also affects the respiratory system, can negatively impact expiratory muscle strength, although a similar effect is not observed on inspiratory muscle strength. No significant difference was found between the two groups in terms of predicted respiratory muscle strength. These findings highlight the role of chronic diseases in preserving respiratory muscle strength in obese individuals.

Keywords: Obesity, Chronic Disease, Respiratory Muscle Strength

THE IMPACT OF SOCIAL MEDIA USAGE ON STUDENT BEHAVIOUR AND DIGITAL IDENTITY MANAGEMENT

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Abstract

In the rapidly evolving digital age, social media has become integral to students' lives, profoundly influencing their behavior and digital identity. The pervasive use of social media platforms among senior secondary students raises significant questions regarding their impact on their social behavior and strategies for managing their digital identities. This article investigates the impact of social media usage on student behavior and digital identity management among senior secondary students aged 16–18 years. A mixed-methods design is employed, integrating both quantitative and qualitative approaches. A stratified random sampling technique is used to select a representative sample of 500 students to ensure a diverse understanding of social media impacts. The quantitative component involves a structured survey administered online through Google Forms and SurveyMonkey, focusing on social media usage frequency, types of online activities, and perceived impacts on behavior and digital identity management. The qualitative component consists of focus group discussions aimed at providing in-depth insights into students' experiences and perceptions related to digital identity management and the influence of social media. Quantitative data analysis is conducted using SPSS, employing descriptive statistics (mean, standard deviation) and inferential statistics (t-tests, ANOVA) to examine the relationships between social media use, behavior, and digital identity management. Qualitative data from focus group discussions are analyzed using NVivo software to identify key themes and patterns. Preliminary findings suggest that high levels of social media usage correlate with increased instances of behavioral issues and more complex digital identity management strategies among students. The results underscore the need for educational institutions to develop policies and programs aimed at promoting responsible social media use and supporting students in managing their digital identities effectively.

Keywords: Social Media Usage, Student Behavior, Digital Identity Management, Senior Secondary Students.

THE SEPARABILITY PROPERTIES OF NONLOCAL GINZBURG-LANDAU TYPE EQUATIONS

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Abstract

Here, the Cauchy problem for linear and nonlinear Ginzburg-Landau type equations are studied. The equation includes variable coefficients with convolution terms. Here, assuming enough smoothness on the initial data and the growth conditions on coefficients, the coercive properties of corresponding linear problem and the existence, uniqueness of local and global solution, L^p -regularity, and blow up properties to solution of nonlinear problem are established. Consider the Cauchy problem for the following nonlocal Ginzburg-Landau (G-L) type equation

$$u_t = (v+i\eta)\Delta u + b * u + (\mu+i\gamma)g * |u|^{2\sigma}u, \quad \#1.1$$

$$u(x,0) = \phi(x), \quad x \in \mathbb{R}^n, \quad t \in (0,T),$$

where $v, \eta, \mu, \gamma, \sigma$ are real numbers, $u = u(x,t)$ is a solution, $a = a(x)$, $g = g(x)$, $b = b(x)$ are complex-valued functions, $u * v$ denotes a convolution of u , v and $\phi = \phi(x)$ is an initial data.

Key Word: Diffusion equations, Ginzburg-Landau equation, Embedding in Sobolev spaces, L^p -regularity property of solutions, Fourier multipliers

BALDA RENK OLUŞUMU VE BAL RENGİNİN DEĞİŞİMİNİ ETKİLEYEN FAKTÖRLERİN İNCELENMESİ

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Özet

Balda renk oluşumunu ve renk değişimini etkileyen faktörlerin incelenmesi, çiçek kaynakları, çevre koşulları ve bal üretim süreçleri arasındaki karmaşık etkileşimlere dair öngörüler ortaya koyan kritik bir araştırma alanıdır. Elde edilen bal rengi sadece çiçek kökenini belirtmekle kalmaz, aynı zamanda tüketici tercihlerini ve bazı sağlık durumlarına da önemli düzeyde etkide bulunur. Bu faktörleri anlamlandırarak, arıcılık alanında çeşitli pazarlamalar için istenilen bal ve bal ürünlerinin üretilmesini sağlar. Bal renginin ilk belirleyen faktörlerden birisi ve önemli olanı, mevsimsel çiçek durumuna göre değişen ölçüde elde edilen nektar kaynağıdır. Örneğin, kayısı, lavanta çiçeğinden elde edilen bal genellikle açık renkli olur, karabuğday balı ise daha koyu olma eğilimindedir ve bu durum da çiçek ve ağaç türleri ile bal rengi arasındaki önemli bir korelasyon yani bir ilişki olduğu belirlenir. Balın rengini etkileyen diğer faktörler ise arı kolonisinin yaşlanması ve depolama koşulları da yer alır; taze bal genellikle daha açık tonda olur, kimyasal değişimler ve kristalleşme süreçleri sebebiyle zamanla koyulaşma görülebilir. Bal rengiyle ilgili tartışmalar genellikle tüketici oluşan algılardan ve kültürel durumdan kaynaklanır. Sebebi ise daha açık renkli ballar genellikle saflık ve tazeliğe konumlandırılırken, daha koyu renkli ballar ise daha zengin tatlar ve daha yüksek antioksidan içeriğiyle ilişkilendirilir. Bal rengini değerlendirmeye yönelik yapılan araştırmalar, Pfund ölçeği gibi geleneksel görsel ölçeklerin yanı sıra renk parametrelerinin hassas ölçümlerini sağlayan spektrofotometri gibi gelişmiş teknikleri de içerir. Bu yöntemler yalnızca doğru renk değerlendirmesini kolaylaştırmakla kalmaz, aynı zamanda balın kimyasal bileşimi ve kalite değerlendirmesi için çıkarımları hakkında daha derin bir bilgi edinimine de katkıda bulunur.

Anahtar kelimeler: Bal rengi, depolama, nektar, pazarlama, pfund ölçeği

INVESTIGATION OF COLOR FORMATION IN HONEY AND FACTORS AFFECTING THE CHANGE OF HONEY COLOR

The study of factors affecting color formation and color change in honey is a critical area of research that provides insights into the complex interactions between floral resources, environmental conditions and honey production processes. The resulting honey color not only indicates floral origin, but also has a significant impact on consumer preferences and some health conditions. By making sense of these factors, it enables beekeeping to produce the desired honey and honey products for various markets. One of the first and important determinants of honey color is the nectar source, which varies according to the seasonal flower condition. For example, honey from apricot and lavender flowers is usually light in color, while buckwheat honey tends to be darker, indicating a significant correlation between flower and tree species and honey color. Other factors affecting the color of honey include the aging of the bee colony and storage conditions; fresh honey is usually lighter in tone, darkening over time due to chemical changes and crystallization processes. Controversy about honey color is often due to consumer perceptions and cultural context. This is because lighter honeys are often positioned as pure and fresh, while darker honeys are associated with richer flavors and higher antioxidant content. Research into assessing honey color includes traditional visual scales such as the Pfund scale, as well as advanced techniques such as spectrophotometry, which provides precise measurements of color parameters. These methods not only facilitate accurate color assessment, but also contribute to a deeper knowledge of the chemical composition of honey and its implications for quality assessment.

Key words: Honey color, storage, nectar, marketing, pfund scale

**İZMİR İLİNDE METEOROLOJİK KURAKLIK ANALİZİ
METEOROLOGICAL DROUGHT ANALYSIS IN İZMİR PROVINCE**

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Abstract

Drought is a natural disaster that has a negative effect not only on humans but also on all living things, compared to other natural disasters, and occurs under different meteorological and environmental conditions. Drought is a natural event that does not occur suddenly like other natural disasters, but begins to show its effect over time. The problems posed by climate change are widely researched around the world. Recently, climate change impacts around the world are causing rural droughts and floods to deteriorate. In this study, meteorological drought analysis was carried out using 4 meteorological observation stations belonging to the province of Izmir in the Aegean Region. 1-month, 3-month and 12-month time periods were used when performing drought analysis. Drought classes and drought percentages were determined for each station, and the distribution of the longest dry periods and the most severe drought values were determined. As a result of the study, it was observed that drought was detected in the same years in the meteorological observation stations, especially in the 12-month drought analyzes. In addition, it has been determined that the dry periods of the meteorological observation stations, which are close to each other in terms of location, mostly occur in the same period as each other. It was determined that the driest period was between the years 1985-1993, and the most humid period was between the years 2009-2013. As a result of the drought analysis conducted with SPI, it was observed that the percentage of drought occurrence generally increased as the time period increased. The evaluation of 4 Meteorological Observation Stations showed that , dry period percentages during the SPI-01 period vary between 39%-52%, dry period percentages during the SPI-03 period vary between 49%-51%, and dry period percentages during the SPI- period vary between 51%-54%. As a result of the evaluation of SPI results for 4 stations, it is seen that drought percentages generally increase with the increase in period durations.

Keywords: İzmir province, Meteorological drought analysis, SPI.

Özet

Kuraklık, diğer doğal afetler ile karşılaştırıldığında sadece insanlar üzerinde değil, tüm canlılar üzerinde olumsuz bir etkiye sahip olan, farklı meteorolojik ve çevresel şartlar altında ortaya çıkan doğal bir afettir. Kuraklık, diğer doğal afetler gibi ani olarak meydana gelmeyen, zamanla etkisini göstermeye başlayan bir doğa olayıdır. İklim değişikliğinin meydana getirdiği sorunlar dünya genelinde yaygın bir şekilde araştırılmaktadır. Son zamanlarda dünya genelinde iklim değişikliği etkileri bölgesel kuraklıkların ve taşkınların artmasına sebep olmaktadır. Bu çalışmada Ege Bölgesi'nde bulunan İzmir iline ait 4 adet meteorolojik gözlem istasyonu kullanılarak meteorolojik kuraklık analizi yapılmıştır. Kuraklık analizi yaparken 1- aylık, 3- aylık ve 12- aylık zamana periyotları kullanılmıştır. Her bir istasyon için kuraklık sınıfları ve kuraklık yüzdeleri belirlenmiş olup en uzun süreli kurak dönemler ve en şiddetli kuraklık değerlerinin dağılımları belirlenmiştir. Yapılan çalışma sonucunda meteorolojik gözlem istasyonlarında, özellikle 12- aylık yapılan kuraklık analizlerinde aynı yıllar aralığında kuraklık tespit edildiği gözlenmiştir. Bununla birlikte konum olarak birbirine yakın olan meteorolojik gözlem istasyonlarının kurak dönemlerinin, büyük oranda birbiri ile aynı dönemde gerçekleştiği tespit edilmiştir. Ayrıca en

kurak dönemin 1985-1993 yılları aralığında, en nemli dönemin ise 2009-2013 yılları aralığında yaşandığı tespit edilmiştir. SPI ile yapılan kuraklık analizi sonucunda, zaman periyodu arttıkça kuraklık görülme yüzdelerinin genel itibari ile arttığı gözlenmiştir. 4 Meteoroloji Gözlem İstasyonunu değerlendirmemiz neticesinde SPI-01 periyodu boyunca kurak dönem yüzdeleri %39-%52 arasında, SPI-03 periyodu boyunca kurak dönem yüzdeleri %49-%51 arasında, SPI- periyodu boyunca kurak dönem yüzdeleri %51-%54 arasında değişmektedir. 4 istasyon için SPI sonuçlarının değerlendirmesi sonucunda genel anlamda periyot sürelerinin artması ile beraber kuraklık yüzdelerinin de arttığı görülmektedir.

Anahtar kelimeler: İzmir ili, Meteorolojik kuraklık analizi, SPI.

PERFORMANCE OF C4-SHOP A HETEROCYCLIC ORGANIC COMPOUND AGAINST CORROSION OF CARBON STEEL IN 1 M HCl: ELECTROCHEMICAL, THERMODYNAMIC AND THEORETICAL ASSESSMENT

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ABSTRACT

The inhibition effectiveness of carbon steel (CS) in 1M HCl by C4-SHOP has been examined using electrochemical impedance spectroscopy (EIS), potentiodynamic polarization (PPD), and weight loss measurements at 298 K. The results indicate that the inhibition efficiency (η %) increases with the concentration of inhibitor C4-SHOP reaching maximum values of 85 % at the optimal concentration ($5 \cdot 10^{-3}$ M) according to PPD analysis. PPD results suggest that inhibitor C4-SHOP act as mixed-type inhibitors. Furthermore, the inhibitor follow the Langmuir adsorption isotherm for monolayer adsorption. Scanning electron microscopy (SEM) analysis of CS has also been conducted and discussed. Theoretical calculations and molecular dynamics (MD) simulations show good agreement with the experimental results for the inhibitor C4-SHOP under study.

Keywords: Corrosion, inhibitor, heterocyclic, organic, compound, carbon steel.

LIFE EXPECTANCY CYCLE

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ABSTRACT

Life expectancy, a key indicator of societal well-being, reflects the complex interaction of various socioeconomic, environmental, and infrastructural factors. Previous studies have explored the influence of healthcare, education, and living conditions on longevity. However, there remains a gap in understanding the combined effect of specific factors in a cyclical pattern. This research investigates the relationships between life expectancy and the selected variables. The study aims to uncover how these factors influence people's longevity. This research utilizes path analysis to analyze data from 107 countries from the World Bank's 2022 database. Key variables include life expectancy at birth, aquaculture and cereal production, and access to clean fuels and electricity. Findings reveal a cyclical relationship, where increased access to electricity leads to improved access to clean fuels, which enhances food production, ultimately boosting life expectancy. This improved life expectancy supports further infrastructure development in a feedback loop, creating a reinforcing cycle. Thus, policymakers should focus on expanding access to clean energy and electricity to improve public health. Infrastructure investments can lead to long-term societal benefits, including enhanced food security and life expectancy.

Keywords: life expectancy, cereal production, access to clean fuels, access to electricity, aquaculture production, path analysis.

INTRODUCTION

Life expectancy denotes the average number of years an individual is anticipated to live, derived from statistical data. Numerous factors shape this metric and can vary widely across countries, regions, and demographic groups. Serving as a holistic indicator of societal well-being and quality of life (Etikan, 2018; Gutin & Hummer, 2021), life expectancy reflects the influence of socioeconomic conditions, healthcare systems, education levels, and environmental factors. By providing insights into population health, life expectancy aids policymakers and researchers in understanding the multifaceted influences on public health and formulating strategies to improve societal well-being.

Understanding the relationship between life expectancy and various factors is crucial. Its information empowers, e.g., patients, families, and caregivers to make informed decisions about care plans and medical choices (Zanetti et al., 2009). Also, it reveals societal transformations. For example, increased life expectancy affects individuals' preferences for productive and non-productive activities across their lifespan, influencing both the financing and costs of social welfare systems (Wickstrøm et al., 2020). To uncover the factors that affect life expectancy, several studies employ various methods such as multivariate regression analysis, panel data models, and spatial autocorrelation (Duque et al., 2018; Hauck et al., 2016; Tafran et al., 2020).

Life expectancy research has raised several questions and identified areas that require further investigation. The determinants of life expectancy have been the subject of extensive research, with studies exploring various factors such as economic, social, and environmental influences (Rahman et al., 2022) (Strulik & Vollmer, 2013). However, despite extensive research on these determinants, there is a notable gap in the literature regarding the combined impact of specific variables in specific patterns.

This study aims to address this gap by using path analysis to investigate some selected variables' interrelationships and their influence on life expectancy. This research contributes to this domain by providing empirical evidence that emphasizes the critical role of the selected variables on life expectancy. Also, the study identifies a cyclical relationship in which enhanced life expectancy. These insights provide a foundation for policy interventions to improve life expectancy. The remaining sections of this research are organized as follows. Section 2 explores the concepts related to this research. Section 3 outlines the research methodology. Finally, the results of the analysis and discussions will be presented.

LITERATURE REVIEWS

This section explores the various determinants of life expectancy, including genetic, socioeconomic, environmental, lifestyle factors, and other related factors, to provide the foundation for understanding the multifaceted influences on life expectancy.

Genetic and physiological factors: These factors encompass X chromosome inactivation, telomere attrition, mitochondrial inheritance, hormonal and cellular stress responses, immune function, and metabolic processes (Seifarth et al., 2012). These mechanisms may explain the sexual dimorphism in life expectancy, as females generally outlive males globally. Some researchers posit that DNA might intrinsically code for longevity, indicating a biological lifespan limit. For example, one study suggests potential longevity asymptotes of approximately 79 years for men and 84 years for women (Marchetti, 1997). However, this perspective is debated by those who reject the concept of fixed biological lifespan barriers (Carnes & Olshansky, 2007). Despite the importance of biological factors, they do not operate in isolation. Research highlights the interaction between biological, psychological, and social factors in determining longevity. For instance, a study on centenarians identified sleep latency (a biological factor) and life satisfaction (a psychological factor) as significant predictors of survival beyond 100 years (Yorgason et al., 2018). Thus, a comprehensive understanding of life expectancy necessitates considering multiple factors beyond biology.

Environmental and demographic factors: These factors, if combined with social and economic elements, will collectively contribute to differences in longevity (Monsef & Mehrjardi, 2015; Zha et al., 2019). The Neolithic Revolution, for example, is thought to have initiated an evolutionary process that notably impacted human lifespan by modifying environmental hazards faced by populations (Galor & Moav, 2007). It was recognized that the urbanization environment could also hurt life expectancy (Monsef & Mehrjardi, 2015). The temperatures can impact life expectancy; e.g., moderate temperatures and adequate rainfall have positive effects (Zha et al., 2019). However, despite challenges such as pollution and stress, urban areas like Moscow report higher life expectancy. This underscores the complex interplay between environmental and socioeconomic factors (Novoselova, 2016). CO2 emissions are consistently associated with negative impacts on life expectancy (Younus et al., 2022; Segbefia et al., 2023). Demographic factors like fertility rate, education, and marital status also influence longevity (Karma, 2023).

Socioeconomic and cultural factors: These factors can cause life expectancy disparities across populations. Research indicates that higher socioeconomic status—measured by education, income, and occupation—correlates with longer life expectancy (Geruso, 2012; Gutin & Hummer, 2021; Singh & Lee, 2020). Education stands out as a particularly strong predictor of life expectancy. Adults with higher educational attainment, especially those with advanced degrees, exhibit significantly longer life spans than those with lower education levels (Singh & Lee, 2020). Income and poverty levels also demonstrate a clear inverse relationship with life expectancy, where individuals living in poverty face substantially reduced life expectancies (Singh & Lee, 2020). Some studies suggest that education and income possess greater explanatory power than other factors, such as labor force participation or marital status, in accounting for life expectancy disparities (Geruso, 2012). Moreover, cultural factors like gender inequality and population growth significantly influence life expectancy (Wirayuda & Chan, 2021). The impact of socioeconomic factors on life expectancy extends beyond individual characteristics to encompass broader societal and economic conditions. Macroeconomic factors such as GDP, income inequality (measured by the Gini coefficient), and unemployment rates are significantly correlated with life expectancy (Wirayuda & Chan, 2021). Additionally, the availability and quality of health resources—encompassing healthcare facilities, public health expenditure, and vaccination rates—also contribute to variations in life expectancy (Wirayuda & Chan, 2021). Additionally, community characteristics and demographic factors, such as fertility rates and marital status, also influence life

expectancy (Dobis et al., 2019; Karma, 2023). Economic factors, especially GDP per capita, are identified as significant drivers of life expectancy (Karma, 2023), with economic growth showing a simultaneous relationship with longevity (Setiawan et al., 2023). However, income inequality has negatively affected life expectancy in certain regions (Ahmad et al., 2023).

Health behaviors and lifestyle factors: These factors influence life expectancy, though their impact is complex and multifaceted. Studies highlight that diet, physical activity, tobacco use, sleep habits, and stress management contribute to overall health and longevity (Kris-Etherton et al., 2021). However, the relationship between lifestyle and life expectancy is not always straightforward. Research indicates that anti-health behaviors can negatively impact health but do not always directly correlate with shorter lifespans. One study found that family members with a higher number of anti-health factors lived longer, suggesting that lifestyle is crucial for health but not the sole determinant of life expectancy (Sygit et al., 2018). This contradiction underscores the complexity of factors influencing longevity. In addition, adult and infant mortality, under-five mortality, and the prevalence of diseases like measles, polio, diphtheria, and HIV/AIDS, significantly impact life expectancy (Amos & Smirnov, 2023). Health expenditure generally contributes positively to life expectancy, although its significance varies across studies (Ahmad et al., 2023; Udoumoh et al., 2023). Lifestyle behaviors, such as smoking, alcohol consumption, and sports participation, also play a role. For example, in Russian regions, increased alcohol consumption and smoking are negatively associated with life expectancy, while sports participation has a positive correlation (Zasimova et al., 2023). In the case of diseases, particularly Alzheimer's, they are significant contributors to reduced life expectancy in aging populations. Diet also has broader effects on life expectancy (Fadnes et al., 2024).

Social and psychological factors: These factors, e.g., perceived control, social participation, morale, and well-being are positively correlated with longevity, especially among older adults (Anstey et al., 2002). Furthermore, elements such as perceived political control and welfare state generosity also impact life expectancy at a population level (Crepaz & Crepaz, 2004). However, it was discovered that the relationship between income inequality and life expectancy appears to be curvilinear. Moderate income inequality is linked with higher life expectancy, which complicates simplistic views on the socioeconomic determinants of longevity (Crepaz & Crepaz, 2004).

A complex interaction of various factors shapes life expectancy. Lifestyle choices, such as alcohol consumption, smoking, and obesity, negatively affect life expectancy, particularly among men (Nakajima & Yano, 2020). Conversely, factors like hospital admission ratios and national health insurance costs have a positive influence (Nakajima & Yano, 2020), although healthcare expenditure shows mixed results, with some studies finding it insignificant (Karma, 2023). Health-related determinants are also critical. The infant mortality rate and illiteracy among individuals aged 10 and over are key predictors in East Java, Indonesia (Azies & Dewi, 2021). Environmental factors, such as renewable energy usage, positively contribute to longevity, while pollution, particularly CO₂ emissions, has a detrimental impact (Rahman & Alam, 2022; Karma, 2023).

From the above knowledge, it becomes clear that a multidisciplinary approach, incorporating insights from sociology, psychology, and biology, is essential for developing effective interventions and policies to promote life expectancy.

METHODOLOGY

Path analysis is a statistical method used to examine and quantify causal relationships among variables. It was originally proposed to decompose and interpret linear relationships between continuous stochastic variables (Lund & Scharen, 1992). The technique allows researchers to formulate theories explicitly and attach quantitative estimates to causal effects that are thought to exist on a priori basis (Wolfe, 1980). It can be applied to various fields, including agriculture, sociology, epidemiology, marketing, and environmental management (Bondari, 1990; Qamaruz-Zaman et al., 2019). It also allows researchers to evaluate the logical consequences of assumptions about causal relationships and provides a means to test competing theories (Duffy et al., 1981). Thus, this research utilizes path analysis to investigate the causal relationships among the variables, namely cereal production (CEP), access to clean fuels (ACF), access to electricity (ACE), aquaculture production (AQP), and life expectancy at birth (LEB). This method allows for the exploration of effects among a set of observed variables. The study utilizes data from 107 countries for 2022, sourced from the World Bank database.

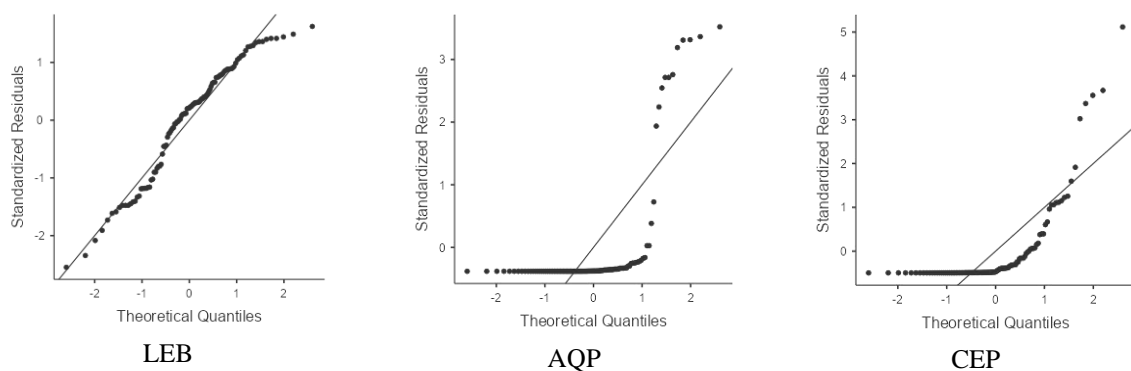
RESULT

This section presents descriptive statistics, correlation analysis, and path analysis findings highlighting key life expectancy determinants.

Table 1 Descriptives

	LEB	AQP	CEP	ACF	ACE
N	107	107	107	107	107
Mean	71.4	1.24e+7	2.70e+8	71.0	87.3
Median	73.0	142008	1.28e+7	87.8	98.6
Standard deviation	7.24	3.25e+7	5.45e+8	32.4	20.9
Minimum	53.0	0.00	15.7	0.100	11.7
Maximum	83.2	1.27e+8	3.06e+9	100	100

Table 1 shows that the average life expectancy (LEB) across these countries is 71.4 years, with a standard deviation of 7.24, indicating moderate variability. The range of life expectancy is between 53.0 and 83.2 years. Aquaculture production (AQP) has a mean of 12.4 million metric tons, but the data is highly variable, with a large standard deviation of 32.5 million metric tons. The median value is significantly lower at 142,008 metric tons, suggesting a skewed distribution where a few countries have very high production while many produce much less. Cereal production (CEP) shows an even higher variation, with a mean of 270 million metric tons and a standard deviation of 545 million metric tons. The median value is much lower at 12.8 million metric tons, indicating that a few countries dominate cereal production while others produce significantly less. Access to clean fuels for cooking (ACF) averages 71.0 percent, but there is substantial variability across countries, as shown by a standard deviation of 32.4 percent. The lowest reported value is just 0.1 percent, while some countries report 100 percent access. Similarly, access to electricity (ACE) has a higher average of 87.3 percent, with a standard deviation of 20.9 percent, showing considerable variation in access to electricity, with values ranging from 11.7 percent to full coverage (100 percent).



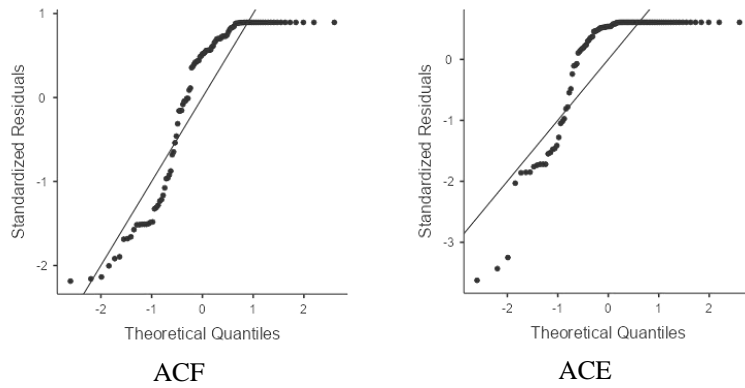


Figure 1 Q-Q plot

Figure 1 shows the Q-Q (quantile-quantile) plot, which assesses whether a variable's distribution follows a normal distribution. For aquaculture and cereal production, it is likely that their Q-Q plots would show significant deviations from the 45-degree line, indicating non-normal distributions. Conversely, life expectancy shows a closer fit to a normal distribution but still could exhibit some deviations.

Table 2 Correlation Matrix

		CEP	ACF	ACE	AQP	LEB
CEP	Pearson's r	—				
	df	—				
	p-value	—				
ACF	Pearson's r	0.089	—			
	df	105	—			
	p-value	0.36	—			
ACE	Pearson's r	0.132	0.85	—		
	df	105	105	—		
	p-value	0.177	<.001	—		
AQP	Pearson's r	0.898	0.092	0.146	—	
	df	105	105	105	—	
	p-value	<.001	0.347	0.134	—	
LEB	Pearson's r	0.097	0.839	0.823	0.109	—
	df	105	105	105	105	—
	p-value	0.318	<.001	<.001	0.262	—

Table 2 presents the correlation matrix. The correlation between CEP and LEB is weakly positive ($r = 0.097$), suggesting that cereal production is positively related to life expectancy. However, the association is not strong or statistically significant ($p\text{-value} = 0.318$). Similarly, the correlation between AQP and LEB is low ($r = 0.109$) and not significant ($p\text{-value} = 0.262$), indicating that aquaculture production has a weak and statistically insignificant relationship with life expectancy. In contrast, ACF and LEB show a strong positive correlation ($r = 0.839$), which is statistically significant ($p\text{-value} < 0.001$). This suggests that access to clean fuels substantially and significantly impacts life expectancy, meaning that populations with better access to clean cooking technologies tend to live longer. Likewise, the correlation between ACE and LEB is also strong and positive ($r = 0.823$, $p\text{-value} < 0.001$), indicating that access to electricity is another important factor positively associated with higher life expectancy. The matrix also reveals strong correlations between CEP and AQP ($r = 0.898$) and between ACF and ACE ($r = 0.850$), both of which are statistically significant. These relationships suggest that cereal and aquaculture production are closely linked, and that access to clean fuels is highly related to access to electricity across the studied countries.

Table 3 model fit indicators

NFI	RFI	IFI	TLI	CFI	CMIN/DF	RMSEA
0.940	0.880	0.950	0.900	0.950	5.499	0.206

Table 4 presents the model fit indicators used to evaluate the performance of the path analysis model. The NFI value is 0.940, indicating that the model fits the data well, as values above 0.90 suggest an acceptable fit. Similarly, the RFI is 0.880, which is close to the threshold for a good fit (typically 0.90), suggesting that the model reasonably explains the data in comparison to a baseline model. The IFI and CFI values are both 0.950, indicating a very good fit, as values closer to 1.0 represent stronger model performance. The TLI score is 0.900, which meets the standard threshold for an acceptable model fit, reinforcing that the model adequately explains the relationships between the variables. The CMIN/DF ratio is 5.499, which is higher than the commonly accepted range of 2 to 3 for a good fit, indicating that the model may be somewhat overfitting or has areas that could be improved for better alignment with the data. Finally, the RMSEA value is 0.206, which exceeds the threshold of 0.08 for a reasonable fit, indicating that there may be some degree of error in the model's approximation of the population data.

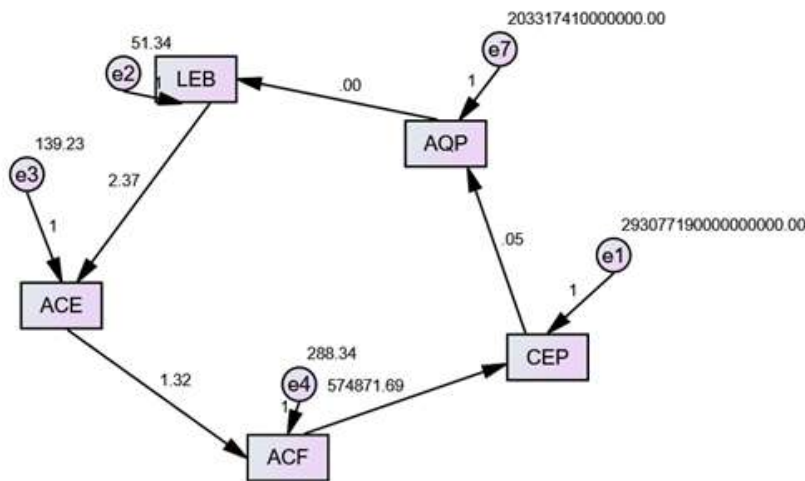


Figure 2 Path analysis

Figure 2 exhibits the cyclical relationship among various factors affecting life expectancy, beginning with access to electricity (ACE). When access to electricity increases, it positively impacts access to clean fuels and technologies for cooking (ACF). This indicates that better electricity access facilitates the use of clean cooking methods, which in turn can improve living conditions and health outcomes. As ACF improves, it positively influences cereal production (CEP), suggesting that access to clean cooking fuels may aid in agricultural productivity, likely through more efficient food processing or preparation methods. Enhanced cereal production then positively affects aquaculture production (AQP), indicating that improved food production capabilities can support the expansion of other forms of food supply, such as fish farming. As aquaculture production increases, it contributes positively to life expectancy at birth (LEB). This is likely because a more diversified and abundant food supply improves nutrition and overall health, leading to longer lifespans. Higher life expectancy then feeds back into the cycle by positively affecting access to electricity. This could imply that societies with longer lifespans are more likely to develop and sustain robust infrastructure, including reliable electricity access. This closed-loop relationship creates a reinforcing cycle where improvements in one factor lead to cascading positive effects on the others, ultimately contributing to an ongoing enhancement in life expectancy and overall well-being.

DISCUSSION

The findings of the study provide valuable insights into the complex interplay between various determinants of life expectancy. The strong positive correlations between life expectancy (LEB) and both access to clean fuels (ACF) ($r = 0.839$, $p < 0.001$) and access to electricity (ACE) ($r = 0.823$, $p < 0.001$) underscore the importance of these resources in enhancing life expectancy. Previous research identified socioeconomic factors, such as education and income, as critical predictors of life expectancy (Geruso, 2012; Singh & Lee, 2020). While this study does not directly analyze education or income, access to clean fuels and electricity can be seen as indicators of a country's socioeconomic development. Therefore, the study's findings support the notion that improving basic infrastructure and energy access is a key strategy for promoting longevity, as it facilitates better living conditions, healthcare, and food production. This aligns with research suggesting that broader access to resources like clean energy significantly contributes to improved life expectancy (Wirayuda & Chan, 2021).

The results reveal weaker and statistically insignificant correlations between cereal production (CEP) and life expectancy ($r = 0.097$, $p = 0.318$) as well as aquaculture production (AQP) and life expectancy ($r = 0.109$, $p = 0.262$). These findings suggest that while food production is vital for overall well-being, its direct impact on life expectancy may be less pronounced than other factors, such as access to clean fuels and electricity. This observation is partially consistent with the previous study that recognizes the importance of food security but highlights that other determinants, including healthcare access and environmental quality, play a more significant role in influencing longevity (Nakajima & Yano, 2020; Rahman & Alam, 2022).

However, the study identifies a strong correlation between cereal production and aquaculture production ($r = 0.898$), suggesting a linkage between different forms of food production. This interplay might reflect the interconnected nature of agricultural systems, where improvements in one area can support advancements in others, indirectly contributing to overall health and life expectancy. This notion is consistent with literature emphasizing the need for integrated food production and energy access approaches to enhance life outcomes (Monsef & Mehrjardi, 2015).

The path analysis model further elaborates on these relationships, highlighting a cyclical pattern wherein access to electricity positively affects access to clean fuels (coefficient = 1.32), positively influencing cereal production, leading to increased aquaculture production and improving life expectancy. The model suggests that life expectancy itself feeds back into improving access to electricity, creating a reinforcing cycle. This cyclical relationship aligns with the study that emphasizes the interdependence of socioeconomic factors, infrastructure, and health outcomes (Halicioglu, 2011; Haan & Prowse, 2012). The findings underscore the critical role of access to clean energy and sustainable food production practices in promoting longer, healthier lives. This mirrors previous research indicating that access to essential resources like clean cooking technologies and electricity significantly impacts life expectancy (Wirayuda & Chan, 2021).

POLICY IMPLICATION

The results reveal critical policy implications for governments and stakeholders. The strong positive correlations between life expectancy and access to clean fuels and electricity emphasize the need for policies to expand energy infrastructure. Governments, particularly in developing countries, should prioritize investment in sustainable energy systems to ensure widespread access to clean cooking technologies and electricity. This addresses immediate health benefits by reducing indoor air pollution and sets the foundation for long-term improvements in public health and economic development. Further, the cyclical nature of the path analysis indicates that improving access to essential resources like clean energy can reinforce other areas, such as food production and overall well-being. Policymakers should adopt an integrated approach that connects energy access with agricultural productivity initiatives. For instance, programs that facilitate the use of clean fuels and electricity in rural agricultural settings can enhance cereal and aquaculture production, contributing to better food security and nutrition. This, in turn, supports higher life expectancy, creating a virtuous cycle of development.

FUTURE RESEARCH

The analysis points to several avenues for future research. First, while this study highlights the significant impact of access to clean fuels and electricity on life expectancy, future research should explore the nuances of this relationship across different regions and income levels. This can help identify context-specific interventions that are most effective in promoting longevity. The cyclical pattern observed in the path analysis warrants further exploration. Researchers should examine how interventions targeting one component, like improving electricity access, propagate through the cycle to impact other variables. Moreover, incorporating additional variables such as healthcare access, education, income inequality, and environmental quality could provide a more comprehensive model of life expectancy determinants.

CONCLUSION

The introduction highlighted life expectancy as a critical measure of a society's well-being. It emphasized the need to explore its multifactorial nature, including socioeconomic conditions, environmental factors, healthcare systems, and lifestyle choices. Recognizing the complexity of these determinants, the study sought to build upon existing literature by focusing on specific factors that can be addressed through policy. Methodologically, the research utilized path analysis to model the causal relationships among these variables. Data for the analysis were drawn from the World Bank database for 107 countries in 2022. Key variables in the analysis included life expectancy at birth (LEB), aquaculture production (AQP), cereal production (CEP), access to clean fuels (ACF), and access to electricity (ACE). The results revealed that access to clean fuels and electricity positively correlates with life expectancy, highlighting their critical role in improving health outcomes. In contrast, cereal and aquaculture production showed weaker correlations, suggesting that while food production is vital, its direct impact on life expectancy is less pronounced. Additionally, the cyclical nature identified in the path analysis, wherein improved life expectancy feeds back into enhancing access to electricity, underscores the interconnectedness of these variables. This research suggests that governments and policymakers should prioritize expanding access to clean energy and electricity as a holistic approach to improving public health and well-being. Investing in energy infrastructure can create a reinforcing cycle that addresses immediate health benefits, fostering environments where populations can achieve longer, healthier lives.

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REFERENCE

- Ahmad, N., Raid, M., Alzyadat, J., & Alhawal, H. (2023). Impact of urbanization and income inequality on life expectancy of male and female in South Asian countries: A moderating role of health expenditures. *Humanities and Social Sciences Communications*, 10(1). <https://doi.org/10.1057/s41599-023-02005-1>
- Anstey, K. J., Andrews, G., & Luszcz, M. A. (2002). Psychosocial factors, gender and late-life mortality. *Ageing International*, 27(2), 73–89. <https://doi.org/10.1007/s12126-002-1003-3>
- Azies, H., & Dewi, V. M. (2021). Factors Affecting Life Expectancy in East Java: Predictions with A Bayesian Model Averaging Approach. *Jurnal Perencanaan Pembangunan: The Indonesian Journal of Development Planning*, 5(2), 283–295. <https://doi.org/10.36574/jpp.v5i2.214>
- Bondari, K. (1990). Path Analysis in Agricultural Research. *Conference on Applied Statistics in Agriculture*. <https://doi.org/10.4148/2475-7772.1439>
- Carnes, B. A., & Olshansky, S. J. (2007). A Realist View of Aging, Mortality, and Future Longevity. *Population and Development Review*, 33(2), 367–381. <https://doi.org/10.1111/j.1728-4457.2007.00172.x>

- Crepaz, M. M. L., & Crepaz, N. (2004). Is Equality Good Medicine? Determinants of Life Expectancy in Industrialized Democracies. *Journal of Public Policy*, 24(3), 275–298. <https://doi.org/10.1017/s0143814x04000133>
- Dobis, E. A., Stephens, H. M., Skidmore, M., & Goetz, S. J. (2019). Explaining the spatial variation in American life expectancy. *Social Science & Medicine*, 246, 112759. <https://doi.org/10.1016/j.socscimed.2019.112759>
- Duque, A. M., Santos, A. D., Goes, M. A. O., Peixoto, M. V., Araújo, K. C. G. M., Nunes, M. A. P., & Lima, S. V. M. A. (2018). Analysis of the relationship between life expectancy and social determinants in a north-eastern region of Brazil, 2010-2017. *Geospatial Health*, 13(2). <https://doi.org/10.4081/gh.2018.702>
- Duffy, J. R., Watt, J., & Duffy, R. J. (1981). Path Analysis. *Journal of Speech, Language, and Hearing Research*, 24(4), 474–490. <https://doi.org/10.1044/jshr.2404.474>
- Etikan, I. (2018). Life Expectancy; Factors, Malaria the Most Common Disease Affecting Pregnant Women in Africa [Nigeria and Cameroon]. *Global Journal of Reproductive Medicine*, 5(1). <https://doi.org/10.19080/gjorm.2018.05.555651>
- Galor, O., & Moav, O. (2007). The Neolithic Origins of Contemporary Variations in Life Expectancy. *SSRN Electronic Journal*. <https://doi.org/10.2139/ssrn.1012650>
- Geruso, M. (2012). Black-White Disparities in Life Expectancy: How Much Can the Standard SES Variables Explain? *Demography*, 49(2), 553–574. <https://doi.org/10.1007/s13524-011-0089-1>
- Gutin, I., & Hummer, R. A. (2021). Social Inequality and the Future of U.S. Life Expectancy. *Annual Review of Sociology*, 47(1), 501–520. <https://doi.org/10.1146/annurev-soc-072320-100249>
- Haan, P., & Prowse, V. L. (2012). Longevity, Life-Cycle Behavior, and Pension Reform. *SSRN Electronic Journal*. <https://doi.org/10.2139/ssrn.1816374>
- Halicioglu, F. (2011). Modeling life expectancy in Turkey. *Economic Modelling*, 28(5), 2075–2082. <https://doi.org/10.1016/j.econmod.2011.05.002>
- Karma, E. (2023). Socioeconomic Determinants of Life Expectancy: Southeastern European Countries. *European Journal of Sustainable Development*, 12(1), 25. <https://doi.org/10.14207/ejsd.2023.v12n1p25>
- Kouame Amos, B., & Smirnov, I. V. (2023). Determinants Factors in Predicting Life Expectancy Using Machine Learning. *Advanced Engineering Research*, 22(4), 373–383. <https://doi.org/10.23947/2687-1653-2022-22-4-373-383>
- Kris-Etherton, P. M., Furie, K. L., Lear, S. A., Lobelo, F., De Ferranti, S. D., Després, J.-P., Braun, L., Sacks, F. M., Morris, P. B., & Petersen, K. S. (2021). Special Considerations for Healthy Lifestyle Promotion Across the Life Span in Clinical Settings: A Science Advisory From the American Heart Association. *Circulation*, 144(24). <https://doi.org/10.1161/cir.0000000000001014>
- Lund, R. E., & Scharen, A. L. (1992). An Example of Path Analysis Applied to Classification Variables. *Conference on Applied Statistics in Agriculture*. <https://doi.org/10.4148/2475-7772.1407>
- Marchetti, C. (1997). Longevity and life expectancy. *Technological Forecasting & Social Change*, 55(3), 281–299. [https://doi.org/10.1016/s0040-1625\(97\)00024-3](https://doi.org/10.1016/s0040-1625(97)00024-3)
- Monsef, A., & Mehrjardi, A. S. (2015). Determinants of Life Expectancy: A Panel Data Approach. *Asian Economic and Financial Review*, 5(11), 1251–1257. <https://doi.org/10.18488/journal.aefr/2015.5.11/102.11.1251.1257>
- Nakajima, H., & Yano, K. (2020). Examination of Factors Affecting Life Expectancy by Prefecture Based on the Criteria of the Organisation for Economic Co-operation and Development. *Nihon Eiseigaku Zasshi. Japanese Journal of Hygiene*, 75(0), n/a. <https://doi.org/10.1265/jjh.20001>
- Novoselova, E. N. (2016). Main factors of megalopolis citizens' life expectancy (example of Moscow). *Moscow State University Bulletin. Series 18. Sociology and Political Science*, 22(2), 176–200. <https://doi.org/10.24290/1029-3736-2016-22-2-176-200>
- Qamaruz-Zaman, N., Abdul-Sukor, N. S., Yaacof, N., & Ab-Rahman, S. A. (2019). The influence of moisture content on the production of odor from food waste using path analysis. *Environmental Science and Pollution Research International*, 26(13), 13658–13663. <https://doi.org/10.1007/s11356-019-04808-9>
- Rahman, M. M., & Alam, K. (2022). Life expectancy in the ANZUS-BENELUX countries: The role of renewable energy, environmental pollution, economic growth, and good governance. *Renewable Energy*, 190, 251–260. <https://doi.org/10.1016/j.renene.2022.03.135>

- Segbefia, E., Sampene, A. K., Adotey, P., Lamptey, C., Amoako, T., & Dai, B. (2023). Renewable energy, technological innovation, carbon emission, and life expectancy nexus: experience from the NAFTA economies. *Environmental Science and Pollution Research*, 30(50), 108959–108978. <https://doi.org/10.1007/s11356-023-29983-8>
- Seifarth, J. E., Milne, K. J., & MCGowan, C. L. (2012). Sex and Life Expectancy. *Gender Medicine*, 9(6), 390–401. <https://doi.org/10.1016/j.genm.2012.10.001>
- Singh, G., & Lee, H. (2020). Marked Disparities in Life Expectancy by Education, Poverty Level, Occupation, and Housing Tenure in the United States, 1997-2014. *International Journal of MCH and AIDS*, 10(1), 7–18. <https://doi.org/10.21106/ijma.402>
- Strulik, H., & Vollmer, S. (2013). Long-run trends of human aging and longevity. *Journal of Population Economics*, 26(4), 1303–1323. <https://doi.org/10.1007/s00148-012-0459-z>
- Sygit, M., Karkowski, T., Krakowiak, J., & Sygit, K. (2018). Lifestyle versus a Person's Life Span. *Central European Journal of Sport Sciences and Medicine*, 22(2), 51–60. <https://doi.org/10.18276/cej.2018.2-06>
- Tafran, K., Tumin, M., & Osman, A. F. (2020). Poverty, Income, and Unemployment as Determinants of Life Expectancy: Empirical Evidence from Panel Data of Thirteen Malaysian States. *Iranian Journal of Public Health*, 49(2). <https://doi.org/10.18502/ijph.v49i2.3092>
- Wickstrøm, K. A., Cheraghi-Madsen, M., & Klyver, K. (2020). Age effect on entry to entrepreneurship: embedded in life expectancy. *Small Business Economics*, 58(1), 57–76. <https://doi.org/10.1007/s11187-020-00398-w>
- Wirayuda, A. A. B., & Chan, M. F. (2021). A Systematic Review of Sociodemographic, Macroeconomic, and Health Resources Factors on Life Expectancy. *Asia Pacific Journal of Public Health*, 33(4), 335–356. <https://doi.org/10.1177/1010539520983671>
- Wolfe, L. M. (1980). Strategies of Path Analysis. *American Educational Research Journal*, 17(2), 183–209. <https://doi.org/10.3102/00028312017002183>
- Yorgason, J. B., Howard, M., Jones, K., Bronson, H., Hill, M. S., Draper, T. W., Nielson, M., & Babcock, K. (2018). Biological, Psychological, and Social Predictors of Longevity Among Utah Centenarians. *The International Journal of Aging and Human Development*, 87(3), 225–243. <https://doi.org/10.1177/0091415018757211>
- Younus, S., Khursheed, A., & Afzal, N. (2022). Impact of Economic Progress, Energy Consumption and Carbon Dioxide Emissions on Life Expectancy: Evidence from Asia and Africa. *Journal of Social Sciences Review*, 2(3), 225–235. <https://doi.org/10.54183/jssr.v2i3.115>
- Zanetti, O., Solerte, S. B., & Cantoni, F. (2009). Life Expectancy in Alzheimer's Disease (AD). *Archives of Gerontology and Geriatrics*, 49, 237–243. <https://doi.org/10.1016/j.archger.2009.09.035>
- Zasimova, L., Sheluntcova, M., Kolosnitsyna, M., Kossova, T., Makshanchikov, K., & Biryukova, A. (2023). Unhealthy lifestyles and regional differences in life expectancy in Russia. *Public Health*, 225, 66–71. <https://doi.org/10.1016/j.puhe.2023.09.028>
- Zha, X., Gao, X., Yu, C., Wang, W., & Tian, Y. (2019). Quantitatively evaluate the environmental impact factors of the life expectancy in Tibet, China. *Environmental Geochemistry and Health*, 41(3), 1507–1520. <https://doi.org/10.1007/s10653-018-0211-z>

THE DETERMINANTS OF COAL RENT

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ABSTRACT

This study employs Bayesian linear regression analysis to examine the economic factors influencing coal rents in Thailand from 1972 to 2020, utilizing data from the World Bank. This study examines the correlations between coal rents and independent variables: oil rents, net primary income, and net financial flows. The analysis demonstrates a statistically significant positive association between oil rents and coal rents, suggesting the reliance of coal rents on oil market fluctuations. In contrast, net financial flows demonstrate a negative albeit statistically insignificant correlation with coal rents, indicating possible detrimental impacts from international financial aid or loans on coal revenue. Net primary income exhibits a minimal beneficial effect on coal rents. Policymakers should focus on optimizing resource management and economic stability in Thailand, highlighting the necessity for diversification in the energy sector, meticulous monitoring of foreign financial flows, and implementing sustainable environmental practices.

Keywords: coal rents, oil rents, net primary income, net financial flows, Bayesian linear regression, Thailand

INTRODUCTION

Coal is a complex and heterogeneous fossil fuel composed of various organic and inorganic constituents formed from plant matter over millions of years (Hodsmann, 1942). Over the past few centuries, it has significantly provided energy for global development (Xu et al., 2017). The importance of coal stems from its diverse applications and economic value. It is crucial in steel production as coking coal, with no economically viable alternative currently available (Sahoo et al., 2019). Coal is also widely used in power generation, with coal-fired thermal plants producing ash that can be repurposed as a geo-material (Trivedi & Sud, 2002). Additionally, coal particles are essential in producing coalbed methane, an important energy resource (Wei et al., 2022). However, coal utilization comes with significant environmental and health concerns. It contributes to greenhouse gas emissions and climate change (Xu et al., 2017), and its exploitation, utilization, and waste disposal can lead to water, soil, and air pollution (Chen et al., 2014). Coal usage has been linked to endemic health issues such as fluorosis, arsenism, and selenosis in some regions of China (Chen et al., 2014). Despite these challenges, research focuses on improving coal utilization efficiency and developing cleaner technologies. The ecological paradigm of coal utilization and integrated energy systems are emerging trends aimed at moving the coal industry towards greener and cleaner production (Xu et al., 2017).

Despite efforts to transition to cleaner energy sources, coal plays a significant role in Thailand's energy mix. According to Pattanapongchai and Limmeechokchai (2014), coal is projected to dominate electricity generation in Thailand due to its low price, with its share expected to increase from 0.72% in 2006 to 14.97% in 2030 (Pattanapongchai & Limmeechokchai, 2011). However, this heavy dependence on coal presents contradictions with Thailand's environmental goals that aims to reduce CO₂ emissions from the power sector by 15.27% in 2026 (Pattanapongchai & Limmeechokchai, 2014). Thus, Thailand faces challenges in balancing its economic needs with environmental concerns. To address this, Thailand is exploring various strategies, including carbon capture and storage for future coal-based power plants (Pattanapongchai & Limmeechokchai, 2011), and increasing investments in renewable energy

sources such as wind, solar, and biomass (Chingulpitak & Wongwises, 2013; Silalertruksa & Gheewala, 2009).

Regarding coal rents, they refer to the economic profits generated from coal extraction, calculated as the difference between the value of coal production at world prices and total production costs. Studying the determinants of coal rents is crucial as it affects resource efficiency utilization. Previous research indicated that several factors can impact the level of coal rent, e.g., economic policy uncertainty and economic growth (Zhou et al., 2023).

Various methodologies have been employed to study the determinants of coal rents, e.g., the Fourier ARDL (FARDL) methodology was utilized to examine the impacts of economic policy uncertainty, geopolitical risk, and economic growth on coal rents in China from 1990 to 2021 by Zhou et al. (2023) to uncover the long-term relationships between these factors and coal rents. Another approach conducted by Ganhane and Stage (2024) involved using company-level data and the residual value method, as prescribed by SEEA-Energy, to estimate resource rents for Mozambican coal mining. Additionally, some studies employed econometric procedures to determine rent capture by various stakeholders in the coal industry. For instance, one study used statistical tests to measure rents earned by firms involved in the extraction, transportation, and consumption of low-sulfur Wyoming coal (Atkinson & Kerkvliet, 1986).

This research arises from coal's critical role in Thailand's energy mix. Understanding the economic determinants of coal rents—particularly the factors affecting resource use efficiency and revenue generation—becomes crucial for formulating strategies that balance economic development with environmental sustainability. The contribution of this research is to focus on the economic determinants of coal rents in Thailand, filling a gap in literature specific to this geographical and economic context. The results offer practical insights for policymakers aiming to optimize resource management while maintaining economic stability. The remaining works are organized as follows: the literature review will provide a theoretical and empirical foundation for the study, focusing on key frameworks such as resource rent theory, the Hotelling rule, and the resource curse hypothesis. The methodology section will describe the Bayesian linear regression model used to analyze the economic determinants of coal rents. The results section will present the regression analysis findings and discuss these results and policy recommendations.

LITERATURE REVIEWS

This literature review summarizes key theoretical frameworks and empirical findings that underpin the understanding of coal rents, focusing on resource rent theory, the Hotelling rule, the resource curse hypothesis, and the impact of various variables on coal rent.

Resource rent theory is a concept in economics that addresses the surplus value generated from natural resources beyond the costs of their extraction and production. This theory has evolved significantly and applied to various sectors, particularly natural resource management and exploitation. The classical understanding of resource rent, rooted in Ricardian theory, focuses on the excess earnings of a factor over the amount necessary to induce its work (Formby, 1972). However, modern interpretations have expanded this concept to include Paretian rent, which considers the excess earnings over opportunity costs in specific resource uses (Formby, 1972). In the context of natural resources, particularly in emerging economies, resource rents produce and attract multiple domestic and external competitive stakeholders, often leading to conflicts over resource appropriation (Omeje, 2016). The application of resource rent theory varies across different industries and contexts. For instance, in the fishing industry, the common-property nature of fishery resources often results in a lack of economic rent, leading to issues of overexploitation and depletion (Gordon, 1954). In contrast, the oil industry's resource rent is based on the potentially conflicting interaction between ownership of oil reserves and oil leases within the global oil industry, resulting in differential oil rents (Bina, 1992). Ricardo (1927) posits that not all resource deposits are created equal; some are naturally more productive than others, resulting in higher returns. When applied to coal, resource rents are significantly influenced by geological availability, extraction costs, and market prices. The richness of coal seams, the depth at which coal is located, and the ease of access all play critical roles in determining the profitability of coal mining operations. Consequently, these factors lead to variations in coal rents, highlighting the importance of geographical and technical considerations in resource extraction. Resource rent theory provides a framework for understanding the economic dynamics of natural resource exploitation. However, the theory's

application and implications can vary significantly depending on the specific resource, industry, and socio-economic context.

Another pivotal framework in understanding coal rents is the Hotelling rule. The Hotelling rule, introduced by Harold Hotelling in 1931, is a fundamental principle in non-renewable resource economics (Cunha & Missemmer, 2020; Cunha, 2020). It states that the net price of a mineral resource must rise at the rate of discount or interest (Adelman & Watkins, 1995). In other words, the expected equilibrium rate increase in net resource price must equal the expected interest rate under certain conditions (Gaudet, 1989). Despite its theoretical importance, empirical tests have consistently failed to validate the Hotelling rule (Cunha & Missemmer, 2020; Cunha, 2020). Recent research suggests that geological constraints may play a more significant role in explaining the behavior of mineral resources than previously thought (Cunha, 2020). Additionally, the rule has been modified to account for uncertainty in rates of return, introducing the concept of risk aversion and covariance between the marginal utility of consumption and the difference between the rate of net price increase and the rate of interest (Gaudet, 1989). However, this rule suggests that resource owners will strive to balance current extraction against future value to maximize the present value of resource rents. In the context of coal, the Hotelling rule has been instrumental in analyzing the temporal aspects of resource rents. This implies that as coal becomes scarcer, its price should naturally increase, assuming that extraction costs remain constant or do not decline at the same rate. This principle helps predict price movements in resource markets and informs strategic decision-making for resource owners. While the Hotelling rule remains a cornerstone of non-renewable resource economics, its practical applicability has been questioned. The failure of the rule in empirical studies has led to various modifications and alternative approaches, such as considering geological constraints and risk factors (Cunha & Missemmer, 2020; Cunha, 2020; Gaudet, 1989).

The resource curse hypothesis offers a socio-economic lens through which to examine the impacts of abundant natural resources on economic development. The resource curse hypothesis posits that countries rich in natural resources often experience slower economic growth and development than countries with fewer natural resources (Sachs & Warner, 1995). Resource-rich regions do not always convert their natural wealth into broad-based economic prosperity. Mismanagement of resource rents and the volatility of commodity markets can lead to economic instability and underdevelopment. Studies by Auty (2001) and Ross (2001) highlight how rent-seeking behavior, corruption, and a lack of economic diversification contribute to the resource curse. This paradoxical phenomenon has been extensively studied across various contexts and countries. Several studies have found evidence supporting the resource curse hypothesis. For instance, research on OECD countries demonstrated that natural resource rent adversely affects economic performance by reducing economic growth (Zhang et al., 2023). Similarly, a study on ASEAN countries validated the financial resource curse hypothesis, showing that natural resources negatively impact financial development (Tang et al., 2022). However, contradictory findings exist. Research on BRIC economies found resources to be a blessing rather than a curse (Hussain et al., 2020). Additionally, a global study using the Fourier augmented ARDL approach invalidated the resource curse hypothesis, showing that natural resources promote economic growth (Syed et al., 2023). The resource curse hypothesis remains a complex and debated topic. While some studies support its existence, others refute it or find mixed results. Institutional quality, geopolitical risk, and specific economic contexts play crucial roles in determining whether natural resources become a curse or a blessing for a country's economic development. The hypothesis has been extended to various domains, including financial development, environmental degradation, and tourism-led growth, highlighting its broad implications for economic policy and development strategies (Boulanour & Essid, 2023; Deng et al., 2014).

Empirical research provides insights into the specific economic determinants of coal rents. Multiple studies have substantiated the relationship between oil rents and coal rents. A notable work by Singh et al. (2019) demonstrated how fluctuations in oil prices and market dynamics impact the broader energy sector, including coal rents, highlighting the dependency on oil market conditions. A comprehensive study by Usman and Hammar (2021) explored the relationship between financial development, technological innovation, and coal rents in Asia-Pacific economies. They emphasized the need for robust policy frameworks to balance resource management and economic growth. Research by Razzaq et al. (2021) delved into the effects of international financial flows on natural resource rents. They found that while financial globalization and foreign aid have complex effects, strategic management of these flows

can mitigate adverse impacts on coal rents. Research by Shafiullah et al. (2021) examined how economic policy uncertainty and financial development affect renewable energy consumption and indirectly influence coal rents. They concluded that financial development and foreign direct investments in the energy sector significantly impact coal rent dynamics. A study by Sun et al. (2022) focused on the spatiotemporal evolution of economic development under carbon emission constraints in China. The research used the Data Envelopment Analysis (DEA) model to measure performance and found that regions with better technological adoption in energy sectors, including coal, showed improved economic efficiency and reduced emissions. Shang et al. (2022) investigated the impact of technological innovation and ecological governance on renewable and non-renewable energy demand in the U.S. Their findings underscored the importance of technological advancements and ecological policies in shaping the future of coal rents. The economic factors affecting coal rents have been the subject of ongoing research. A study by Liu et al. (2022) analyzed the role of carbon trading schemes in China's transition to low-carbon coal power. They found that carbon trading significantly promotes upgrades in coal power plants, with technological advancements in carbon capture utilization and storage (CCUS) playing a crucial role in achieving stable low-carbon strategies. Technological innovation and environmental policies also play a crucial role in shaping the dynamics of coal rents. Advances in extraction technologies, cleaner coal technologies, and carbon capture and storage (CCS) methods can significantly alter the cost structures and environmental impacts of coal production (Citaristi, 2022). Geopolitical risks and economic policy uncertainties have also been identified as significant factors influencing coal and energy rents. Research by Yu and Guo (2023) explored how these uncertainties, alongside technological innovations, drive green energy transitions in China, emphasizing the complex interplay between economic policies and resource rents.

It was also found that economic policy uncertainty has been found to significantly hamper coal rents, according to a study focusing on China from 1990 to 2021. However, the same study found that geopolitical risk does not significantly influence coal rents. While economic growth emerges as a positive determinant, bolstering coal rent in the long run (Zhou et al., 2023). Contradictory findings emerge when examining the relationship between coal rents and environmental factors. While one study suggests that coal rents have a relative relationship with carbon emissions in upper-middle-income economies (Li et al., 2023), another study indicates that coal rents exhibit a statistically significant negative relationship with emissions, particularly in higher quantiles (Shahbaz et al., 2024). The process of digitalization also plays a role in determining coal rents. Research on European Union countries from 2011 to 2019 demonstrates that digital businesses cause a rise in overall natural rents, including coal rents (Ha et al., 2022). However, the same study notes that digitalization in the business sector tends to lower coal rents, suggesting a nuanced relationship between digital transformation and coal rents. Recently, the residual value method, as described in Ganhane and Stage (2024), is used to estimate resource rents for coal mining. This method considers the difference between the value of coal production and the extraction costs. The paper reveals that the World Bank's estimates of coal rents for Mozambique are significantly higher than those calculated using company-level data, primarily due to an underestimation of extraction costs (Ganhane & Stage, 2024). This suggests that an accurate assessment of extraction costs is crucial in determining coal rents.

METHODOLOGY

Bayesian linear regression is a statistical approach that combines linear regression with Bayesian inference, viewing model parameters as random variables rather than fixed values (Permai & Tanty, 2018). This method incorporates prior knowledge about parameters and updates these beliefs with observed data to produce a posterior distribution of parameter estimates. Bayesian linear regression has diverse applications across various fields. Spectroscopy is used for developing calibration models, demonstrating improved prediction results compared to partial least squares (Chen & Martin, 2008). The method is also applied in biostatistics as an alternative data analysis technique, incorporating fuzzy logic and bootstrapping (Ahmad et al., 2022). A multivariate recursive Bayesian linear regression approach is employed in mechanical engineering for output-only recursive identification of time-varying systems (Ma et al., 2020). The approach is particularly useful when traditional linear regression assumptions are unmet (Permai & Tanty, 2018). Bayesian linear regression offers several advantages over frequentist methods. It provides a framework for variable selection, potentially improving predictive performance by identifying the most informative variables (Chen & Martin, 2008). The method can be adapted for robust regression with heavy-tailed noise using Student-t error

models (Zhang et al., 2017). Additionally, Bayesian linear regression can be extended to handle multiple response variables and time-varying dynamics (Ma et al., 2020). Bayesian linear regression offers a flexible and powerful tool for modeling linear relationships in various scientific and engineering applications, often outperforming traditional frequentist approaches regarding prediction accuracy and model interpretability (Permai & Tanty, 2018; Zhang et al., 2017).

This research employs Bayesian linear regression model to investigate Thailand's economic determinants of coal rents. The regression model is specified as follows:

$$CRN_t = \beta_0 + \beta_1 ORN_t + \beta_2 NPI_t + \beta_3 NFF_t + \epsilon_t$$

where CRN_t is the coal rents as a percentage of GDP at the time t . ORN_t is the oil rent as a percentage of GDP at the time t . NPI_t is the net primary income (current US\$) at the time t . NFF_t is the net financial flows from the International Bank for Reconstruction and Development (IBRD) (current US\$) at the time t . β_0 is the intercept of the model. $\beta_1, \beta_2, \beta_3$ are the coefficients for the independent variables. ϵ_t is the error term at time t . Data from Thailand between 1972 and 2020 downloaded from the World Bank database are utilized in this study.

RESULT AND DISCUSSION

This section presents the findings from our analysis of the economic determinants of coal rents in Thailand.

Table 1 descriptive statistics

	CRN	ORN	NPI	NFF
mean	0.051	0.517	-6.407E+09	-7.357E+06
std	0.050	0.545	7.649E+09	3.474E+08
min	0.001	0.000	-2.687E+10	-1.615E+09
25percent	0.018	0.140	-8.949E+09	-5.550E+07
50percent	0.035	0.290	-3.272E+09	-1.697E+06
75percent	0.062	0.675	-5.618E+08	1.055E+08
max	0.247	1.927	0.000E+00	8.905E+08

The descriptive statistics for the variables in Table 1 summarize the data's central tendency, dispersion, and range from 1972 to 2020. For Coal Rents (CRN), the mean value is 0.051 percent of GDP, indicating that, on average, coal rents contribute a small fraction. The standard deviation is 0.050, showing considerable variation over the years. The minimum value recorded is 0.001 percent, and the maximum is 0.247 percent. The quartile values (25 percent, 50 percent, and 75 percent) are 0.018 percent, 0.035 percent, and 0.062 percent, respectively, indicating a skewed distribution towards lower values. Oil Rents (ORN) have a mean of 0.517 percent of GDP and a higher standard deviation of 0.545 percent, suggesting substantial fluctuation. The minimum and maximum values range from 0.000 percent to 1.927 percent, reflecting significant periods of varying oil rent contributions. The quartiles (0.140 percent, 0.290 percent, and 0.675 percent) show a distribution that tends towards lower values but with high spikes. The mean value is negative for Net Primary Income (NPI) (-6.407E+09 US\$), indicating a net outflow over the period. The standard deviation is 7.649E+09 US\$, showing large fluctuations. The minimum and maximum values are -2.687E+10 US\$ and 0 US\$, respectively. The quartiles (-8.949E+09 US\$, -3.272E+09 US\$, and -5.618E+08 US\$) indicate that most values are negative, with significant variations. Net Financial Flows (NFF) also show a negative mean value of -7.357E+06 US\$, with a high standard deviation of 3.474E+08 US\$, indicating wide variability. The values range from -1.615E+09 US\$ to 8.905E+08 US\$. The quartile values (-5.550E+07 US\$, -1.697E+06 US\$, and 1.055E+08 US\$) indicate that while most values are negative, there are substantial positive inflows in some years.

Table 2 correlation matrix

	CRN	ORN	NPI	NFF
CRN	1.000	0.751	- 0.189	- 0.227
ORN	0.751	1.000	- 0.621	- 0.057
NPI	- 0.189	- 0.621	1.000	- 0.059
NFF	- 0.227	- 0.057	- 0.059	1.000

The correlation matrix in Table 2 reveals the relationships between Coal Rents (CRN), Oil Rents (ORN), Net Primary Income (NPI), and Net Financial Flows (NFF). A strong positive correlation exists between CRN and ORN (0.751), suggesting that higher oil rents are associated with higher coal rents. This implies a linkage between the revenues from these two natural resources, potentially due to overlapping economic factors or resource management practices. CRN has a weak negative correlation with NPI (-0.189) and NFF (-0.227). Although these correlations are not strong, they suggest that as net primary income and net financial flows decrease, coal rents might slightly increase, indicating that lower-income from abroad and financial inflows could coincide with higher dependency on coal rents. ORN also shows a moderate negative correlation with NPI (-0.621), indicating that higher oil rents are associated with lower net primary income. This could reflect an inverse relationship where the country might export more oil, resulting in lower net primary income from abroad. Lastly, ORN has a weak negative correlation with NFF (-0.057), suggesting little to no relationship between oil rents and net financial flows. The weak correlations of NPI (-0.059) and NFF (0.059) with other variables suggest minimal direct impacts on coal and oil rents among these financial variables.

Table 3 Model Summary

Statistic	Value
MCMC iterations	12500
Burn-in	2500
MCMC sample size	10000
Number of obs	49
Acceptance rate	0.6386
Efficiency (min)	0.001282
Efficiency (avg)	0.03166
Efficiency (max)	0.1108
Log marginal-likelihood	-34.3355

Table 3 provides the performance information of the MCMC sampling in the Bayesian linear regression model. 12,500 iterations were run, with 2,500 iterations discarded during the burn-in period, leaving 10,000 samples for analysis. The acceptance rate of 63.86% indicates efficient exploration of the parameter space. Efficiency values ranged from 0.001282 to 0.1108, with an average of 0.03166, reflecting moderate performance in generating independent samples. The log marginal likelihood is -34.3355, offering a quantitative measure of model fit. Thus, it was confirmed that the MCMC process was effective and reliable for estimating the model parameters.

Table 4 Bayesian linear regression model estimations

Parameter	Mean	Std. dev.	MCSE	Median	95% Cred. Interval	
					Lower	Upper
ORN	0.0936	4.14E-12	9.9E-13	0.0936	0.0936	0.0936
NPI	2.85E-12	5.01E-12	2.4E-12	2.86E-12	1.82E-12	3.8E-12
NFF	1.32E-12	5.71E-12	1.6E-12	1.15E-12	1.02E-12	1.02E-12
_cons	0.021199	4.13E-12	1E-12	0.021199	0.021199	0.021199
sigma2	0.001263	0.000269	8.1E-06	0.001229	0.000839	0.001897

Table 4 summarizes the Bayesian regression results for the effects of ORN, NPI, and NFF on CRN. The coefficient for ORN is 0.0936, indicating a significant positive impact on CRN, with a narrow, credible interval confirming its importance. In contrast, NPI and NFF show negligible effects, as their coefficients are near zero and statistically insignificant. The intercept is 0.021199, suggesting that CRN is expected to be around 0.021% of GDP when other variables are constant. The residual variance (σ^2) is 0.001263, indicating limited unexplained variation. Therefore, ORN significantly influences CRN, while NPI and NFF have minimal impact.

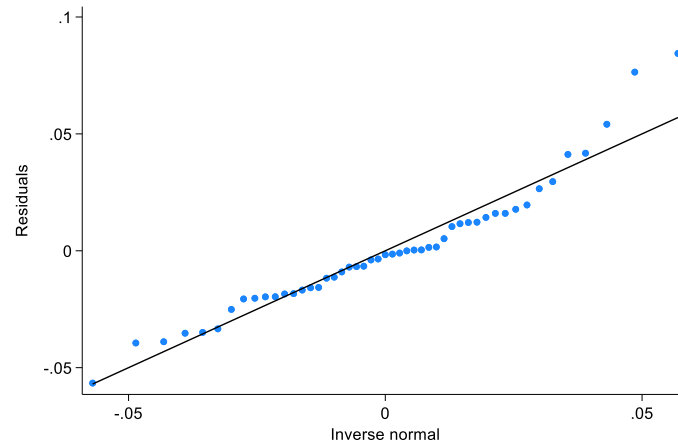


Figure 1 Residuals Plot

Figure 1 displays the residual plot for the Bayesian regression model of CRN. The plot shows that the residuals are evenly scattered around zero, indicating no apparent pattern or systematic bias. This suggests that the model fits the data well, with no significant violations of linearity or constant variance assumptions.

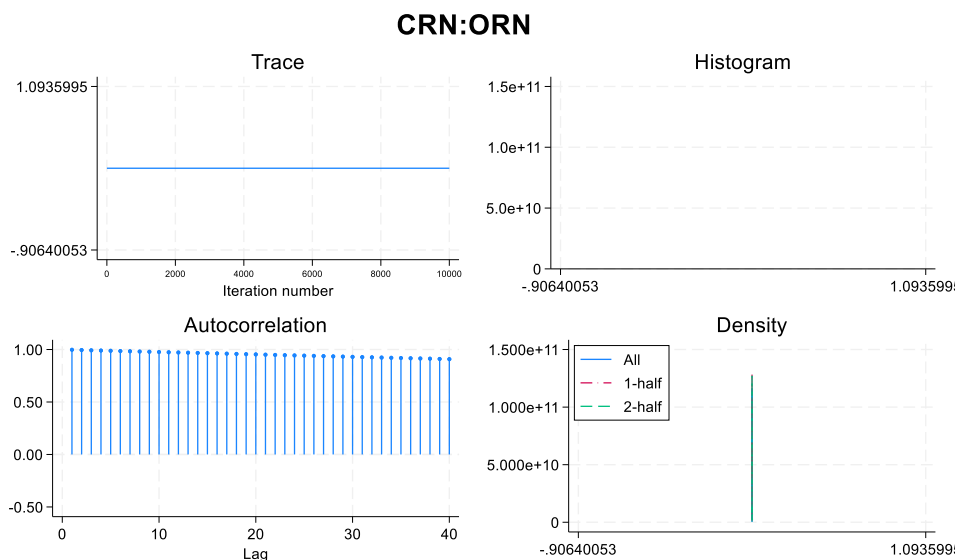


Figure 2 MCMC convergence CRN:ORN

Figure 2 confirms that the Markov Chain Monte Carlo (MCMC) sampling has converged well, as evidenced by the stable trace and smooth density plots. This implies that the model's estimation of the relationship between coal rents and oil rents (CRN) is robust and reliable, reinforcing the finding that oil rents are a significant predictor of coal rents in Thailand.

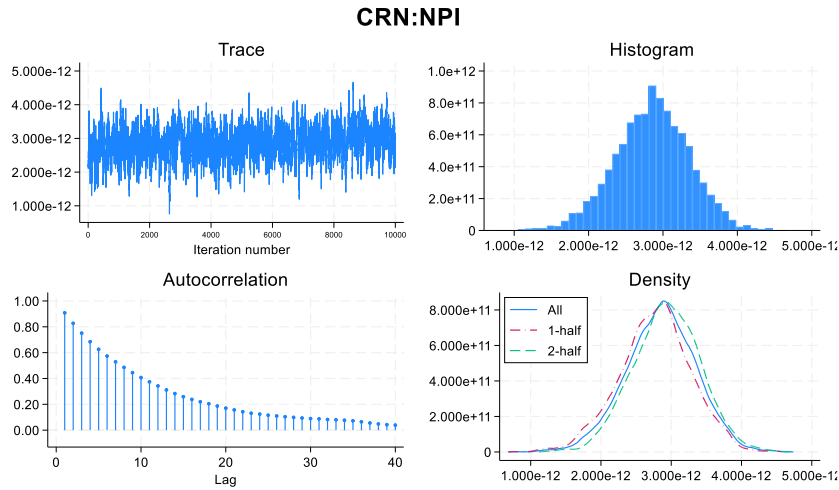


Figure 3 MCMC convergence CRN:NPI

Figure 3 indicates that the MCMC sampling for CRN has successfully converged, providing reliable estimates for the relationship between coal rents and net primary income. Although the impact of net primary income on coal rents is marginal, the MCMC results validate the robustness of the estimation process

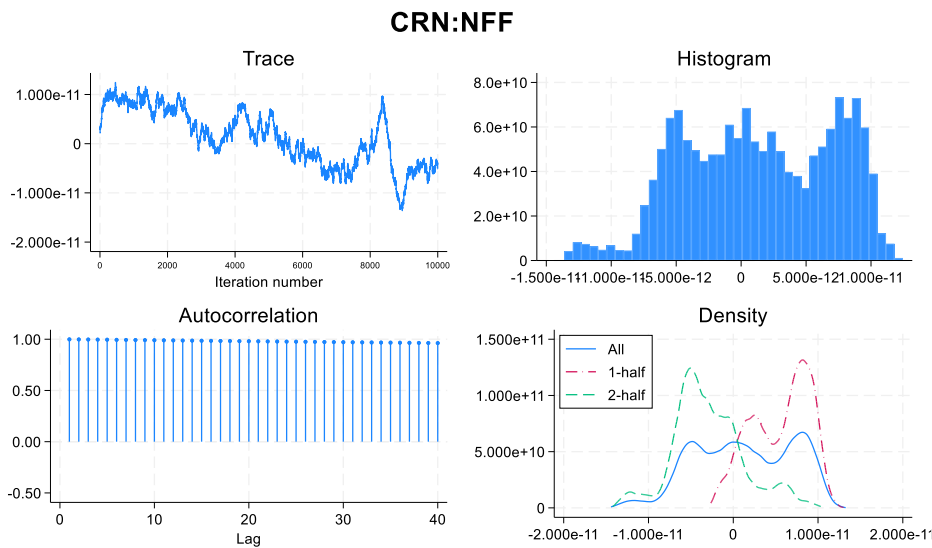


Figure 4 MCMC convergence CRN:NFF

Figure 4 confirms that the MCMC sampling for CRN has successfully converged, indicating reliable parameter estimates for the relationship between coal rents and net financial flows. Although net financial flows had a negative but statistically insignificant impact on coal rents

The results highlight the significant role that broader energy market dynamics, particularly oil rents, play in influencing coal rents with an increase in oil rents associated with an increase in coal rents. This interdependence suggests that Thailand's coal sector does not operate in isolation but is closely tied to the performance of the oil market. This outcome is consistent with the result from Singh et al. (2019), who discovered that oil price fluctuations directly influence the broader energy sector, including coal rents. Also, resource rent theory helps contextualize this finding. The theory posits that natural resource rents, including those from coal, depend on factors such as extraction costs, market prices, and the availability of the resource (Formby, 1972), which reflect the connection between some resources. While oil rents emerged as a strong predictor of coal rents, the impact of net primary income (NPI) and net financial flows (NFF) was less straightforward. This aligns with the resource curse hypothesis, which

suggests that mismanagement of resource rents and external financial dependencies can undermine economic stability (Sachs & Warner, 1995).

POLICY IMPLEMENTATION

Based on the findings, multiple policy solutions can be formulated to enhance resource management and economic stability. The notable positive correlation between oil and coal rents indicates a strong connection between the success of the coal sector and the oil market. Consequently, governments should emphasize the energy industry's diversification to mitigate reliance on oil market volatility. This may encompass investing in renewable energy sources and improving energy efficiency initiatives. Considering the unfavorable, but not statistically significant, correlation between net financial flows and coal rents, it is essential to oversee international financial aid and loans meticulously. Policymakers must guarantee that financial inflows are allocated to sustainable development initiatives that do not unintentionally undermine the earnings of the coal sector. The slight positive influence of net primary income on coal rentals underscores the necessity for policies that promote foreign investments and international commerce, which can indirectly aid the coal industry in lowering costs and enhancing revenue or rent.

FUTURE RESEARCH

The results of this study present opportunities for subsequent investigation. Future research should measure the impact of advancements in mining technology and carbon capture and storage (CCS) techniques on cost structures and coal rent. Furthermore, integrating additional factors into the model, such as carbon emissions, could provide policymakers with insights into the trade-offs between economic advantages and environmental consequences. Broadening the geographical scope to encompass comparative studies across many nations may provide significant insights. Comprehending how various national contexts affect the determinants of coal rents will improve the generalizability of the findings and facilitate the formulation of universally applicable resource management policies.

CONCLUSION

Coal is essential to Thailand's energy composition, underscoring its significance in electricity production and economic advancement, notwithstanding the related environmental and health issues. Comprehending the determinants of coal rents is crucial for enhancing resource management and promoting sustainable economic development. This study examines the economic factors influencing coal rents in Thailand from 1972 to 2020. This study utilizes Bayesian linear regression analysis to examine the effects of oil rents, net primary income, and net financial flows on coal rent. Data were obtained from the World Bank website. The findings reveal a statistically significant positive link between oil rents and coal rents, suggesting that variations in the oil market directly affect coal income. This discovery highlights the interconnection of energy resources and indicates that economic strategies regarding coal cannot be separated from advancements in the oil sector. Conversely, net primary income demonstrated a positive albeit minimal effect on coal rents, whereas net financial flows indicated a negative correlation that lacked statistical significance. The findings indicate that international financial aid may fail to deliver the anticipated help for the coal sector, thus hindering income creation. Consequently, diversity within Thailand's energy sector is essential to limit risks linked to oil price volatility, promote investments in renewable energy sources, and attract foreign investments to bolster the coal industry.

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REFERENCES

- Adelman, M. A., & Watkins, G. C. (1995). Reserve asset values and the Hotelling valuation principle: Further evidence. *Southern Economic Journal*, 61(3), 664. <https://doi.org/10.2307/1060989>
- Auty, R. M. (2001). *Resource abundance and economic development*. Oxford University Press.

- Bina, C. (1992). The laws of economic rent and property: The American oil industry. *The American Journal of Economics and Sociology*, 51(2), 187–204. <https://doi.org/10.1111/j.1536-7150.1992.tb03347.x>
- Boulanouar, Z., & Essid, L. (2023). Extending the resource curse hypothesis to sustainability: Unveiling the environmental impacts of natural resources rents and subsidies in fossil fuel-rich MENA countries. *Resources Policy*, 87, 104330. <https://doi.org/10.1016/j.resourpol.2023.104330>
- Chen, J., Wu, B., Kang, Y., Sun, R., Liu, G., Wu, D., & Zhou, C. (2014). Coal utilization in China: Environmental impacts and human health. *Environmental Geochemistry and Health*, 36(4), 735–753. <https://doi.org/10.1007/s10653-013-9592-1>
- Chen, T., & Martin, E. (2008). Bayesian linear regression and variable selection for spectroscopic calibration. *Analytica Chimica Acta*, 631(1), 13–21. <https://doi.org/10.1016/j.aca.2008.10.014>
- Cunha, R. F., & Missemer, A. (2020). The Hotelling rule in non-renewable resource economics: A reassessment. *Canadian Journal of Economics/Revue Canadienne d'économique*, 53(2), 800–820. <https://doi.org/10.1111/caje.12444>
- Deng, T., Cao, J., & Ma, M. (2014). Tourism resource development and long-term economic growth: A resource curse hypothesis approach. *Tourism Economics*, 20(5), 923–938. <https://doi.org/10.5367/te.2013.0325>
- Ferreira Da Cunha, R. P. (2020). Non-renewable resource economics and geological constraints: A review. *OEconomia*, 10(3), 507–519. <https://doi.org/10.4000/oeconomia.9697>
- Formby, J. P. (1972). A clarification of rent theory. *Southern Economic Journal*, 38(3), 315. <https://doi.org/10.2307/1056899>
- Gaudet, G. (1989). A note on uncertainty and the Hotelling rule. *Journal of Environmental Economics and Management*, 16(1), 80–86. [https://doi.org/10.1016/0095-0696\(89\)90047-8](https://doi.org/10.1016/0095-0696(89)90047-8)
- Gordon, H. S. (1954). The economic theory of a common-property resource: The fishery. *Journal of Political Economy*, 62(2), 124–142. <https://doi.org/10.1086/257497>
- Ha, L. T., Van Hop, H., Khanh, H. D., Hanh, P. T. N., Phuong, L. L., & Hang, N. T. T. (2022). Moderating role of knowledge-sharing on the nexus of digital business and natural resources. *Journal of the Knowledge Economy*, 15(1), 408–434. <https://doi.org/10.1007/s13132-022-01091-x>
- Hodsman, H. J. (1942). Analysis and testing of coal. *Nature*, 150(3814), 667–668. <https://doi.org/10.1038/150667a0>
- Hussain, M., Ye, Z., Usman, M., Mir, G. M., Usman, A., & Rizvi, S. K. A. (2020). Re-investigation of the resource curse hypothesis: The role of political institutions and energy prices in BRIC countries. *Resources Policy*, 69, 101833. <https://doi.org/10.1016/j.resourpol.2020.101833>
- Li, J., Li, Y., Zheng, Z., & Si, X. (2023). Environment and natural resources degradation under COVID-19 crises: Recovery post pandemic. *Resources Policy*, 83, 103652. <https://doi.org/10.1016/j.resourpol.2023.103652>
- Ma, Z.-S., Li, L., & Ding, Q. (2020). Multivariate recursive Bayesian linear regression and its applications to output-only identification of time-varying mechanical systems. *Journal of Vibration and Control*, 27(11–12), 1395–1406. <https://doi.org/10.1177/1077546320941703>
- Omeje, K. (2016). Natural resource rent and stakeholder politics in Africa: Towards a new conceptualization. *Commonwealth & Comparative Politics*, 54(1), 92–114. <https://doi.org/10.1080/14662043.2015.1126887>
- Pattanapongchai, A., & Limmeechokchai, B. (2011). CO2 mitigation model of future power plants with integrated carbon capture and storage in Thailand. *International Journal of Sustainable Energy*, 30(sup2), S155–S174. <https://doi.org/10.1080/1478646x.2010.539690>
- Pattanapongchai, A., & Limmeechokchai, B. (2014). Alternative energy technologies for long-term power generation expansion planning and CO2 mitigation in Thailand. *Energy Sources, Part B: Economics, Planning, and Policy*, 10(3), 271–280. <https://doi.org/10.1080/15567249.2010.545795>
- Permai, S. D., & Tanty, H. (2018). Linear regression model using bayesian approach for energy performance of residential building. *Procedia Computer Science*, 135, 671–677. <https://doi.org/10.1016/j.procs.2018.08.219>
- Sachs, J. D., & Warner, A. (1995). Natural resource abundance and economic growth. *National Bureau of Economic Research, Cambridge, MA*. <https://doi.org/10.3386/w5398>

- Sahoo, M., Bhowmick, T., Mishra, V., Pal, S., Sharma, M., & Chakravarty, S. (2019). Significance of coal quality on thermoplastic properties: A case study. *International Journal of Coal Preparation and Utilization*, 42(4), 1015–1032. <https://doi.org/10.1080/19392699.2019.1678470>
- Shafiullah, M., Miah, M. D., Alam, M. S., & Atif, M. (2021). Does economic policy uncertainty affect renewable energy consumption? *Renewable Energy*, 179, 1500–1521.
- Shang, Y., Han, D., Gozgor, G., Mahalik, M. K., & Sahoo, B. K. (2022). The impact of climate policy uncertainty on renewable and non-renewable energy demand in the United States. *Renewable Energy*, 197, 654–667.
- Singh, H. V., Bocca, R., Gomez, P., Dahlke, S., & Bazilian, M. (2019). The energy transitions index: An analytic framework for understanding the evolving global energy system. *Energy Strategy Reviews*, 26, 1–10.
- Syed, Q. R., Durani, F., Kisswani, K. M., Alola, A. A., Siddiqui, A., & Anwar, A. (2023). Testing natural resource curse hypothesis amidst geopolitical risk: Global evidence using novel Fourier augmented ARDL approach. *Resources Policy*, 88, 104317. <https://doi.org/10.1016/j.resourpol.2023.104317>
- Trivedi, A., & Sud, V. K. (2002). Grain characteristics and engineering properties of coal ash. *Granular Matter*, 4(3), 93–101. <https://doi.org/10.1007/s10035-002-0114-6>
- Wan Ahmad, W. M. A. B., Aleng, N. A., Mohd Noor, N. F., Nizam Akbar, N. A., & Mohamad Ghazali, F. M. (2022). Fuzzy regression model with Bayesian approach and its application to public health data. *Bulletin of Applied Mathematics and Mathematics Education*, 2(1), 19–32. <https://doi.org/10.12928/bamme.v2i1.3953>
- Wei, Y., Wang, A., Pan, Z., Cui, B., Cui, M., & Yao, Z. (2022). Influence of coal mechanical properties and water content on generation characteristics of coal particles. *International Journal of Oil, Gas, and Coal Technology*, 29(4), 359. <https://doi.org/10.1504/IJOGCT.2022.121265>
- Xu, J., Dai, J., Xie, H., & Lv, C. (2017). Coal utilization eco-paradigm towards an integrated energy system. *Energy Policy*, 109, 370–381. <https://doi.org/10.1016/j.enpol.2017.06.029>
- Zhang, H., Wang, P., Dong, Q., & Wang, P. (2017). Sparse Bayesian linear regression using generalized normal priors. *International Journal of Wavelets, Multiresolution and Information Processing*, 15(03), 1750021. <https://doi.org/10.1142/s0219691317500217>
- Zhou, B., Huang, Y., Gao, K., & Luo, C. (2023). How geopolitical risk and economic policy uncertainty impact coal, natural gas, and oil rent? Evidence from China. *Resources Policy*, 88, 104393. <https://doi.org/10.1016/j.resourpol.2023.104393>

FACTORS INFLUENCING HOUSEHOLD CONSUMPTION

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ABSTRACT

Given the pivotal role of consumption in driving economic activity, understanding the factors influencing consumer spending is crucial for formulating effective economic policies. This study aimed to identify and analyze the factors significantly impacting household consumption expenditure. Employing Bayesian linear regression analysis, the study incorporated several key economic indicators as independent variables, including general government final consumption expenditure, taxes on income, profits and capital gains, GDP per capita, inflation, old age population, population growth, and tax revenue. Key findings revealed significant positive relationships between household consumption, government expenditure, GDP per capita, and taxes on income, suggesting that economic growth and favorable tax conditions enhance consumer spending. Conversely, tax revenue, inflation, and population growth did not exhibit significant effects. Based on these findings, the study recommends that policymakers focus on stimulating economic growth and reevaluating tax policies to boost household consumption.

Keywords: Consumption Expenditure, taxes on income, profits and capital gains, GDP per capita, inflation, population ages, population growth, tax revenue

INTRODUCTION

Household consumption expenditure refers to the total money households spend on goods and services for personal use. It is a key economic indicator, reflecting living standards, purchasing power, and economic well-being, and it plays a significant role in driving economic growth, influencing GDP, and guiding policy decisions (Su et al., 2023; Tang & Chen, 2023). Consumption patterns, sensitive to economic shocks and policy changes, reveal socio-economic trends and disparities, e.g., job loss (Gupta & Kishore, 2021), financial inclusion (Nsiah et al., 2024), climate change, and public health (Swarnata et al., 2024).

Understanding household consumption expenditure and its relationships with various factors is vital for developing effective policies, addressing socio-economic challenges, and improving overall quality of life. Household consumption expenditure provides valuable insights into economic well-being, living standards, and consumer behavior. It helps policymakers and researchers identify factors influencing household spending patterns and make informed decisions. For instance, Coruh et al. (2024) demonstrate how analyzing household transportation expenditure can lead to effective policies for reducing CO₂ emissions, such as incentivizing electric vehicles and expanding public transportation (Coruh et al., 2024). The relationship between household expenditure and different variables reveals crucial socio-economic trends. Nguyen-Phung and Le (2024) show how urbanization affects health expenditure, with urbanization reducing inpatient and outpatient expenses but increasing self-treatment costs. This information can guide healthcare policy decisions in rapidly urbanizing areas (Nguyen-Phung & Le, 2024). Understanding these relationships can help address critical issues like energy poverty and climate change. Yang et al. (2024) highlights how temperature variations impact electricity consumption in urban areas, which is essential for sustainable energy planning (Yang et al., 2024). Similarly, Lu et al. (2024) identifies key drivers of energy poverty, such as household income

and education, which can inform targeted interventions to reduce energy poverty (Lu et al., 2024). Moreover, analyzing household expenditure patterns can reveal potential negative impacts of certain consumption habits.

Several studies have investigated the determinants of household consumption expenditure using various methodologies. For instance, Mugosa et al. (2024) and Swarnata et al. (2024) focus on the crowding-out effect of tobacco expenditure on other household commodities using a three-stage least squares approach with instrumental variables. Nguyen-Phung and Le (2024) explore the impact of urbanization on health expenditure using a two-stage least squares regression with instrumental variables (Nguyen-Phung & Le, 2024). Nguyen-Phung and Le (2024) show that energy poverty negatively affects health expenditure using a double-hurdle model (Nguyen-Phung & Le, 2024). These studies provide insights into complex household spending behaviors across different contexts.

Although several works identify the determinants of household consumption expenditure, there is a gap in comprehending the specific impacts of these macroeconomic factors on household consumption in different contexts, especially in developing countries like Thailand. This research aims to fill this gap by analyzing how these economic indicators interact with household consumption in Thailand. This research is conducted to understand the determinants of household consumption expenditure. By analyzing factors that significantly impact consumption, such as government expenditure, taxes on income, GDP per capita, inflation, population growth, and tax revenue, this study aims to inform effective economic policy-making. The remaining sections of this research are organized as follows. Section 2 explores the concepts related to this research. Section 3 outlines the research methodology. Finally, the results of the analysis and discussions will be presented.

LITERATURE REVIEWS

In examining the determinants of household consumption expenditure, various economic theories and empirical studies provide a comprehensive framework for understanding the dynamics of consumer behavior. This literature review explores key concepts, models, and findings from various sources to elucidate the factors influencing household spending.

Keynesian Consumption Theory

Keynesian consumption theory, proposed by John Maynard Keynes in his seminal work "The General Theory of Employment, Interest, and Money," is foundational in understanding household consumption expenditure. This theory posits that household consumption is primarily driven by disposable income, the portion of an individual's income that remains after taxes (Keynes, 1936; Menz, 2010; Xinbang et al., 2021). This theory emphasizes the importance of the relative income hypothesis and debt finance in understanding household consumption behavior (Kim et al., 2014). The theory suggests that consumption directly and indirectly impacts economic growth, with a multiplier effect on the economy. According to Keynes, households allocate their disposable income between consumption and saving, a concept encapsulated in the consumption function $C = a + bY_d$, where C represents total consumption, a denotes autonomous consumption (the level of consumption that occurs even when disposable income is zero), b is the marginal propensity to consume (MPC), and Y_d signifies disposable income. Autonomous consumption, a , is the baseline level of consumption that households maintain regardless of their current income levels. This reflects essential spending on necessities such as food, housing, and clothing. Even if a household's income drops to zero, it will still engage in some level of consumption, often financed through savings or borrowing. This component of the consumption function highlights the critical nature of certain expenditures that are deemed necessary for survival and basic well-being. The marginal propensity to consume, b , represents the fraction of additional income that households spend on consumption. For instance, if b equals 0.8, it indicates that for every additional dollar of disposable income, households will spend 80 cents and save the remaining 20 cents. The value of b lies between 0 and 1, and it captures the responsiveness of consumption to changes in income. Keynes argued that the MPC is crucial in understanding the dynamics of aggregate demand within an economy. Higher MPC values suggest that income increases lead to significant consumption rises, which can stimulate economic growth.

Empirical evidence supports the Keynesian consumption theory, demonstrating the strong relationship between disposable income and consumption expenditure. Studies have shown that periods of economic growth, characterized by rising incomes, increase household consumption, fueling further economic expansion. Conversely, during economic downturns, declines in disposable income result in reduced consumption, highlighting the critical role of income in driving consumption patterns (Blanchard &

Sheen, 2013). While Keynesian Consumption Theory remains influential, it has evolved and been integrated with other perspectives. New Keynesian models often incorporate consumption habits, although the specific modeling approach can vary (Dennis, 2009). Additionally, some scholars argue for the need to consider factors such as fundamental uncertainty (Charusheela, 2008) and Islamic perspectives on consumption (Rahim & Bahari, 2018) to comprehensively understand consumption behavior in different contexts.

Permanent Income Hypothesis

The Permanent Income Hypothesis (PIH), proposed by Milton Friedman, posits that an individual's consumption is determined by their lifetime resources or permanent income rather than their current income (Friedman, 1957; Khalid, 1994). According to this theory, people base their consumption decisions on long-term income expectations, smoothing their spending over time. The PIH suggests that consumption will only respond to changes in permanent income, not transitory fluctuations (Juan & Seater, 1997; Khalid, 1994). The PIH highlights the role of expectations and future income prospects in shaping consumption behavior. This theory diverges from the Keynesian view by emphasizing that consumption is more stable and less responsive to short-term fluctuations in income. The core idea of the PIH is that households aim to smooth consumption over time, adjusting their spending to reflect their expectations of future income rather than reacting sharply to temporary changes in their financial situation.

Under the PIH, income can be divided into two components, i.e. permanent and transitory. Permanent income is the stable, expected income households anticipate over a long horizon based on factors like education, career prospects, and accumulated wealth. Transitory income, on the other hand, consists of temporary and unpredictable fluctuations, such as bonuses, lottery winnings, or temporary unemployment. According to Friedman, households largely disregard these transitory changes when making consumption decisions, preferring to maintain a consistent standard of living that aligns with their permanent income. This smoothing behavior helps to explain why consumption patterns are often more stable than income levels. For instance, if a household anticipates higher future income, it may be more inclined to borrow and spend more in the present, expecting to repay debts when the anticipated income materializes. Conversely, if future income is expected to decline, households may save more and reduce current consumption to prepare for leaner times ahead.

The PIH also highlights the importance of financial markets and credit availability in facilitating consumption smoothing. Access to credit allows households to borrow against future income, enabling them to maintain consumption even during periods of income volatility. Similarly, savings mechanisms allow households to accumulate wealth during high-income periods and draw down on these savings when income falls. These financial instruments play a critical role in enabling households to adhere to the consumption patterns predicted by the PIH (Campbell & Mankiw, 1989). Critics of the PIH argue that it may oversimplify the complexities of consumer behavior. For example, not all households have equal access to credit, and liquidity constraints can prevent some from smoothing consumption effectively. Psychological factors and behavioral biases can also lead households to deviate from the rational expectations the PIH assumes. Despite these critiques, the PIH is a powerful tool for understanding the relationship between income and consumption, particularly in long-term financial planning and policy analysis (Carroll, 1997).

However, empirical evidence has shown mixed results regarding PIH. While data from industrial countries tend to support the PIH, developing countries' data often do not, though this discrepancy may be due to differences in data quality rather than behavioral differences (Juan & Seater, 1997). Some studies have found substantial departures from the PIH, estimating that about 50 percent of income accrues to individuals who consume based on current rather than permanent income (Campbell & Mankiw, 1990). While the PIH remains a dominant theoretical framework, its empirical support is not unequivocal. Some evidence suggests that rich households save a higher proportion of their permanent income than poor households, contradicting a basic implication of the theory (Alvarez-Cuadrado & Long, 2011). Additionally, flexible-lag estimates indicate that permanent income may depend largely on recent income receipts, challenging a central assumption of Friedman's original theory (Boughton, 1976). Despite these challenges, the PIH continues to be an important concept in understanding consumption behavior and policy implications.

Life-Cycle Hypothesis

The Life-Cycle Hypothesis (LCH), formulated by Franco Modigliani and Richard Brumberg in the 1950s (Modigliani & Brumberg, 1954), is an influential economic theory that extends the Permanent Income Hypothesis (PIH) concepts. While the PIH focuses on the role of expected long-term income in shaping consumption, the LCH incorporates the entire life span of an individual, providing a more comprehensive framework for understanding consumption and savings behavior. The Life-Cycle Hypothesis (LCH) is a prominent economic theory that explains household saving and consumption behavior over an individual's lifetime. According to this hypothesis, people aim to smooth their consumption over their lifetime by saving during their working years and dissaving in retirement (Chao et al., 2010; Yeager & Dornbusch, 1988).

According to the LCH, individuals plan their consumption and savings over their lifetime to maintain a stable level of consumption despite variations in income at different stages of life. The LCH posits that individuals experience varying income levels throughout their life. During their working years, individuals typically earn higher incomes, while income generally decreases upon retirement. To smooth consumption over these periods of fluctuating income, individuals save a portion of their earnings during their working years and draw down on these savings during retirement. This behavior ensures a stable consumption pattern, aligning with the individual's goal of lifetime utility maximization. The theory outlines three distinct phases of financial behavior over the life cycle: the borrowing, saving, and dissaving phases. In the early years, often called the borrowing phase, individuals may have low or negative savings due to investments in education, housing, and other long-term assets. As their income grows, they enter the saving phase, accumulating wealth to prepare for retirement. Finally, in the dissaving phase, individuals rely on their accumulated savings and investments to maintain their consumption levels after retirement (Modigliani & Brumberg, 1954).

The LCH also emphasizes the importance of wealth accumulation in determining consumption patterns. Wealth includes financial assets, real estate, and other investments in this context. The hypothesis suggests that individuals accumulate wealth to support consumption during retirement and provide a buffer against unexpected expenses and income fluctuations. This perspective underscores the dual role of savings: facilitating stable consumption over time and providing financial security (Ando & Modigliani, 1963). The LCH also integrates the concept of intertemporal choice, which is the decision-making process involving trade-offs between present and future consumption. According to the theory, individuals make these choices based on their expectations of future income, interest rates, and personal preferences for consumption over time. This aspect of the LCH aligns closely with modern financial planning and retirement strategies, where individuals are encouraged to save and invest wisely to ensure a comfortable retirement.

Empirical studies have supported the LCH by demonstrating that consumption patterns vary with age and are influenced by anticipated changes in income. For example, research has shown that young adults have higher borrowing rates and lower savings, while middle-aged individuals exhibit higher savings rates as they prepare for retirement. Dissaving becomes more prominent upon retirement as individuals draw down their accumulated wealth to finance their consumption (Hurd & Rohwedder, 2008). The LCH has been applied to explain various economic phenomena, including the "Chinese saving puzzle." However, research suggests that while the LCH can account for some of the increase in Chinese household saving rates, it cannot fully explain the surge, particularly during the 1980s (Chao et al., 2010).

While the Life-Cycle Hypothesis has influenced the understanding of saving and consumption patterns, it has limitations. Researchers have proposed modifications and alternative theories to address these shortcomings, such as incorporating behavioral economics concepts (Chao et al., 2010; Shefrin & Thaler, 1988). The LCH has faced criticisms and challenges, particularly regarding its rational behavior and perfect foresight assumptions. Critics argue that not all individuals have the financial literacy or discipline to plan their consumption and savings over their lifetime optimally. Behavioral economics has highlighted that psychological factors, such as procrastination, lack of self-control, and myopia, can lead to deviations from the predicted behavior of the LCH. Additionally, unexpected life events, such as health issues or economic downturns, can disrupt the smooth consumption patterns proposed by the theory (Thaler, 2012). Despite these criticisms, the LCH remains a foundational theory in understanding consumption and savings behavior. It provides valuable insights into how individuals plan for the future, emphasizing the importance of savings and wealth accumulation in achieving long-term financial

stability. Policymakers and financial advisors often draw on the principles of the LCH to design retirement plans, savings programs, and fiscal policies that promote economic well-being across the life cycle (Modigliani, 1986).

The determinants of household consumption expenditure have been extensively studied across various regions and economic contexts. In the euro area, research has focused on the drivers of private consumption during economic expansion phases. Studies have emphasized the role of household income and wealth, finding that GDP per capita significantly impacts household consumption. Private consumption growth has been closely tied to GDP per capita and income levels, reinforcing that economic growth boosts household spending (Dossche et al., 2018). In Asian countries, the determinants of household consumption expenditure have been closely linked to GDP per capita and household incomes. A comprehensive study found that higher GDP per capita significantly boosts household spending, aligning with broader economic theories that emphasize the role of income in driving consumption (Arapova, 2018). Research on India has provided robust evidence of the impact of economic growth and tax policies on household consumption. A detailed analysis found that economic growth, measured by GDP per capita, positively influences household consumption, while tax burdens negatively impact spending. This study used data from the National Sample Survey Organization (NSSO) and highlighted the significant influence of economic growth on consumption patterns (Heshmati et al., 2019). Another study confirmed a close link between GDP and household consumption expenditures across various economic conditions (Koyuncu & Ünal, 2020). The relationship between GDP per capita and healthcare expenditures in OECD countries further illustrates that economic growth drives higher household expenditures. Higher income levels, as indicated by GDP per capita, leading to increased medical and health service consumption, aligning with broader trends observed in household spending (Matthes & Schwartzman, 2021). Further studies found that income level, education, household size, and asset ownership are positively associated with consumption expenditure (Rashid et al., 2024). The cognitive ability of the household head is also positively related to overall consumption and non-durable consumption, with wealth, information, and social networks mediating this relationship (Su et al., 2023). Additionally, age, gender, marital status, and rural/urban location impact household expenditure (Rashid et al., 2024). Additionally, technological advancements and digital financial development have emerged as important determinants. Internet usage significantly increases household consumption, which is more pronounced in urban areas and for certain consumption types (Chunfang et al., 2022). Similarly, digital financial development promotes household consumption upgrading through improved liquidity, payment convenience, investment efficiency, and risk-hedging ability (Hu et al., 2023). It further supported that income and wealth play a significant role in determining household consumption expenditure. Higher income and wealth levels generally increase spending on various goods and services (Nguyen-Phung & Le, 2024; Nsiah et al., 2024). However, the gross national income significantly contributes to household consumption in Africa (Nsiah et al., 2024). Macroeconomic factors such as inflation, unemployment, and government expenditure also shape household consumption (Nsiah et al., 2024; Todorović et al., 2024).

METHODOLOGY

Bayesian linear regression is a statistical approach that combines linear regression with Bayesian inference to estimate model parameters and make predictions. It incorporates prior knowledge about the parameters and updates these beliefs based on observed data, resulting in a posterior distribution of the parameters (Barde, 2024; Liu et al., 2024). In Bayesian linear regression, the model parameters are treated as random variables with prior distributions rather than fixed values. This approach allows for the quantification of uncertainty in parameter estimates and predictions. The method is particularly useful when dealing with limited or noisy data, as it can incorporate prior knowledge to improve estimation and prediction accuracy (Barde, 2024; Nothdurft et al., 2024). The representation of this model in this study is as follows:

$$HCE = \beta_0 + \beta_1 GFE + \beta_2 TAI + \beta_3 GDP + \beta_4 INF + \beta_5 POO + \beta_6 POP + \beta_7 TAX + \delta, \quad (2)$$

where HCE is the household's final consumption expenditure, GFE, TAI, GDP, INF, POO, POP, and TAX denote general government final consumption expenditure, taxes on income, GDP per capita,

inflation, population ages 65 and above, population growth, and tax revenue. This study estimates the model using the yearly data of Thailand from 1972 to 2020 downloaded from World Bank databases.

RESULTS

The following subsections will present the Bayesian linear regression model's estimation results, interpret the descriptive statistics, analyze the correlation matrix, and compare the actual and predicted values of household consumption expenditure.

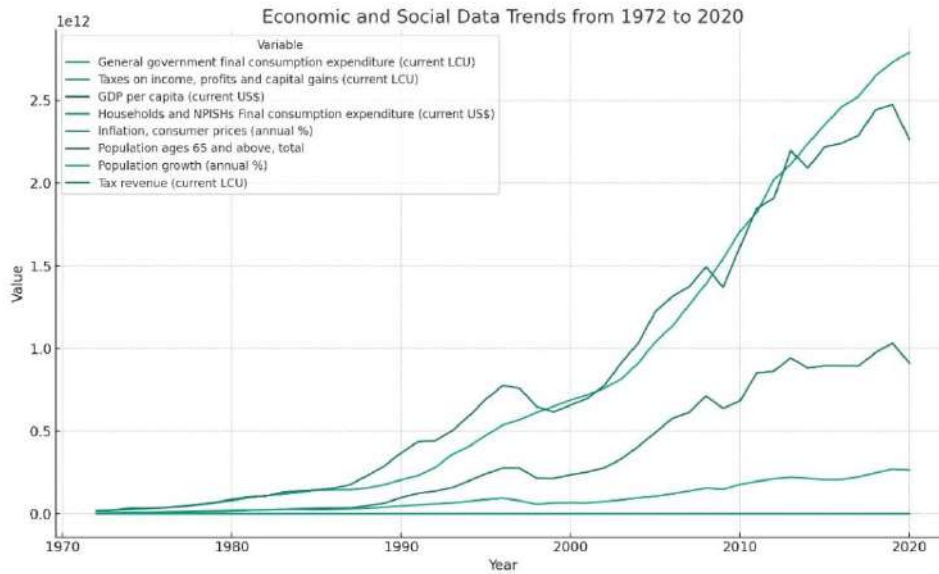


Figure 1 Data series of variables

The data series of variables in Figure 1 highlights the trends and changes over time for several key economic indicators that influence household consumption expenditure. Over the observed period from 1972 to 2020, GFE and TAX exhibit substantial fluctuations, reflecting changes in government spending and tax policies. TAI and GDP also show notable upward trends, indicating economic growth and increasing tax burdens on income. INF varies significantly, pointing to periods of economic instability. POO and POP trends reveal demographic shifts, with POO steadily increasing as the population ages and POP showing variable growth rates.

Table 1 Descriptive statistics

	GFE	TAI	GDP	HCE	INF	POO	POP	TAX
mean	8.490E+1	3.410E+1	2,713.968	9.310E+1	4.630	3.995E+0	1.243	8.610E+1
	1	1		0		6		1
std	8.940E+1	3.510E+1	2,232.650	8.000E+1	4.879	2.243E+0	0.772	8.100E+1
	1	1		0		6		1
min	1.860E+1	2.550E+0	209.375	5.650E+0	- 0.900	1.380E+0	0.250	1.880E+1
	0	9		9		6		0
25 percent	1.300E+1	3.110E+1	798.080	2.610E+1	1.804	2.007E+0	0.526	1.390E+1
	1	0		0		6		1
50 percent	5.370E+1	2.150E+1	2,033.258	6.740E+1	3.809	3.409E+0	1.044	6.480E+1
	1	1		0		6		1
75 percent	1.390E+1	6.380E+1	4,213.007	1.490E+1	5.626	5.594E+0	1.819	1.370E+1
	2	1		1		6		2
max	2.790E+1	1.030E+1	7,814.384	2.710E+1	24.314	9.044E+0	2.844	2.480E+1
	2	2		1		6		2

Table 1 presents the descriptive statistics for the key variables analyzed in the study. The mean values indicate the average levels of each variable over the observed period from 1972 to 2020. The general government's final consumption expenditure (GFE) averages approximately 849 billion, while taxes on

income (TAI) average around 341 billion. GDP per capita (GDP) has a mean value of 2713.968, and household final consumption expenditure (HCE) averages 93.1 billion. The average inflation rate (INF) is 4.63 percent, the population aged 65 and above (POO) averages about 3.995 million, population growth (POP) has a mean rate of 1.243 percent, and tax revenue (TAX) averages 861 billion. The standard deviations highlight the variability in the data. GFE and TAX exhibit the highest variability, with standard deviations of 894 billion and 810 billion, respectively, indicating significant fluctuations. TAI and GDP also show substantial variability, with 351 billion and 2232.650 standard deviations, respectively. The minimum and maximum values provide further insights into the range of the data, with GFE ranging from 18.6 billion to 2.79 trillion and GDP per capita ranging from 209.375 to 7814.384. The quartile values (25 percent, 50 percent, 75 percent) offer additional context for the distribution of each variable, showing the spread and central tendency. For example, the 25th percentile value for GDP per capita is 798.080, the median (50th percentile) is 2033.258, and the 75th percentile is 4213.007.

Table 2 Correlation matrix

	GFE	TAI	GDP	HCE	INF	POO	POP	TAX
GFE	1.000	0.985	0.982	0.987	- 0.509	0.985	- 0.828	0.990
TAI	0.985	1.000	0.983	0.988	- 0.491	0.976	- 0.857	0.995
GD P	0.982	0.983	1.000	0.998	- 0.505	0.974	- 0.867	0.989
HCE	0.987	0.988	0.998	1.000	- 0.507	0.979	- 0.864	0.991
INF	- 0.509	- 0.491	- 0.505	- 0.507	1.000	- 0.556	0.619	- 0.511
PO O	0.985	0.976	0.974	0.979	- 0.556	1.000	- 0.893	0.986
POP	- 0.828	- 0.857	- 0.867	- 0.864	0.619	- 0.893	1.000	- 0.872
TA X	0.990	0.995	0.989	0.991	- 0.511	0.986	- 0.872	1.000

Table 2 presents the correlation matrix for the variables, illustrating the strength and direction of the relationships between these variables. The results show a strong positive correlation between general government final consumption expenditure (GFE) and taxes on income (TAI) at 0.985, indicating that taxes on income also tend to rise as government spending increases. Similarly, GDP per capita (GDP) and household final consumption expenditure (HCE) exhibit strong positive correlations with GFE and TAI, with coefficients of 0.982 and 0.987 for GFE and 0.983 and 0.988 for TAI, respectively. This suggests that higher government spending and income taxes are associated with higher GDP per capita and household consumption expenditure. Inflation (INF) shows a weak negative correlation with most variables, such as GFE (-0.509), TAI (-0.491), GDP (-0.505), and HCE (-0.507), indicating that higher inflation rates are generally associated with lower levels of these economic indicators. The population aged 65 and above (POO) has a strong positive correlation with GFE (0.985) and TAI (0.976), but a negative correlation with inflation (-0.556), suggesting that as the elderly population increases, government spending and income taxes also rise, while inflation tends to decrease. Population growth (POP) displays negative correlations with most economic indicators, particularly with TAI (-0.857) and GDP (-0.867), indicating that higher population growth rates are generally associated with lower levels of income taxes and GDP per capita. Lastly, tax revenue (TAX) shows a strong positive correlation with GFE (0.990), TAI (0.995), GDP (0.989), and HCE (0.991), underscoring the interconnectedness of tax policies, government spending, and economic growth.

Table 3 Posterior Summaries of Coefficients

Coefficient	P(incl)	P(excl)	P(incl data)	P(excl data)	BF _{inclusion}	Mean	SD	95 percent Credible Interval	
								Lower	Upper
Intercept	1.000	0.000	1.000	0.000	1.000	9.315×10 ⁺¹⁰	4.436×10 ⁺⁸	9.229×10 ⁺¹⁰	9.401×10 ⁺¹⁰
GFE	0.500	0.500	0.962	0.038	25.384	0.738	0.281	0.248	1.362
TAI	0.500	0.500	0.978	0.022	44.578	0.034	0.010	0.017	0.055
GDP	0.500	0.500	1.000	1.794×10 ⁻⁷	5.575×10 ⁺⁶	2.060×10 ⁺⁷	3.505×10 ⁺⁶	1.412×10 ⁺⁷	2.762×10 ⁺⁷
INF	0.500	0.500	0.023	0.977	0.023	181585.512	2.289×10 ⁺⁷	0.000	0.000
POO	0.500	0.500	0.046	0.954	0.048	62.775	485.681	0.000	0.000
POP	0.500	0.500	0.586	0.414	1.415	3.137×10 ⁺⁹	2.928×10 ⁺⁹	7.517×10 ⁺⁹	0.000
TAX	0.500	0.500	0.043	0.957	0.045	2.751×10 ⁺⁷	1.677×10 ⁺⁸	0.000	1.091×10 ⁺⁷

The posterior summaries of the coefficients in Table 3 explore the influence of various economic variables on household final consumption expenditure (HCE). The general **government final consumption expenditure (GFE)** shows a positive and significant impact on HCE, with a mean coefficient of 0.738 and a 95 percent credible interval between 0.248 and 1.362, indicating a strong relationship between government spending and household consumption. Similarly, **taxes on income (TAI)** positively impact HCE with a mean coefficient of 0.034 and a narrow credible interval, further supporting the idea that favorable tax policies boost consumption. **GDP per capita (GDP)** also positively influences HCE, reinforcing the relationship between economic growth and household consumption. On the other hand, inflation (INF) and the population aged 65 and above (POO) show weak and statistically insignificant effects on HCE. For instance, the posterior probability of inclusion for INF is extremely low, and the mean coefficient is not meaningful. The same applies to POO, suggesting that aging population dynamics may not play a significant role in household consumption patterns in this context. Population growth (POP) displays a negative but statistically insignificant relationship with HCE, while tax revenue (TAX) also shows a weak influence on household consumption, highlighting that broader tax burdens might not have a substantial impact in this model.

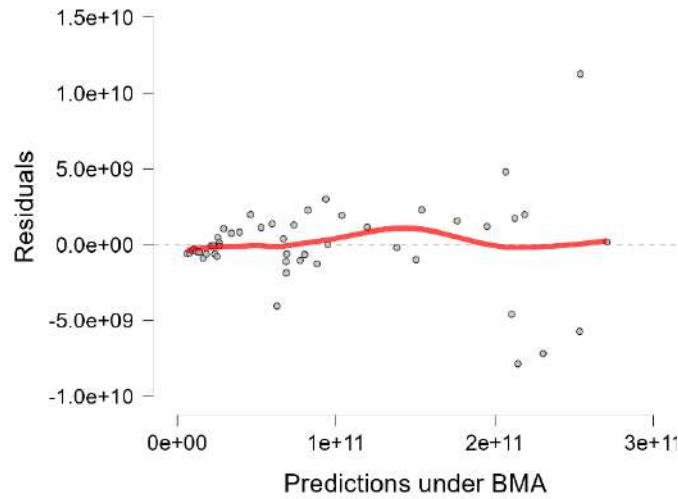


Figure 2 Residuals vs Fitted

Figure 2 visually assesses the model's fit by plotting the residuals against the fitted values of household final consumption expenditure (HCE). The plot reveals a random scatter of residuals around the horizontal axis, suggesting that the model does not exhibit significant patterns of heteroscedasticity or systematic bias.

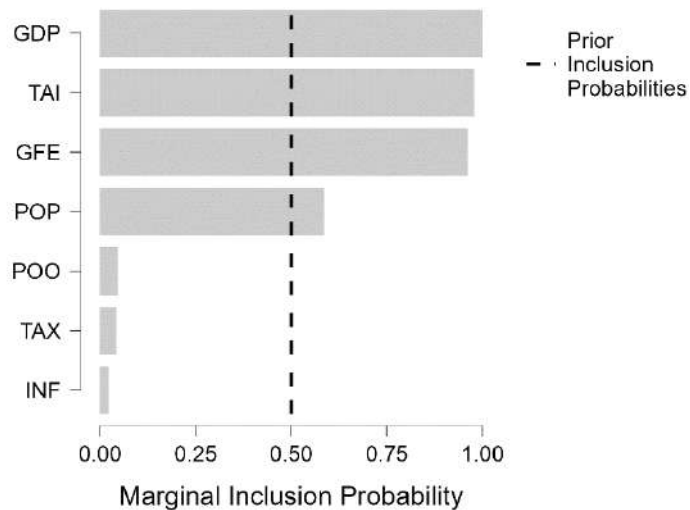


Figure 3 Inclusion Probabilities

Figure 3 illustrates the inclusion probabilities of variables for predicting household final consumption expenditure (HCE). In this context, general government final consumption expenditure (GFE), taxes on income (TAI), and GDP per capita (GDP) show high inclusion probabilities, highlighting their significant roles in influencing household consumption. In contrast, inflation (INF), population growth (POP), and the population aged 65 and above (POO) exhibit low probabilities, suggesting they have little to no impact on HCE in this model.

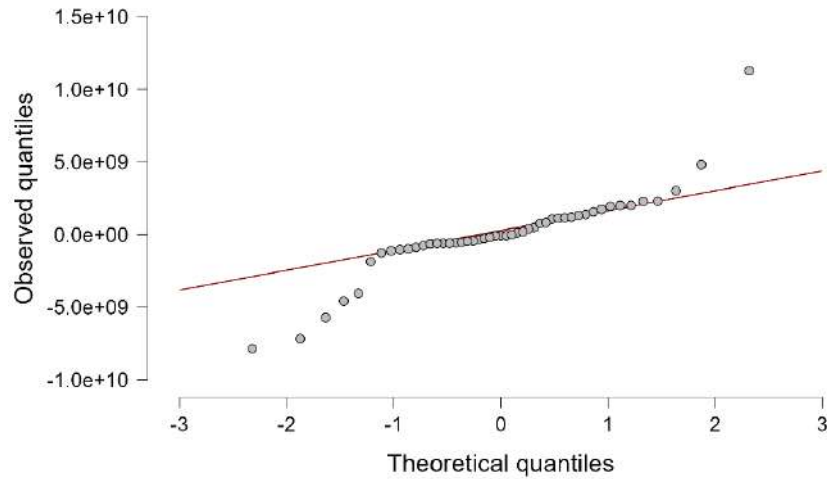


Figure 4 Q-Q Plot

Figure 5 presents a Q-Q plot to assess the normality of the residuals, which suggests that the model's residuals are mostly normally distributed, supporting the validity of the regression model's assumptions.

DISCUSSION

The results indicate that GFE positively and significantly impacts household consumption. This finding aligns with Keynesian consumption theory, which emphasizes the role of government spending in stimulating aggregate demand and, consequently, household consumption (Keynes, 1936). As Keynes argued, increased government expenditure boosts overall economic activity, creating a multiplier effect that enhances household disposable income and consumption. The strong correlation between GFE and HCE in this study mirrors previous empirical studies that have demonstrated the significance of government spending in influencing household consumption, especially in developing economies where public investment can be crucial to economic growth (Blanchard & Sheen, 2013; Arapova, 2018). The result also reveals that **the positive and significant relationship between GDP per capita and household consumption expenditure (HCE)** supports Keynesian consumption theory and the Permanent Income Hypothesis (PIH). Keynesian theory posits that household consumption is primarily driven by disposable income, and as income levels rise, so does consumption (Keynes, 1936). This finding corroborates empirical studies that highlight the central role of income in driving consumption during periods of economic expansion (Blanchard & Sheen, 2013; Arapova, 2018). The strong association **between GDP per capita and HCE** in the results suggests that households respond positively to rising income levels, potentially aligning their consumption patterns with long-term expectations of economic stability. This supports the argument that households seek to smooth consumption over time, as predicted by the PIH (Friedman, 1957; Juan & Seater, 1997). However, the lack of significant effects from short-term factors such as inflation may imply that households are more influenced by stable, long-term income changes rather than transitory economic shocks. The analysis reveals two **divergent effects of tax policies on household consumption expenditure. On the one hand, taxes on income (TAI) exhibit a significant positive relationship with HCE**, suggesting that favorable tax conditions can enhance household spending. This finding aligns with the broader Keynesian view, which holds that tax reductions can increase disposable income and stimulate consumption (Keynes, 1936; Menz, 2010). As disposable income rises, households have more financial resources to allocate toward consumption, thus driving overall economic activity. Conversely, the study finds a negative relationship between total tax revenue (TAX) and HCE. This suggests that while reductions in income taxes may boost consumption, broader tax burdens, such as those associated with indirect taxes, can dampen household spending. This dual impact of tax policies underscores the complexity of fiscal measures, highlighting the need for a balanced approach that supports consumer spending without imposing excessive tax burdens that might stifle economic growth (Heshmati et al., 2019).

POLICY IMPLICATIONS

The results highlight several critical policy implications. Firstly, the strong positive relationship between GDP per capita and household consumption expenditure underscores the necessity for policies that promote economic growth. Policymakers should focus on stimulating investment, enhancing workforce skills through improved educational and training opportunities, and facilitating technological advancements. Such measures can boost economic conditions, increasing consumer spending and further economic growth. Tax policy is another vital area of consideration. The negative impact of total tax revenue on consumption expenditure indicates a need for a balanced approach to tax policies. It is essential to design tax systems that do not stifle consumer spending while ensuring adequate revenue for public services.

FUTURE RESEARCH RECOMMENDATIONS

Future research should focus on several key areas to deepen the understanding and enhance the accuracy of findings. They should expand the range of variables in the analysis to provide a more comprehensive picture of the factors influencing household consumption. Future studies should consider incorporating additional variables such as consumer confidence, unemployment rates, personal savings rates, and other relevant economic and demographic indicators.

CONCLUSION

This study analyzes the determinants of household consumption expenditure in Thailand from 1972 to 2020. Using a Bayesian linear regression model, the research explored the relationship between household consumption and various economic variables, namely government final consumption expenditure, GDP per capita, taxes on income, inflation, population growth, and tax revenue downloaded from the World Bank databases. The findings indicate that government final consumption expenditure, GDP per capita, and taxes on income significantly and positively influence household consumption, affirming the importance of economic growth and favorable tax conditions in boosting consumer spending. However, the research also found a negative relationship between total tax revenue and household consumption, suggesting that while income tax reductions can enhance consumption, higher overall tax burdens may suppress household spending. Contrary to expectations, inflation and population growth did not affect household consumption expenditure statistically significantly. From a policy perspective, the study recommends that policymakers focus on stimulating economic growth and reevaluating tax policies to boost household consumption.

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REFERENCES

- Alvarez-Cuadrado, F., & Van Long, N. (2011). The relative income hypothesis. *Journal of Economic Dynamics and Control*, 35(9), 1489–1501. <https://doi.org/10.1016/j.jedc.2011.03.012>
- Arapova, E. (2018). Determinants of household final consumption expenditures in Asian countries: A panel model, 1991–2015. *Applied Econometrics and International Development*, 18(1), 121–140.
- Barde, S. (2024). Bayesian estimation of large-scale simulation models with Gaussian process regression surrogates. *Computational Statistics & Data Analysis*, 196, 107972. <https://doi.org/10.1016/j.csda.2024.107972>
- Blanchard, O., & Sheen, J. (2013). *Macroeconomics: Australasian edition*. Pearson Higher Education AU.
- Boughton, J. M. (1976). The aggregate permanent income consumption function. *Economic Inquiry*, 14(1), 129–145. <https://doi.org/10.1111/j.1465-7295.1976.tb00384.x>
- Campbell, J. Y., & Mankiw, N. G. (1989). Consumption, income, and interest rates: Reinterpreting the time series evidence. *NBER Macroeconomics Annual*, 4, 185–216.

- Campbell, J. Y., & Mankiw, N. G. (1990). Permanent income, current income, and consumption. *Journal of Business & Economic Statistics*, 8(3), 265–279. <https://doi.org/10.1080/07350015.1990.10509798>
- Carroll, C. D. (1997). Buffer-stock saving and the life cycle/permanent income hypothesis. *The Quarterly Journal of Economics*, 112(1), 1–55.
- Chao, C.-C., Laffargue, J.-P., & Yu, E. (2010). The Chinese saving puzzle and the life-cycle hypothesis: A reevaluation. *China Economic Review*, 22(1), 108–120. <https://doi.org/10.1016/j.chieco.2010.09.004>
- Charusheela, S. (2008). Gender and the stability of consumption: A feminist contribution to post-Keynesian economics. *Cambridge Journal of Economics*, 34(6), 1145–1156. <https://doi.org/10.1093/cje/bem049>
- Chunfang, Y., Yifeng, Z., & Suyun, W. (2022). The impact of the Internet on household consumption expenditure: An empirical study based on China Family Panel Studies data. *Economic Research-Ekonomska Istraživanja*, 36(3), 1–24. <https://doi.org/10.1080/1331677x.2022.2150255>
- Coruh, E., Bilgic, A., Cengiz, V., & Urak, F. (2024). Uncovering the determinants of bottom-up CO2 emissions among households in Türkiye: Analysis and policy recommendations. *Journal of Cleaner Production*, 469, 143197. <https://doi.org/10.1016/j.jclepro.2024.143197>
- De Juan, J. P., & Seater, J. J. (1997). A cross-country test of the permanent income hypothesis. *International Review of Applied Economics*, 11(3), 451–468. <https://doi.org/10.1080/02692179700000029>
- Dennis, R. (2009). Consumption habits in a new Keynesian business cycle model. *Journal of Money, Credit, and Banking*, 41(5), 1015–1030. <https://doi.org/10.1111/j.1538-4616.2009.00242.x>
- Đurović Todorović, J., Mirović, V., Đorđević, M., Pavlović, N., & Kalaš, B. (2024). Modeling tax revenue determinants: The case of Visegrad group countries. *Economies*, 12(6), 131. <https://doi.org/10.3390/economies12060131>
- Friedman, M. (1957). *Theory of the consumption function*. Princeton University Press.
- Gupta, M., & Kishore, A. (2021). Unemployment and Household Spending in Rural and Urban India: Evidence from Panel Data. *The Journal of Development Studies*, ahead-of-print(ahead-of-print), 545–560. <https://doi.org/10.1080/00220388.2021.1983171>
- Hall, R. E. (1978). Stochastic implications of the life cycle-permanent income hypothesis: Theory and evidence. *Journal of Political Economy*, 86(6), 971–987.
- Heshmati, A., Maasoumi, E., & Wan, G. (2019). An analysis of the determinants of household consumption expenditure and poverty in India. *Economies*, 7(4), 96.
- Hu, D., Zhai, C., & Zhao, S. (2023). Does digital finance promote household consumption upgrading? An analysis based on data from the China family panel studies. *Economic Modelling*, 125, 106377. <https://doi.org/10.1016/j.econmod.2023.106377>
- Hurd, M. D., & Rohwedder, S. (2008). The retirement consumption puzzle: Actual spending change in panel data. *National Bureau of Economic Research*.
- Khalid, A. H. (1994). Empirical tests of the rational expectations - Permanent income hypothesis: Evidence from Pakistan. *The Pakistan Development Review*, 33(4II), 1043–1053. <https://doi.org/10.30541/v33i4iipp.1043-1053>
- Kim, Y. K., Setterfield, M., & Mei, Y. (2014). A theory of aggregate consumption. *European Journal of Economics and Economic Policies: Intervention*, 11(1), 31–49. <https://doi.org/10.4337/ejeep.2014.01.03>
- Koyuncu, C., & Ünal, H. S. (2020). The link between GDP and household consumption expenditures in the long run in Turkey: ARDL analysis. *Balkan ve Near Eastern Journal of Social Sciences*, 6(1), 171–177.
- Liu, Q., Huang, X., & Bai, R. (2024). Bayesian modal regression based on mixture distributions. *Computational Statistics and Data Analysis*, 199, 108012. <https://doi.org/10.1016/j.csda.2024.108012>
- Lu, S., Yu, X., & Ren, J. (2024). Identifying driving factors of energy poverty and their interaction mechanism based on the BPNN-WINGS method: Household-level evidence from China. *Journal of Cleaner Production*, 452, 142194. <https://doi.org/10.1016/j.jclepro.2024.142194>
- Matthes, C., & Schwartzman, F. (2021). How much does household consumption impact business cycles? *Richmond Fed Economic Brief*, 21(25).

- Menz, J.-O. (2010). Uncertainty, social norms and consumption theory: Post and new Keynesian approaches. *European Journal of Economics and Economic Policies: Intervention*, 7(1), 125–146. <https://doi.org/10.4337/ejeep.2010.01.11>
- Modigliani, F. (1986). Life cycle, individual thrift, and the wealth of nations. *Science*, 234(4777), 704–712.
- Modigliani, F., & Brumberg, R. (1954). Utility analysis and the consumption function: An interpretation of cross-section data. *Post-Keynesian Economics*, 1(338–436).
- Mugosa, A., Cizmovic, M., & Vulovic, V. (2024). Impact of tobacco spending on intrahousehold resource allocation in Montenegro. *Tobacco Control*, 33(Suppl 2), s75–s80. <https://doi.org/10.1136/tc-2022-057786>
- Nguyen-Phung, H. T., & Le, H. (2024a). Energy Poverty and Health Expenditure: Empirical Evidence from Vietnam. *Social Sciences*, 13(5), 253. <https://doi.org/10.3390/socsci13050253>
- Nguyen-Phung, H. T., & Le, H. (2024b). Urbanization and Health Expenditure: An Empirical Investigation from Households in Vietnam. *Economies*, 12(6), 153. <https://doi.org/10.3390/economies12060153>
- Nsiah, A. Y., Tweneboah, G., & Tweneboah, G. (2024). Threshold Effect of Financial Inclusion on Poverty Reduction in Africa: Does institutional quality play a role? *Journal of African Business, ahead-of-print*, 1–35. <https://doi.org/10.1080/15228916.2024.2344136>
- Nothdurft, A., Tockner, A., Witzmann, S., Kraßnitzer, R., Ritter, T., Finley, A. O., Stampfer, K., & Gollob, C. (2024). Spatial Prediction of Diameter Distributions for the Alpine Protection Forests in Ebensee, Austria, Using ALS/PLS and Spatial Distributional Regression Models. *Remote Sensing*, 16(12), 2181. <https://doi.org/10.3390/rs16122181>
- Palley, T. I. (2008). The relative permanent income theory of consumption: A synthetic Keynes–Duesenberry–Friedman model. *Review of Political Economy*, 22(1), 41–56. <https://doi.org/10.1080/09538250903391954>
- Pérez-Granja, U., Andina-Díaz, A., & Jiménez, J. L. (2024). Volcanic eruptions and tourism prosocial consumption. *Tourism Economics*. <https://doi.org/10.1177/13548166241244844>
- Rahim, H., & Bahari, Z. (2018). Keynes' consumption theory: A reevaluation according to the Islamic perspective. *Global Journal al Thaqafah*, 8(1), 7–13. <https://doi.org/10.7187/gjat072018-1>
- Rashid, F. N., Sesabo, J. K., Lihawa, R. M., & Mkuna, E. (2024). Determinants of household food expenditure in Tanzania: Implications on food security. *Agriculture & Food Security*, 13(1). <https://doi.org/10.1186/s40066-023-00462-0>
- Shefrin, H. M., & Thaler, R. H. (1988). The behavioral life-cycle hypothesis. *Economic Inquiry*, 26(4), 609–643. <https://doi.org/10.1111/j.1465-7295.1988.tb01520.x>
- Soh Wenda, B. D., Fon, D. E., Molua, E. L., & Longang, S. G. (2024). Women, income use and nutrition quality: Effects of women's decision-making in rural households in Cameroon. *Agriculture & Food Security*, 13(1). <https://doi.org/10.1186/s40066-024-00480-6>
- Stock, J. H., & Watson, M. W. (2020). *Introduction to econometrics* (4th ed.). Pearson.
- Su, D., Xie, X., Yang, Z., & Xu, S. (2023). Do smart people prefer to consume? The role of cognitive abilities in household consumption. *The Singapore Economic Review*, 1–38. <https://doi.org/10.1142/s0217590823500194>
- Swarnata, A., Kamilah, F. Z., Wisana, I. D. G. K., Meilissa, Y., & Kusnadi, G. (2024). Crowding-out effect of tobacco consumption in Indonesia. *Tobacco Control*, 33(Suppl 2), s81–s87. <https://doi.org/10.1136/tc-2022-057843>
- Tang, Z., & Chen, L. (2023). Measurement and analysis of direct and indirect household energy consumption: a case study of China. *Frontiers in Energy Research*, 11. <https://doi.org/10.3389/fenrg.2023.1220207>
- Thaler, R. H. (2012). *The winner's curse: Paradoxes and anomalies of economic life*. Simon and Schuster.

- Vladislavljevic, M., Zubović, J., Jovanovic, O., & Đukić, M. (2024). Crowding-out effect of tobacco consumption in Serbia. *Tobacco Control*, 33(Suppl 2), s88–s94. <https://doi.org/10.1136/tc-2022-057727>
- Wostner, S. Š., Križanič, F., Brezovnik, B., & Vojinović, B. (2022). The role of personal consumption in the economic system – Case of Slovenia. *Eastern European Economics*, 60(5), 433–451. <https://doi.org/10.1080/00128775.2022.2098146>
- Xinbang, C., Wang, F., Wang, Y., & Wang, Y. (2021). An investigation of whether pensions increase consumption: Evidence from family portfolios. *Finance Research Letters*, 47, 102591. <https://doi.org/10.1016/j.frl.2021.102591>
- Yang, S., Jahanger, A., & Awan, A. (2024). Temperature variation and urban electricity consumption in China: Implications for demand management and planning. *Utilities Policy*, 90, 101782. <https://doi.org/10.1016/j.jup.2024.101782>
- Yeager, L. B., & Dornbusch, R. (1988). Macroeconomics and finance: Essays in honor of Franco Modigliani. *Southern Economic Journal*, 55(1), 253. <https://doi.org/10.2307/1058897>

VAR MODEL APPLICATION IN ECONOMIC AND DEMOGRAPHIC VARIABLE ANALYSIS

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ABSTRACT

This study examines the dynamic interrelationships among critical variables, including cereal yield, rural population, rural population growth, and the percentage of the rural population. This study utilises the BVAR model and examines data from 1972 to 2020 sourced from the World Bank. The findings indicate that cereal output demonstrates robust autoregressive characteristics, suggesting that enhancements in agricultural productivity are self-perpetuating. Demographic variables, including rural population increase and percentage, do not significantly affect crop yield. The interdependencies between rural population characteristics and crop yields are intricate, with minimal direct effects. This research indicates that policymakers should prioritise the maintenance of agricultural productivity by persistently investing in technology and rural infrastructure. Moreover, improving rural living standards and employment prospects may stabilise rural demography and promote sustainable agricultural productivity.

Keywords: Cereal yield, rural population, BVAR, Thailand

INTRODUCTION

Agricultural production and population growth are critically important as they directly impact global food security and sustainability. The world's population is projected to reach over 9.1 billion by 2050, outpacing current food production rates (Akanmu et al., 2023). This rapid growth poses significant challenges to ensuring food availability and avoiding starvation (Islam et al., 2023). Agricultural production must double by 2050 to meet the increasing demands of the growing population, a challenge further exacerbated by climate change (Janni et al., 2024). While population growth and food demand are increasing, some regions are experiencing plateaus in crop production, loss of arable land, and dramatic shifts in climatic conditions (Badiyal et al., 2024). This contradiction highlights the urgent need for sustainable agricultural practices and innovative approaches to food production. Addressing this challenge requires multidisciplinary approaches, including agroecology, biotechnology, and precision farming techniques, to increase crop productivity while maintaining environmental sustainability (Addas et al., 2023; Akanmu et al., 2023; Badiyal et al., 2024).

Population growth directly impacts food demand, necessitating increased agricultural productivity. As Kushartadi et al. (2023) notes, the estimated global population for 2050 is 9 billion, implying a significant increase in food demand. The relationship between population density and agricultural machinery adoption can be counterintuitive. In Ghana, for instance, lower population density is associated with higher machinery adoption to improve agricultural production (Warren, 2023).

Previous research has investigated the relationship between agricultural production and population growth, employing various methodologies to explore this interaction with different approaches. For instance, research has used panel data analysis and regression models to investigate the impact of agricultural socialized services on grain production growth in China (Wu et al., 2024). This study employed static panel, mediator, and threshold regression models to analyze the effects of agricultural services on grain production, considering the context of population growth. In another study, researchers

utilized remote sensing techniques and Google Earth Engine to analyze the impact of population growth on agricultural practices and land use changes (Fertas et al., 2024). This approach revealed significant demographic growth and its effects on farming practices, including a shift towards intensive farming and increased irrigated lands. Some studies have focused on the role of technological advancements in addressing the challenges posed by population growth. For example, studies have explored the potential of alternative proteins, including insect farming, as a sustainable solution to meet the nutritional needs of a growing global population (Hasnan et al., 2023). Machine learning techniques have also been employed to study the relationship between climate change, crop yield, and population growth (Gyamerah et al., 2023). While the relationship between agricultural production and population growth is well-established, many questions remain unanswered. Therefore, this research aims to explore the complex relationship between agricultural production and demographic changes, specifically focusing on cereal yield and rural population dynamics in Thailand. This research's key contribution lies in applying the BVAR model to understand the intricate relationships between agricultural productivity and rural demographic variables. The results can inform policymakers to stabilize rural demographics and support sustainable agricultural production. The remaining sections of this research are organized as follows. Section 2 explores the concepts related to this research. Section 3 outlines the research methodology. Finally, the results of the analysis and discussions will be presented.

LITERATURE REVIEWS

This section summarizes research findings on the interdependencies between economic and demographic variables. The studies span a range of methodologies and geographic focuses but collectively contribute to our understanding of how demographic factors and economic dynamics interact. (Olenev & Sarancha, 2001) developed a model to examine how demographic factors, particularly fertility rates and education levels, influence economic outcomes. Their findings highlight the significant impact of demographic structure on economic productivity and consumption levels, emphasizing the importance of educational investments in enhancing labor productivity. (Trinh et al., 2008) extended the understanding of inter-regional economic interdependencies by integrating demographic-economic modeling (IRDEM). Their study demonstrated that changes in demographic variables such as population distribution significantly affect economic flows within and between regions, illustrating the complex feedback loops between economic activities and demographic changes. (Titu et al., 2012) discussed the evolution of demographic and economic dependency ratios in Romania. They identified increasing economic dependency ratios due to demographic shifts, such as aging populations, and suggested policy measures to address these challenges, such as increasing birth rates and reducing unemployment through investments. (Siramaneerat & Sawangdee, 2015) Analyzed health-risk behaviors in the Thai population and their associations with socioeconomic-demographic factors. Their study found significant correlations between demographic variables (such as gender, age, and education level) and health-risk behaviors like smoking and alcohol consumption. These findings suggest targeted health promotion policies that consider demographic factors. (Somrongthong et al., 2017) explored the impact of socioeconomic factors on the daily activities and quality of life of Thai elderly. They found that education levels, income, and gender significantly influence the ability of seniors to live independently and their overall life satisfaction. The study emphasizes the need for comprehensive policies that address economic and social dimensions to improve the quality of life for the elderly. (Meehom & Khodpun, 2013) Investigated the influence of demographic variables on electricity consumption in Nakhonratchasima, Thailand. Their multiple regression analysis revealed that variables like the number of electricity consumers, industrial activity, and labor force size significantly affect electricity consumption. This study underscores the importance of demographic considerations in sustainable energy management. (Siriphirunphong et al., 2015) Used BVAR and MS-BVAR models to analyze the Thai business cycle, examining population, GDP, and inflation variables. They found that demographic changes significantly impact economic cycles, suggesting that demographic trends should be integrated into macroeconomic planning. (Nwakeze, 2014) focused on Nigeria, exploring the links between macroeconomic variables and demographic dynamics. The study found that macroeconomic factors such as GDP and age dependency ratios have significant but complex relationships with demographic trends, which require nuanced policy responses to achieve sustainable development. (Mason, 2019) discussed the broader implications of demographic changes on economic outcomes, particularly in the context of demographic transitions. His work highlights how demographic dividends can lead to economic growth if supported by appropriate policies that enhance labor productivity and

economic participation. The relationship between cereal production and population is not always straightforward. In Somalia, for instance, the rural population hurt cereal production, along with other factors like CO₂, temperature, and rainfall (Ali et al., 2023).

Agricultural production and population density are interconnected, but the nature of their relationship varies across regions. For example, in China's Songnen Plain, agricultural labor transfer has increased per capita cultivated land and more intensive production but also resulted in abandoned farmland and potential food insecurity (Yang et al., 2019). This highlights the complex interaction between population dynamics, labor, and food production. Using Fréchet distance, a study found diverse relationships between crop yield and population density, influenced by factors like land area, GDP, and cereal production. Countries with higher GDPs often show a weaker link between agricultural production and population distribution due to agricultural industrialization (Zhang et al., 2021). Population growth drives the need for increased food production, especially in rapidly growing regions of the Global South (Khaledi-Alamdari et al., 2023; Daum et al., 2023). For instance, Iraq's population is expected to reach 50 million by 2030, emphasizing the urgency for food security amid challenges like climate change (Albaaji & S.s, 2023). However, the relationship between population growth and agricultural production is complex. Excessive plant growth may reduce grain or protein yields, indicating that optimizing rather than maximizing crop growth can be more effective (Vain et al., 2023). To meet food production challenges, strategies such as using artificial intelligence for crop yield prediction (M. & Dhanraj, 2023) and agrivoltaic systems for dual land use are being explored (Sarr et al., 2023). Additionally, "biodiversity-smart agriculture" is crucial for balancing biodiversity conservation with productivity in regions with rapid population growth (Daum et al., 2023). Regional factors also influence the relationship between population growth and agricultural production. In Bhutan, farmer participation in agricultural extension services significantly boosted cereal production (Shangshon et al., 2023). Sustainable practices, including crop diversification and improved management, are essential to maintain food security as populations grow (Kong et al., 2023; Raza et al., 2023).

METHODOLOGY

Bayesian vector autoregression (BVAR) is a statistical model used for multivariate time series analysis that combines vector autoregression (VAR) with Bayesian methods. It addresses the issue of dense parameterization in traditional VAR models by imposing shrinkage on model coefficients through informative priors, thereby reducing parameter uncertainty (Kuschnig & Vashold, 2021). BVAR models are widely applied in various fields, particularly economic and financial forecasting. BVAR models have been used in various situations, e.g., forecasting industrial production indices (Aprigliano, 2020), predicting regional economic indicators (Ma et al., 2021), and analyzing macroeconomic variables such as inflation, unemployment, and interest rates (Mcadam & Warne, 2024; Pajor et al., 2023).

Let us consider the variables CYH_t is cereal yield (kilograms per hectare) at time t. RUP_t denotes rural population at time t, RPG_t present rural population growth (annual percentage) at time t. RPT stand for rural population (percentage of total population) at time t. The basic form of a VAR model for these four variables at time t with p lags can be written as

$$Y_t = A_1 Y_{t-1} + A_2 Y_{t-2} + \dots + A_p Y_{t-p} + \hat{\epsilon}_t, \tag{1}$$

where $Y_t = \begin{bmatrix} CYH_t \\ RUP_t \\ RPG_t \\ RPT_t \end{bmatrix}$.

In the Bayesian VAR (BVAR) model, priors are placed on the parameters A_1, A_2, \dots, A_p to shrink the model's coefficients and reduce overfitting, which is common in high-dimensional VAR models. The BVAR model can be formulated as:

$$Y_t = \sum_{i=1}^p A_i Y_{t-i} + c + \epsilon_t, \tag{2}$$

where c is a vector of constants (intercepts), The coefficients A_1, A_2, \dots, A_p follow prior distributions, often normal distributions with mean zero and small variance. A typical choice for the prior in a BVAR is Minnesota prior, which imposes tighter priors on longer lags and shrinks the off-diagonal elements of the A_i matrices toward zero.

For the analysis, this study employs annual data of Thailand spanning from 1972 to 2020, which was sourced from the World Bank database.

RESULTS

This section presents the results obtained from the analysis. The results are presented through various statistical tests and model outputs, including data series visualization, descriptive statistics, stationary tests, lag length determination, model fit information, and variance decomposition.

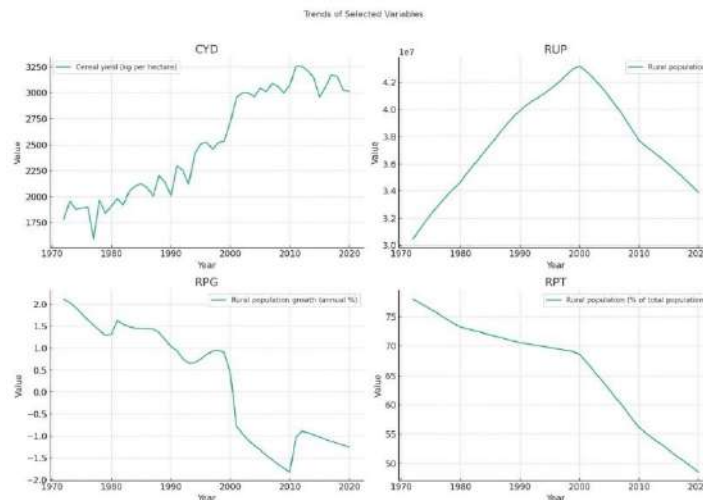


Figure 1 Data series of variable

Figure 1 presents trends in variables from 1972 to 2020. CYH shows a steady upward trend, reflecting agricultural practices and technology advancements. RUP fluctuates, indicating demographic shifts and migration patterns influenced by economic opportunities and policy changes. RPG is more volatile, with positive and negative growth rates driven by birth rates, migration, and economic conditions. RPT gradually declines, highlighting the demographic transition in Thailand, with increasing urbanization and industrialization reducing the rural population share

Table 1 descriptive statistics

Stat.	CYH	RUP	RPG	RPT
mean	2,512.876	3.776E+07	0.262	65.970
std	516.585	3.517E+06	1.293	8.720
min	1,592.000	3.046E+07	- 1.822	48.570
25 percent	2,009.200	3.516E+07	- 1.079	58.758
50 percent	2,507.400	3.773E+07	0.764	69.551
75 percent	3,015.700	4.087E+07	1.433	72.168

max	3,257.200	4.319E+07	2.124	77.994
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Table 1 provides descriptive statistics for key variables. The mean Cereal Yield per hectare (CYH) is 2512.876 kg, with a standard deviation of 516.585, indicating moderate variability. Yields range from 1592.000 to 3257.200 kg, with the 25th and 75th percentiles at 2009.200 and 3015.700 kg, respectively. The Rural Population (RUP) has a mean of 37.76 million and a standard deviation of 3.52 million, ranging from 30.46 to 43.19 million. The interquartile range is 35.16 to 40.87 million, capturing the central 50 percent of values. Rural Population Growth (RPG) averages 0.262 percent annually, with high variability (standard deviation of 1.293 percent). Growth rates vary from -1.822 percent to 2.124 percent, with the interquartile range from -1.079 percent to 1.433 percent. The Rural Population percentage (RPT) averages 65.970 percent, indicating that about two-thirds of the population is rural. The standard deviation of 8.720 percent and a range from 48.570 percent to 77.994 percent reflect the changing rural-urban population dynamics, with the interquartile range spanning 58.758 percent to 72.168 percent. Figure 2 shows CYH correlogram.

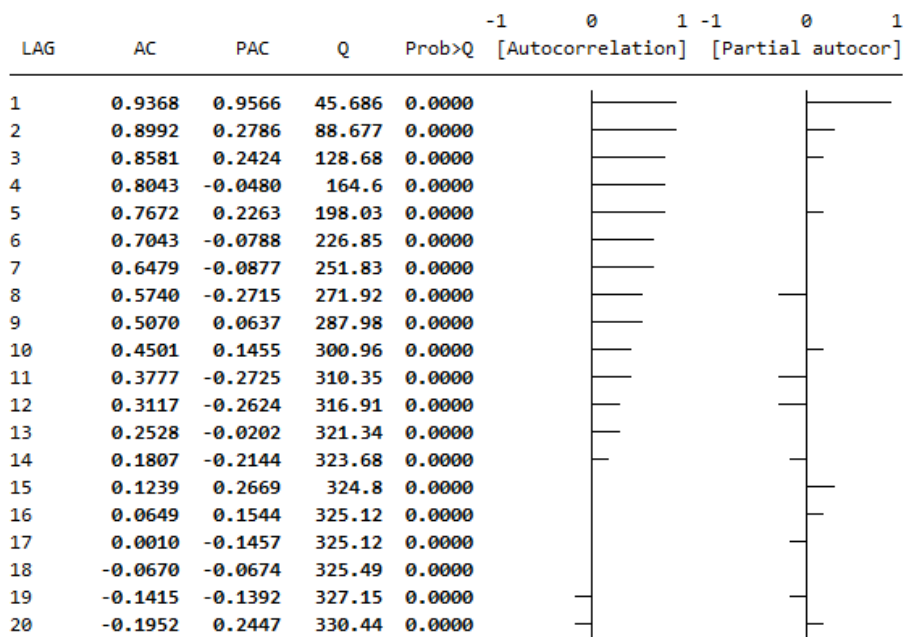


Figure 2 CYH correlogram

Table 2 Model summary

Metric	Value
MCMC iterations	12,500.000
Burn-in	2,500.000
MCMC sample size	10,000.000
Number of obs	47.000
Acceptance rate	1.000
Efficiency: min	0.969
Efficiency: avg	0.997
Efficiency: max	1.000
Log marginal-likelihood	- 911.163

Table 2 presents key metrics of the Bayesian Vector Autoregressive (BVAR) model. The analysis utilized 12,500 MCMC iterations with a 2,500 burn-in, yielding a sample size of 10,000. A total of 47

observations were analyzed, with an acceptance rate of 1.000, indicating full convergence of the model. Efficiency metrics ranged from 0.969 to 1.000, demonstrating strong sampling efficiency.

Table 3 BVAR Model estimation

Var.	Mean	Std. dev.	MCSE	Median	95% Cred. Interval
CYH					
CYH L1.	0.841601	0.078067	0.000781	0.841645	[0.6874728, 0.9944245]
CYH L2.	-0.00645	0.047783	0.000478	-0.00658	[-0.1011725, 0.0872513]
RUP L1.	3.73E-06	5.59E-05	5.6E-07	4.13E-06	[-0.0001077, 0.0001133]
RUP L2.	1.03E-05	5.57E-05	5.6E-07	9.95E-06	[-0.0000992, 0.0001216]
RPG L1.	-18.4778	39.81493	0.398149	-18.4647	[-96.61742, 60.37351]
RPG L2.	-0.31311	25.13289	0.246776	0.017134	[-50.25301, 49.03057]
RPT L1.	-8.00884	38.22527	0.382353	-7.63626	[-82.28662, 66.81443]
RPT L2.	3.781236	36.23419	0.362342	3.432653	[-67.2082, 75.3116]
_cons	185.2785	412.9731	4.0789	178.3546	[-615.1309, 1013.758]
RUP					
CYH L1.	-141.574	82.84697	0.82847	-141.232	[-305.7784, 21.06025]
CYH L2.	-37.0847	50.37389	0.503739	-36.8289	[-136.5599, 59.79161]
RUP L1.	1.095108	0.059298	0.000593	1.093555	[-0.977771, 1.209346]
RUP L2.	-0.10055	0.05931	0.000593	-0.10116	[-0.2163288, 0.0161565]
RPG L1.	193746.5	42054.03	420.54	193777.9	[-111206.9, 278021.7]
RPG L2.	21184.19	26909.84	269.098	21134.63	[-30602.64, 74512.29]
RPT L1.	68645.04	40614.79	406.148	69049.49	[-11281.62, 147722.2]
RPT L2.	-67310.9	38497.96	384.98	-67550.5	[-142995.6, 8773.923]
_cons	603633.3	436617.8	4366.18	601818.9	[-261142.8, 1461847]
RPG					
CYH L1.	-0.00011	0.000143	1.4E-06	-0.00011	[-0.0003961, 0.0001715]
CYH L2.	-2.9E-05	8.59E-05	8.7E-07	-3E-05	[-0.0001978, 0.0001368]
RUP L1.	-2E-08	1.03E-07	1E-09	-2E-08	[-2.24e-07, 1.81e-07]
RUP L2.	3.46E-09	1.03E-07	1.1E-09	3.05E-09	[-1.99e-07, 2.06e-07]
RPG L1.	0.960922	0.072244	0.000722	0.9615	[-0.8193751, 1.150513]
RPG L2.	-0.04566	0.046534	0.000465	-0.04602	[-0.1357151, 0.0465082]
RPT L1.	0.011207	0.069536	0.000703	0.012267	[-0.1262061, 1.1472215]
RPT L2.	-0.01212	0.06587	0.000666	-0.01327	[-1.139321, -0.1193642]
_cons	1.002114	0.751623	0.007516	0.9986	[-0.4837206, 2.475958]
RPT					
CYH L1.	-0.00024	0.000128	1.3E-06	-0.00024	[-0.0004952, 9.78e-06]
CYH L2.	-6.8E-05	7.75E-05	7.8E-07	-6.8E-05	[-0.0002215, 0.0000822]
RUP L1.	1.62E-07	9.18E-08	9.2E-10	1.63E-07	[-1.90e-08, 5.28e-08]
RUP L2.	-1.3E-07	9.19E-08	9.2E-10	-1.3E-07	[-3.06e-07, 5.19e-08]
RPG L1.	0.258607	0.065225	0.000652	0.258559	[-0.1299696, 0.3876314]
RPG L2.	0.023279	0.041635	0.000441	0.022968	[-0.6575342, 1.1068907]
RPT L1.	1.080242	0.062607	0.000626	1.079874	[-0.9572535, 1.203233]
RPT L2.	-0.12012	0.059357	0.000594	-0.12019	[-0.2375466, -0.0045225]
_cons	1.522099	0.675813	0.006758	1.524134	[-0.200817, 2.857133]

Var.	Mean	Std. dev.	MCSE	Median	95% Cred. Interval
Sigma_1_1	14622.47	3072.085	30.7209	14245.03	[9795.136, 21651.08]
Sigma_2_1	-1399186	2297747	22977.5	-1335632	[-6244208, 3049866]
Sigma_3_1	-1.1076	3.932501	0.039325	-1.09283	[-9.011408, 6.551881]
Sigma_4_1	-2.04305	3.563851	0.036211	-1.96907	[-9.474593, 4.752837]
Sigma_2_2	1.67E+10	3.5E+09	35000000	1.62E+10	[1.12e+10, 2.49e+10]
Sigma_3_2	18797.7	5116.536	50.5518	18182.08	[10669.44, 30899.1]
Sigma_3_3	23878.31	5220.83	52.2083	23144.25	[15677.78, 36105.72]
Sigma_4_3	0.049486	0.010373	0.000104	0.048417	[0.0331144, 0.072912]
Sigma_4_4	0.029331	0.007948	0.000079	0.028341	[0.0165919, 0.0478569]

Table 3 provides the BVAR model estimation results. For CYH, the first lag of CYH (CYH L1) shows a strong positive and significant relationship with its own value (mean = 0.8416), suggesting high autoregressive properties. The second lag (CYH L2) is negligible and non-significant. The impact of RUP on CYH, both at the first and second lags, is minimal and statistically insignificant. RPG and RPT also show no significant effects on CYH in both lags. For RUP, CYH's first lag negatively impacts RUP, though not significantly. The first lag of RUP has a positive and significant impact on itself, while its second lag has a negative but non-significant influence. The effects of RPG and RPT on RUP are also largely insignificant, although RPG L1 shows a large positive mean, but with wide credible intervals, indicating uncertainty. RPG is most influenced by its own first lag, showing a strong positive and significant relationship (mean = 0.961), while its second lag has a minor negative effect. CYH, RUP, and RPT all have negligible and insignificant impacts on RPG. For RPT, the first lag of RPT shows a strong positive and significant impact on itself (mean = 1.080), while the second lag has a slight negative effect. CYH, RUP, and RPG exhibit minimal and non-significant effects on RPT. In this case, CYH displays strong autoregressive behavior, while the influence of demographic variables (RUP, RPG, and RPT) on CYH is limited. Similarly, RUP and RPT show strong relationships with their own past values, with minimal cross-variable impacts.

Table 4 Model stability

					Companion matrix size	8
					MCMC sample size	10000
Eigenvalue modulus	Mean	Std. dev.	MCSE	Median	95% Cred. Interval	
1	0.988222	0.023444	0.000234	0.985359	[0.9511809, 1.040177]	
2	0.984267	0.022126	0.000224	0.982213	[0.9442577, 1.032832]	
3	0.942962	0.034777	0.000348	0.956248	[0.8348188, 0.9740263]	
4	0.784991	0.101286	0.000813	0.796591	[0.5665951, 0.9549797]	
5	0.203328	0.063614	0.000636	0.197405	[0.0896037, 0.3392207]	
6	1.013131	0.047086	0.00074	1.008236	[0.9325845, 1.083517]	
7	0.05612	0.029072	0.000291	0.051531	[0.0147944, 0.1258425]	
8	0.024921	0.017589	0.000176	0.0219	[0.0010616, 0.0652466]	

Table 4 presents the model stability results which show that most eigenvalues fall within the 95 % credible interval, confirming that the system is well-behaved and that the dynamics of the variables do not suggest any explosive behavior, ensuring the model's reliability for forecasting. Figure 3 shows IRF analysis, and Table 5 expresses variance decomposition.

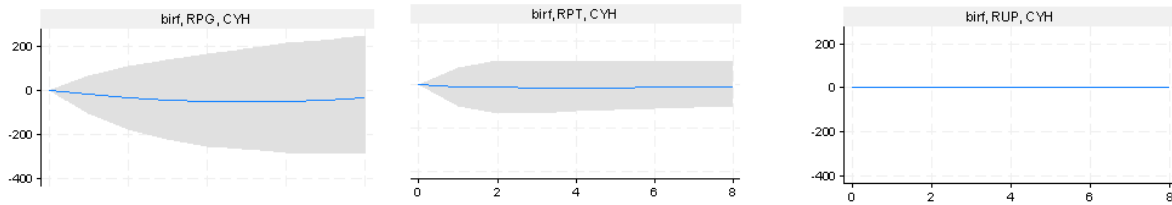


Figure 3 IRF analysis

Table 5 variance decomposition

Step	(1) irf	(1) Lower	(1) Upper	(2) irf	(2) Lower	(2) Upper	(3) irf	(3) Lower	(3) Upper
0	0	0	0	0	0	0	0	0	0
1	-	-	78.0225	4.00E-07	-	0.000131	-	-	66.5694
	8.02415	96.6465			0.00013		17.3665	103.101	
2	-	-	110.35	1.00E-05	-	0.000181	-	-	109.36
	11.9344	133.087			0.00017		32.3969	174.805	
3	-	-	108.376	0.000023	-	0.000188	-43.171	-	139.631
	13.9049	130.375			0.00015			220.375	
4	-	-123.58	106.105	0.000036	-	0.000193	-	-252.33	165.818
	14.0675				0.00013		48.7846		
5	-	-	105.511	0.000046	-	0.000195	-	-	191.604
	13.3707	115.422			0.00011		49.8881	268.694	
6	-	-	104.237	0.000055	-9.9E-05	0.000196	-	-	216.43
	12.2319	108.712			05		47.3783	279.992	
7	-	-	104.459	0.000063	-8.7E-05	0.000197	-	-	231.216
	10.8585	102.447			05		42.1544	288.703	
8	-	-	104.569	0.000069	-7.8E-05	0.0002	-34.942	-	250.119
	9.35368	96.8921			05			287.401	

Posterior means reported. 95% equal-tailed credible lower and upper bounds reported. (1) irfname = birf, impulse = RPT, and response = CYH., (2) irfname = birf, impulse = RUP, and response = CYH, (3) irfname = birf, impulse = RPG, and response = CYH.

DISCUSSION

The findings indicate that cereal yield (CYH) in Thailand has significant autoregressive characteristics, implying that cereal production is self-perpetuating and predominantly influenced by its historical values. This conclusion suggests that enhancements in agricultural output, whether from technological innovations or improved farming techniques, tend to perpetuate and amplify over time. This result corresponds with research by Vain et al. (2023), which contends that enhancing agricultural productivity can be achieved by optimising methods rather than exclusively through expansion. The analysis reveals that the direct influence of demographic variables—rural population (RUP), rural population growth (RPG), and rural population percentage (RPT)—on cereal production is constrained. The study's findings correspond with the research conducted by Zhang et al. (2021), indicating that the interplay between population dynamics and agricultural productivity is intricate and may fluctuate according to land usage, GDP, and agricultural industrialisation. In Thailand, rural demographic changes are inadequate to directly affect wheat production, likely due to mitigating factors such as technological adoption, regulatory interventions, and agricultural commercialisation. This insight reinforces the notion that economic and agricultural outcomes are influenced by demographic considerations and a wider array of determinants, including policy frameworks and market conditions (Khaledi-Alamdari et al., 2023). The research investigates. These findings contradict the conventional perspective that population growth and distribution directly influence agricultural production (Ali et al., 2023). Although population growth requires heightened agricultural output, factors such as technical innovations, economic policies, and climatic conditions may exert a more significant influence on agricultural production.

POLICY IMPLICATIONS

Policymakers should continue investing in agricultural technology and infrastructure to sustain and enhance productivity. However, demographic variables such as rural population growth and percentage have limited effects on cereal yield, integrated rural development policies focusing on quality of life, job opportunities, and access to education and healthcare to stabilize rural demographics can indirectly support sustainable agricultural production.

FUTURE RESEARCH

Future studies should explore the inclusion of additional variables, such as climate change indicators, technological advancements, and economic factors like market prices and trade, to capture a more comprehensive picture of the factors influencing agricultural production.

CONCLUSION

This study examined the relationships between economic and demographic variables in Thailand utilising the Bayesian vector autoregression (BVAR) model. The study examined the reciprocal influence of rural population dynamics on agricultural production. The analysis utilised data from 1972 to 2020, obtained from the World Bank, concentrating on factors including cereal yield, rural population, rural population growth, and the proportion of the rural population. The BVAR model was selected for its capacity to encapsulate the linear interdependencies among various time series variables, facilitating a thorough comprehension of their dynamic interactions. The findings indicated that cereal yield in Thailand demonstrates significant autoregressive characteristics, suggesting that enhancements in agricultural production are predominantly self-reinforcing. The direct influence of rural demographic parameters on cereal yield was minimal. This indicates that agricultural productivity in Thailand is likely more affected by technological innovations, governmental measures, and market dynamics than by alterations in rural demography alone. The findings suggest that authorities should persist in investing in agricultural technology and rural infrastructure to sustain production. Demographic changes alone do not substantially affect grain yields.

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REFERENCES

- Addas, A., Tahir, M., & Ismat, N. (2023). Enhancing precision of crop farming towards smart cities: An application of artificial intelligence. *Sustainability*, *16*(1), 355. <https://doi.org/10.3390/su16010355>
- Akanmu, A. O., Kutu, F. R., Akol, A. M., Babalola, O. O., & Ndolo, D. O. (2023). Agroecological techniques: Adoption of safe and sustainable agricultural practices among the smallholder farmers in Africa. *Frontiers in Sustainable Food Systems*, *7*. <https://doi.org/10.3389/fsufs.2023.1143061>
- Albaaji, G. F., & S. S. V. C. (2023). Artificial intelligence SoS framework for sustainable agricultural production. *Computers and Electronics in Agriculture*, *213*, 108182. <https://doi.org/10.1016/j.compag.2023.108182>
- Ali, D. A., Dahir, A. M., & Yusuf, S. M. (2023). Autoregressive distributed lag modeling of climate and non-climatic determinants affecting cereal production: Empirical evidence from Somalia. *International Journal of Energy Economics and Policy*, *13*(5), 577–584. <https://doi.org/10.32479/ijeep.14553>
- Aprigliano, V. (2020). A large Bayesian VAR with a block-specific shrinkage: A forecasting application for Italian industrial production. *Journal of Forecasting*, *39*(8), 1291–1304. <https://doi.org/10.1002/for.2687>

- Badiyal, A., Rana, T., Manhas, S., Jayswal, D. K., Sood, R., Mahajan, R., Walia, A., & Rana, R. S. (2024). Synergizing biotechnology and natural farming: Pioneering agricultural sustainability through innovative interventions. *Frontiers in Plant Science*, 15. <https://doi.org/10.3389/fpls.2024.1280846>
- Daum, T., Baudron, F., Birner, R., Qaim, M., & Grass, I. (2023). Addressing agricultural labour issues is key to biodiversity-smart farming. *Biological Conservation*, 284, 110165. <https://doi.org/10.1016/j.biocon.2023.110165>
- Fertas, L., Alouat, M., & Benmahamed, H. (2024). The emergence of irrigated agriculture in semi-arid zones in the face of climate change and urbanization in peri-urban areas in Setif, Algeria. *Sustainability*, 16(3), 1112. <https://doi.org/10.3390/su16031112>
- Gyamerah, S. A., Asare, C., Mintah, D., Appiah, B., & Kayode, F. A. (2023). Exploring the optimal climate conditions for maximum maize production in Ghana: Implications for food security. *Smart Agricultural Technology*, 6, 100370. <https://doi.org/10.1016/j.atech.2023.100370>
- Hasnan, F. F. B., Zarei, M., Feng, Y., Parraga, K., Sun, T., & Schwarz, M. (2023). Insects as valuable sources of protein and peptides: Production, functional properties, and challenges. *Foods*, 12(23), 4243. <https://doi.org/10.3390/foods12234243>
- Islam, M., Qayyum, A., Shehzad, F., Siddiqui, R., & Abbas, M. (2023). Growth analysis of production of food crops and population growth for food security in Pakistan. *Proceedings of the Pakistan Academy of Sciences: B. Life and Environmental Sciences*, 60(1). [https://doi.org/10.53560/ppasb\(60-1\)762](https://doi.org/10.53560/ppasb(60-1)762)
- Janni, M., Marmiroli, N., Gulli, M., Marmiroli, M., & Maestri, E. (2024). Plant responses to climate change: How global warming may impact on food security: A critical review. *Frontiers in Plant Science*, 14. <https://doi.org/10.3389/fpls.2023.1297569>
- Khaledi-Alamdari, M., Majnooni-Heris, A., Fakheri-Fard, A., & Russo, A. (2023). Probabilistic climate risk assessment in rainfed wheat yield: Copula approach using water requirement satisfaction index. *Agricultural Water Management*, 289, 108542. <https://doi.org/10.1016/j.agwat.2023.108542>
- Kong, X., Li, L., Peng, P., Zhang, K., Hu, Z., Wang, X., & Zhao, G. (2023). Wheat cultivar mixtures increase grain yield under varied climate conditions. *Basic and Applied Ecology*, 69, 13–25. <https://doi.org/10.1016/j.baae.2023.03.007>
- Kuschnig, N., & Vashold, L. (2021). BVAR: Bayesian Vector Autoregressions with Hierarchical Prior Selection in R. *Journal of Statistical Software*, 100(14). <https://doi.org/10.18637/jss.v100.i14>
- Kushartadi, T., Al Hamdi, A. H., Asvial, M., Suryanegara, M., Sadat Faidar, M. A., Rizki, M. A., Harsanto, W. D., & Mulyono, A. E. (2023). Theme mapping and bibliometric analysis of two decades of smart farming. *Information*, 14(7), 396. <https://doi.org/10.3390/info14070396>
- M. C., & Dhanraj, R. K. (2023). Ensemble deep learning algorithm for forecasting of rice crop yield based on soil nutrition levels. *ICST Transactions on Scalable Information Systems*, e7. <https://doi.org/10.4108/eetsis.v10i3.2610>
- Ma, J., Zhang, H., & Shang, Y. (2021). Application of Bayesian Vector Autoregressive Model in Regional Economic Forecast. *Complexity*, 2021, 1–10. <https://doi.org/10.1155/2021/9985072>
- Mason, A. (2019). Economic demography. In *Handbook of Population* (pp. 643–668).
- Mcadam, P., & Warne, A. (2024). Density forecast combinations: The real-time dimension. *Journal of Forecasting*, 43(5), 1153–1172. <https://doi.org/10.1002/for.3068>
- Pajor, A., Osiewalski, J., Kwiatkowski, Ł., & Wróblewska, J. (2023). Hybrid SV-GARCH, t-GARCH and Markov-switching covariance structures in VEC models—Which is better from a predictive perspective? *International Statistical Review*, 92(1), 62–86. <https://doi.org/10.1111/insr.12546>
- Raza, M. A., Din, A. M. U., Zhiqi, W., Gul, H., Ur Rehman, S., Bukhari, B., Haider, I., Rahman, M. H. U., Liang, X., Luo, S., El Sabagh, A., Qin, R., & Zhongming, M. (2023). Spatial differences influence nitrogen uptake, grain yield, and land-use advantage of wheat/soybean relay intercropping systems. *Scientific Reports*, 13(1). <https://doi.org/10.1038/s41598-023-43288-3>
- Sarr, A., Soro, Y. M., Diop, L., & Tossa, A. K. (2023). Agrivoltaic: A synergistic co-location of agricultural and energy production in perpetual mutation: A comprehensive review. *Processes*, 11(3), 948. <https://doi.org/10.3390/pr11030948>

- Shangshon, B. B., Polthanee, A., Wongsamun, C., & Suriya, P. (2023). Impact of agricultural extension services on cereal production among rural farmers in Bhutan. *Journal of Agricultural Extension*, 27(1), 13–26. <https://doi.org/10.4314/jae.v27i1.2>
- Siriphirunphong, D., Chaiboonsri, C., & Saosaovapak, A. (2015). Thai business cycle from macroeconomic model using BVAR and MS-BVAR methods. *International Journal of Social Sciences*, 1(1), 452–466.
- Somrongthong, R., Wongchalee, S., Ramakrishnan, C., Hongthong, D., Yodmai, K., & Wongtongkam, N. (2017). Influence of socioeconomic factors on daily life activities and quality of life of Thai elderly. *Journal of Public Health Research*, 6(1), jphr-2017.
- Titu, M. B., Banu, I., & Banu, I.-M. (2012). Demographic and economic dependency ratios: Present and perspectives. *International Journal of Economics and Finance*, 4(12), 214–223.
- Trinh, B., Thanh, N. D., & Secretario, F. T. (2008). Economy-wide multipliers extended by the inter-regional demographic-economic modeling (IRDEM).
- Vain, S., Tamm, I., Tamm, Ü., Annusver, M., & Zobel, K. (2023). Negative relationship between topsoil root production and grain yield in oat and barley. *Agriculture, Ecosystems & Environment*, 349, 108467. <https://doi.org/10.1016/j.agee.2023.108467>
- Warren, F. (2023). Population density, urbanisation, and agricultural mechanisation in modern Ghana. *Review of Development Economics*, 27(3), 1605–1629. <https://doi.org/10.1111/rode.13007>
- Wu, A., Elahi, E., Cao, F., Yusuf, M., & Abro, M. I. (2024). Sustainable grain production growth of farmland: A role of agricultural socialized services. *Heliyon*, 10(5), e26755. <https://doi.org/10.1016/j.heliyon.2024.e26755>
- Yang, Y., Huang, F., Liu, J., Yang, Q., & Zhang, Y. (2019). Coupling relationship between agricultural labor and agricultural production against the background of rural shrinkage: A case study of Songnen Plain, China. *Sustainability*, 11(20), 5804. <https://doi.org/10.3390/su11205804>
- Zhang, Y., Zhao, J., Yan, Y., Yu, Q., & Shi, Y. (2021). Relationship of population migration, crop production pattern, and socioeconomic development: Evidence from the early 21st century. *Environmental Research Letters*, 16(7), 074045. <https://doi.org/10.1088/1748-9326/ac0e66>

A VAR PERSPECTIVE ON AGRICULTURE, MANUFACTURING, AND INCOME

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ABSTRACT

This study aims to elucidate the dynamic relationships among total natural resource rents, GDP per capita, manufacturing value-added, and agricultural value-added. The study utilises a Bayesian Vector Autoregression (BVAR) model to examine time-series data from 1972 to 2020. The results demonstrate that natural resources substantially enhance economic growth, especially through their favourable effect on GDP and manufacturing. Manufacturing is a vital economic development catalyst, exhibiting robust self-reinforcing effects and profiting from natural resource rents and GDP expansion. Agriculture demonstrates a detrimental self-impact, indicating a diminishing contribution to future economic growth. The research emphasises the necessity of sustainable management of natural resources and modernising the agriculture sector to ensure economic stability and growth.

Keywords: Total Natural Resources rents, GDP per capita, Manufacturing Value Added, Agriculture Value Added

INTRODUCTION

Natural resources, manufacturing, and economic growth are interconnected factors that play crucial roles in a nation's development and sustainability. They are important because they provide raw materials for manufacturing and contribute to economic growth. However, their exploitation can lead to environmental degradation. For instance, Tariq et al. (2024) note that natural resources significantly negatively affect environmental pollution in South Asia. Li et al. (2024) reveal that natural resource rents adversely affect economic growth in BRICS countries. Manufacturing is also a key driver of economic growth and industrialization. Sharma et al. (2024) highlight that the manufacturing industry plays a pivotal role in the economic growth of all countries. Effective natural resource and manufacturing management can lead to economic growth, improved living standards and increased wealth. However, the relationship between these factors is complex and often contradictory. While natural resources and manufacturing contribute to economic growth, they can also lead to environmental degradation if not managed sustainably. Zhou et al. (2024) conclude that "the mere blind use of natural resources to achieve economic growth without raising productivity and green energy is ecologically unsustainable." This highlights the need for balanced and sustainable resource management and economic development approaches. Policies that promote efficient resource use, sustainable manufacturing practices, and environmentally friendly economic growth are crucial for achieving this balance (Bhowmik et al., 2024; Bian & Liu, 2024; Wang & Sibt-E-Ali, 2024).

It was recognized that natural resources play a crucial role in economic development, particularly in resource-rich regions (Huang et al., 2024). However, the relationship between natural resources and economic growth is complex. Also, it was known that manufacturing, particularly through production digitalization, can significantly impact economic growth (Lastauskaite & Krusinskas, 2024). Thus, understanding the interplay between natural resources, manufacturing, and economic growth becomes crucial for sustainable development as it allows for formulating effective policies that balance resource utilization, environmental protection, and economic advancement. This knowledge can guide strategic

investments in both natural resource management and manufacturing technologies, leading to more sustainable and equitable economic growth (Wang et al., 2024; Yang & Smith, 2024).

Several researchers have investigated the relationship between natural resources, manufacturing, and economic growth, employing various methodologies. In Khan et al. (2024), researchers examined the connection between GDP growth, research and development expenditure, and medium- to high-tech manufacturing exports in Pakistan. They utilized the ARDL model, bound-F test, and ECM regression to evaluate long- and short-term causal relationships. The study found positive relationships between GDP growth and technological innovation in the short and long run, with R&D expenditure showing significance in the long run (Khan et al., 2024). Gong and Aslam (2024) focused on BRICS countries, exploring the roles of natural resources and economic factors in biofuel production and solid fossil waste management. The researchers applied second-generation econometric methodologies, including the Driscoll-Kraay standard errors (DKSE) approach. Their findings revealed a significant negative relationship between biofuel production and environmental damage through waste management, while natural resources, urbanization, trade, and economic growth were positively correlated with environmental degradation (Gong & Aslam, 2024). In addition, Işık et al. (2024) investigated the impacts of renewable energy consumption, internet usage, mineral rent, and economic growth on CO₂ emissions across 27 OECD nations. The researchers employed a panel quantile regression technique to discover heterogeneous effects at various quantile levels of environmental destruction. Their results showed a positive association between mineral rents and environmental deterioration, emphasizing the need for strategic policies to balance economic benefits with environmental preservation (Işık et al., 2024).

The motivation for this research arises from the critical role that natural resources and manufacturing play in economic growth. The research aims to contribute to this research domain by exploring the interrelationships among agriculture, manufacturing, and income, with the ultimate goal of informing policy decisions that support sustainable economic growth. The organization of the remaining sections of this research are as follows. Section 2 explores the concepts related to this research. Section 3 outlines the research methodology. Finally, the results of the analysis and discussions will be presented.

LITERATURE REVIEW

Agriculture and manufacturing are two foundational pillars of economic growth, especially in developing nations. These sectors significantly influence a country's income levels, employment rates, and economic stability. This section explores the intricate relationships between agriculture, manufacturing, and income, drawing on various theoretical frameworks and empirical studies to highlight their interdependencies and impacts on economic growth.

Agriculture has historically been the bedrock of economic development, particularly in developing countries. It is crucial in providing food security, employment, and raw materials for other sectors, especially manufacturing. The impact of agriculture on income and economic development can be examined through various theoretical lenses. The classical theory, as proposed by Adam Smith and later expanded by David Ricardo, emphasizes the role of agriculture in providing a surplus that can be invested in other sectors (Smith, 1793; Ricardo, 1821). This surplus is critical for industrialization and economic growth. Empirical studies underscore agriculture's role in economic development. For instance, Johnston and Mellor (1961) highlight the agricultural sector's role in providing food, labor, and capital for industrial expansion. They argue that productivity growth in agriculture can lead to higher incomes and poverty reduction, thus fostering overall economic development.

As economies develop, there is typically a structural shift from agriculture to manufacturing. Productivity differentials between the two sectors often drive this transition. Manufacturing tends to offer higher productivity and wages, attracting labor from agriculture. This process is central to the structural transformation theories proposed by Lewis (1954) and Kuznets (1966). Lewis posited the dual-sector model, where surplus labor from the traditional agricultural sector is transferred to the modern industrial sector, leading to economic growth. Similarly, Kuznets emphasized that structural transformation is essential for sustained economic growth and development.

Manufacturing plays a crucial role in economic development by fostering technological advancements, increasing productivity, and creating employment opportunities. The sector is often viewed as the engine of growth due to its capacity for economies of scale, innovation, and higher value addition compared to agriculture. Empirical evidence supports the positive impact of manufacturing on economic growth. Szirmai (2012) highlights that manufacturing has a higher productivity growth potential than agriculture.

The sector's ability to absorb labor from agriculture and other low-productivity sectors contributes significantly to economic growth and development.

Effective policy interventions, such as investments in technology, infrastructure, and education, enhance productivity and income in both sectors. Countries can achieve balanced and sustainable economic development by recognizing and fostering the interdependencies between agriculture and manufacturing.

Several studies continue to explore the interactions between economic variables. For instance, Razak et al. (2017) used ARIMA and VAR models to forecast Malaysian economic growth. They highlighted the strengths of VAR models in capturing dynamic relationships between key economic indicators. This study utilized time-series data to model and predict the future economic performance of Malaysia, demonstrating that VAR models effectively reflect the interplay between variables such as GDP, inflation, and trade balances. Similarly, Romyen et al. (2019) examined the dynamics of monetary policy, external shocks, and economic growth in East Africa using a Structural Vector Autoregression (S-VAR) model. They discovered significant interactions between these variables, highlighting how commodity price shocks affect exchange rates and GDP. This finding was parallel to observations in the sectoral interdependencies in Thailand's economy, indicating that external shocks can propagate through different economic sectors, affecting overall growth. Additionally, Gupta and Shastri (2020) explored the relationship between public expenditure and economic growth in India using a VAR model. Their research identified significant causal links between government spending and macroeconomic variables, such as GDP and inflation. The study underscored the critical role of public expenditure in driving economic growth, suggesting that strategic government spending can positively influence economic development. Jin et al. (2021) assessed the macroeconomic impacts of foreign exchange interventions across 26 countries. Their findings indicated that while such interventions could stabilize nominal exchange rates in the short term, their impact on real exchange rates was less significant. This often led to greater asset price volatility, especially in countries with frequent interventions, suggesting that these policies might have mixed effects on economic stability. Furthermore, Nupehewa et al. (2022) conducted a comprehensive causality analysis between foreign direct investment (FDI) and economic growth across multiple regions using panel VAR/block exogeneity tests. Their research highlighted dynamic causal linkages between FDI and GDP, echoing findings of interdependencies seen in other regional studies, such as the sectoral interdependencies in Thailand. Finally, Promma and Chutsagulprom (2023) introduced an adaptive parameter VAR-KF model to forecast financial and macroeconomic variables. Their study emphasized the superior performance of the adaptive model in predicting economic indicators, showcasing the robustness of VAR methodologies in economic forecasting. The adaptive model demonstrated better accuracy in capturing economic variables' dynamic nature than traditional VAR models.

Agriculture and manufacturing are integral to economic development, particularly in developing nations. The interdependencies between these sectors significantly influence income levels, employment rates, and overall economic stability. Countries can achieve sustainable economic growth and development by understanding these relationships and implementing effective policy interventions.

METHODOLOGY

Bayesian vector autoregression (BVAR) is an econometric technique for multivariate time series modelling and forecasting. It combines the vector autoregression (VAR) approach with Bayesian methods to alleviate the over-parameterization issue associated with unrestricted VARs and to correct coefficient bias in nonstationary time series (Bewley, 2002). BVAR models use informative priors to impose shrinkage on model coefficients, reducing parameter uncertainty and improving forecasting performance. BVAR has been applied in various economic and financial contexts. It has been used to forecast employment in Georgia (Partridge & Rickman, 1998), analyze economic growth in South Korea (Ghatak, 1998), study monetary policy transmission in Romania (Spulbăr, 2012), and forecast economic indicators in Italy (Aprigliano, 2020). A standard BVAR model can be written as:

$$Y_t = A_1 Y_{t-1} + A_2 Y_{t-2} + \dots + A_p Y_{t-p} + u_t$$

where Y_t is a vector of endogenous variables at time t , which includes TNR, GDP, MVA, and AFF. A_1, A_2, \dots, A_p are matrices of coefficients to be estimated. u_t is the vector of error terms, which follows a normal distribution $u_t \sim N(0, \Sigma)$, with Σ being the variance-covariance matrix of residuals. The BVAR methodology introduces prior distributions to these parameters to mitigate overfitting and reduce uncertainty in the coefficient estimates. The priors are incorporated into the model estimation through Bayesian inference, and posterior distributions of the parameters are derived using Markov Chain Monte Carlo (MCMC) techniques. This approach allows the inclusion of prior beliefs about the structure of the model, which is particularly useful when the time-series data is nonstationary or exhibits over-parameterization issues. The data, sourced from the World Bank database, spans from 1972 to 2020 and is used to estimate this model.

RESULT

This section presents the findings, analyzing the interrelationships among key economic sectors in Thailand. Table 1 shows descriptive statistics, and Figure 1 expresses the time Series of variables

Table 1 Descriptive statistics

Variable	Obs	Mean	Std. dev.	Min	Max
TNR	49	1.747	0.788	0.546	3.717
GDP	49	2,713.968	2,232.650	209.375	7,814.384
MVA	49	25.606	3.596	18.401	30.930
AFF	49	13.973	6.468	8.026	27.690

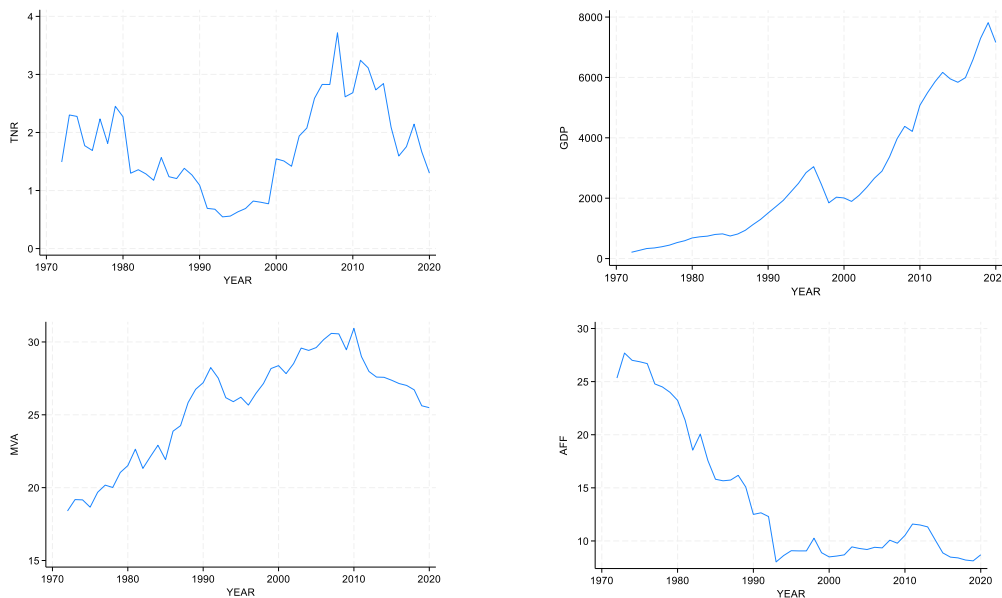


Figure 1 Time Series of variables

Table 2 Model summary

Description	Value
MCMC iterations	12500
Burn-in	2500
MCMC sample size	10000
Number of obs	47
Acceptance rate	1
Efficiency: min	0.9593

Efficiency: avg	0.996
Efficiency: max	1
Log marginal-likelihood	-530.145

Table 2 shows 12,500 MCMC iterations, of which 2,500 were discarded as burn-in, leaving an MCMC sample size of 10,000 for inference. It indicate successful MCMC convergence. Model efficiency ranged from 0.9593 (minimum) to 1 (maximum), with an average of 0.996, suggesting highly efficient sampling.

Table 3 BVAR model estimation

Variable	Mean	Std. dev.	MCSE	Median	Lower 95 percent	Upper 95 percent
TNR						
TNR L1.	0.928461	0.072771	0.000728	0.928483	0.785568	1.071791
TNR L2.	0.002263	0.047321	0.000473	0.002275	-0.09137	0.095706
GDP L1.	-8.4E-06	6.58E-05	6.6E-07	-8.8E-06	-0.00014	0.00012
GDP L2.	-3.7E-05	6.04E-05	6E-07	-3.7E-05	-0.00016	8.35E-05
MVA L1.	0.026183	0.031628	0.000302	0.02622	-0.03577	0.088128
MVA L2.	-0.00172	0.021818	0.000218	-0.00185	-0.04457	0.041271
AFF L1.	0.004075	0.022341	0.000223	0.00052	-0.04386	0.043965
AFF L2.	-0.00518	0.016545	0.000165	-0.00513	-0.03761	0.027453
_cons	-0.34895	1.0112	0.010112	-0.35772	-2.28689	1.638948
GDP						
TNR L1.	25.69266	52.61891	0.526189	25.39221	-77.5239	130.1767
TNR L2.	15.77937	33.60947	0.336695	15.83927	-50.4282	81.01542
GDP L1.	1.009787	0.047164	0.000479	1.009679	-0.91714	1.102003
GDP L2.	-0.02203	0.043992	0.00044	-0.02175	-0.10857	0.065172
MVA L1.	27.61429	22.69936	0.220885	27.62246	-17.0637	72.14501
MVA L2.	9.1765	15.85668	0.158567	9.270788	-21.8766	40.33552
AFF L1.	5.175387	16.177	0.16177	5.271646	-26.365	36.72764
AFF L2.	1.244345	12.01955	0.121903	1.002015	-22.3016	24.94396
_cons	-933.09	723.0782	7.23078	-936.756	-2332.21	531.961
MVA						
TNR L1.	0.045427	1.141605	0.001416	0.046707	-2.33792	0.326745
TNR L2.	0.954155	0.896539	0.000897	0.05483	-1.19572	0.227329
GDP L1.	-0.00023	0.000129	1.3E-06	-0.00023	-0.00048	2.18E-05
GDP L2.	2.84E-05	0.000119	1.2E-06	-2.9E-05	-0.00021	0.00026
MVA L1.	0.91313	0.060887	0.000609	0.912745	-0.79258	1.031309
MVA L2.	-0.0037	0.042534	0.000425	-0.00394	-0.08769	0.080699
AFF L1.	-0.04661	0.045373	0.000436	-0.04623	-1.13384	0.036481
AFF L2.	-0.01822	0.031729	0.000317	-0.01819	-0.08033	0.044848
_cons	3.731717	1.953792	0.019538	3.731497	-12.6642	7.572885
AFF						
TNR L1.	0.216193	0.1936	0.001936	0.213808	-0.16419	0.60158
TNR L2.	0.021032	0.122293	0.00124	0.021115	-0.22015	0.262976
GDP L1.	-3E-06	0.000175	1.8E-06	-1.1E-06	-0.00035	0.000337
GDP L2.	3.64E-05	0.000161	1.6E-06	-3.5E-05	-0.00035	7.29E-05

Variable	Mean	Std. dev.	MCSE	Median	Lower 95 percent	Upper 95 percent
MVA L1.	-0.08461	0.083558	0.000821	-0.08461	-0.25094	0.079192
MVA L2.	-0.00213	0.058097	0.000581	-0.00214	-0.11555	0.111569
AFF L1.	-0.90646	0.059189	0.000592	-0.90663	-1.78887	1.02264
AFF L2.	-0.01609	0.043743	0.000437	-0.01713	-1.02483	0.070849
_cons	3.046735	2.662724	0.026307	3.066091	-2.21543	8.293798
Sigma_1_1	0.150167	0.03152	0.000315	0.146233	-0.10051	0.224173
Sigma_2_1	23.49857	16.02012	0.160201	22.82895	-6.63205	57.83788
Sigma_3_1	0.003957	0.04265	0.000427	0.003858	-0.08111	0.089071
Sigma_4_1	0.069427	0.058738	0.000596	0.066966	-0.04164	1.993349
Sigma_2_2	78742.47	16454.15	162.471	76651.85	53122.9	117611.3
Sigma_3_2	9.242575	31.21363	0.312136	8.487642	-51.3187	72.4976
Sigma_4_2	7.978422	42.51789	0.434107	7.45009	-75.4813	93.57116
Sigma_3_3	57.12283	120.0546	0.001201	0.556533	-380.689	850.0745
Sigma_4_3	2.011491	1.182817	0.001188	1.930653	-0.01168	4.565272
Sigma_4_4	1.054946	0.222227	0.002222	1.025258	-0.70097	1.569849

Table 3 presents the results of model estimation. The coefficients for the lagged values of TNR show a strong positive impact on its own future values with TNR L1. A mean coefficient of 0.928 and a 95 percent credible interval of [0.786, 1.072] indicates a persistent influence. TNR L2. has a minimal effect, with a near-zero coefficient. GDP is influenced by both TNR and its own past values. TNR L1. has a substantial positive impact on GDP, with a mean of 25.69 and a wide 95 percent interval of [-77.52, 130.18], suggesting some uncertainty. TNR L2. shows a smaller, though still positive, effect. The direct effect of GDP's own lag is small but significant with GDP L1. having a coefficient of 1.009 and GDP L2. contributing a slight negative effect (-0.022). For MVA, MVA L1. shows a strong self-reinforcing effect, with a coefficient of 0.913 and a credible interval of [0.793, 1.031], highlighting its importance in the model. However, MVA L2. has a minimal effect. TNR and GDP positively affect MVA, though TNR L2. has a stronger impact. AFF displays a significant negative self-influence with AFF L1, unlike the other sectors. having a mean of -0.906 and a credible interval of [-1.789, 1.023] indicates that past AFF values tend to suppress future values. The lagged values of GDP and MVA have a smaller and less consistent influence on AFF.

Table 4 stability

Index	Mean	Std. dev.	MCSE	Median	Companion matrix size = 8	
					MCMC sample size = 10000	
					Lower 95 percent	Upper 95 percent
1	0.99984	0.030083	0.000301	0.997098	0.947689	1.066786
2	0.987764	0.035464	0.000305	0.988197	0.925571	1.047556
3	0.935737	0.043669	0.000437	0.943937	0.826129	1.001402
4	0.7959	0.10445	0.001045	0.807723	0.566093	0.955335
5	0.108263	0.047372	0.000437	0.100147	0.051329	0.212917
6	0.078519	0.026193	0.000262	0.075908	0.034976	1.136818
7	0.05418	0.022367	0.000224	0.052513	0.015542	0.102215
8	0.030711	0.020278	0.000203	0.028362	0.001273	0.074762

Pr(eigenvalues lie inside the unit circle) = 0.5424

Table 4 provides the stability analysis for the Bayesian Vector Autoregression (BVAR) model by examining the eigenvalues of the companion matrix. The Pr(eigenvalues lie inside the unit circle) is

0.5424, confirming that most of the system's dynamics are stable over time. Figure 2 exhibits Impulse response analysis.

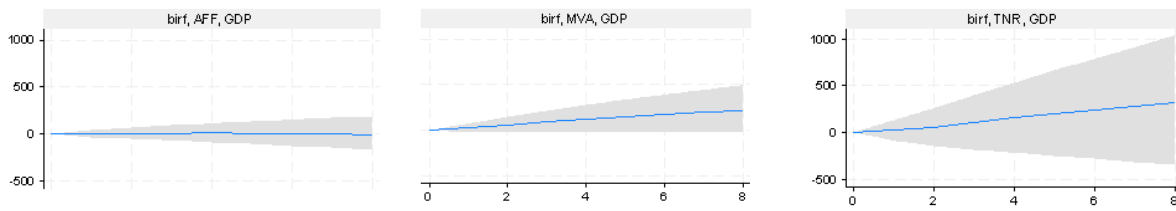


Figure 2 Impulse response analysis

Table 5 Variance decomposition

Step	(1)			(2)			(3)		
	irf	Lower	Upper	irf	Lower	Upper	irf	Lower	Upper
0	0	0	0	0	0	0	0	0	0
1	21.2211	-84.0666	126.114	26.6816	-18.9757	72.9546	3.61381	-30.828	38.041
2	59.0136	-139.881	257.702	59.6622	-22.3372	143.943	6.82196	-51.7811	67.1159
3	106.289	-179.833	393.564	93.879	-18.6594	211.698	9.96846	-68.241	91.8968
4	153.662	-216.143	526.229	124.909	-16.3609	277.053	10.5378	-86.894	114.332
5	199.977	-246.973	661.737	152.872	-15.2031	336.328	8.70098	-105.229	134.685
6	244.186	-279.338	792.123	177.963	-15.0438	391.347	4.8398	-124.854	151.761
7	285.269	-310.715	917.961	200.313	-16.9353	443.591	-	-	168.857
8	322.445	-345.016	1046.46	220.011	-18.3862	495.059	-	-	182.79

Posterior means reported. 95 percent equal-tailed credible lower and upper bounds reported.

(1) irfname = birf, impulse = TNR, and response = GDP, (2) irfname = birf, impulse = MVA, and response = GDP, (3) irfname = birf, impulse = AFF, and response = GDP.

Table 5 presents the variance decomposition analysis, illustrating how much of the forecast error variance in GDP is explained by shocks to TNR, MVA, and AFF over different time steps. Initially, at step 1, TNR has the largest impact, contributing 21.22 units to the variance in GDP, with a wide uncertainty range of [-84.07, 126.11]. This indicates that TNR shocks significantly influence GDP in the short run. By step 3, the influence of both TNR and MVA increases, with MVA contributing 93.88 units and a narrower uncertainty range of [-18.66, 211.70], suggesting that manufacturing plays a growing role in GDP variance over time. AFF's impact remains relatively modest throughout, peaking at 10.54 units in step 4, with larger uncertainty intervals. At step 8, TNR continues to dominate, contributing 322.45 units, while MVA and AFF play smaller roles. This indicates that, over the long term, TNR remains the most significant driver of GDP variance, while the contributions of MVA and AFF are smaller and less consistent. Figure 3 shows Variable Forecast.

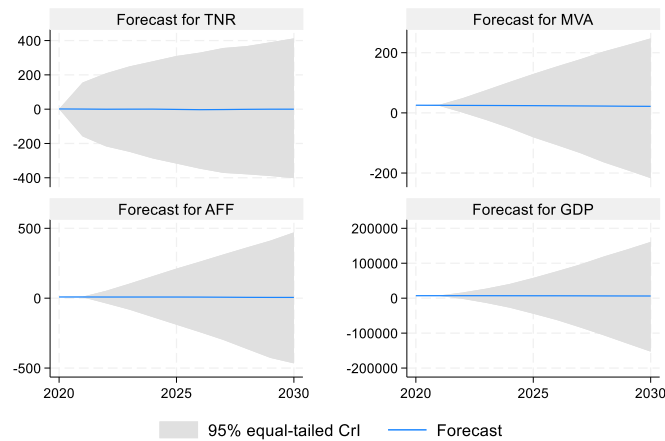


Figure 4 Variable Forecast

DISCUSSION

The findings underscore that natural resources, denoted by TNR, significantly and consistently contribute to Thailand's economic development, especially through their impact on GDP and the manufacturing sector. The VAR model demonstrates a significant positive influence of historical TNR values on future levels, underscoring the enduring importance of natural resource utilisation in determining economic results. This corresponds with classical economic theories that underscore the significance of natural resources as a basis for economic progress, especially in resource-abundant areas (Ricardo, 1821). This finding corroborates empirical research, such as Li et al. (2024), which observed that natural resource rents can substantially affect economic growth but with potential environmental harm. Nonetheless, the analysis indicates that although natural resources persist in propelling economic success, their impact is not consistently advantageous across all sectors. The moderate contribution of agriculture (AFF), indicated by its substantial negative self-influence in the model, may signify the restricted capacity of resource-intensive sectors such as agriculture to continue rapid growth absent technological innovation and sustainability initiatives. This conclusion aligns with the observations of Zhou et al. (2024), who contended that dependence exclusively on natural resources, without enhancing productivity or integrating green energy solutions, is ecologically unsustainable. It indicates that although natural resources are a fundamental catalyst for economic progress, their enduring effects must be meticulously controlled to prevent the dangers of excessive dependence. The findings also indicate that manufacturing (MVA) is a pivotal catalyst for Thailand's economic expansion, exhibiting robust self-reinforcing effects and beneficial influences from natural resource rents and GDP. The sector's ability to assimilate labour from lower-productivity industries, including agriculture, and its aptitude for technical innovation establish manufacturing as a pivotal element of economic progress. This corroborates the structural transformation theories posited by Lewis (1954) and Kuznets (1966), emphasising the significance of reallocating workers from agriculture to manufacturing during economic development. The positive feedback loop in the manufacturing sector corroborates Szirmai's (2012) claim that manufacturing had greater productivity growth potential than agriculture, functioning as the "engine of growth." Prior empirical research further substantiates the beneficial effect of manufacturing on economic growth. Sharma et al. (2024) contended that the manufacturing sector is crucial for industrialisation and economic development, highlighted by the significant beneficial impact of manufacturing on GDP noted in this study. Furthermore, the findings indicating that TNR positively influences MVA reinforces the notion that natural resources can be directed towards productive sectors such as manufacturing to foster comprehensive economic growth, contingent upon the efficient and sustainable use of these resources. The analysis reveals that, unlike the significant impact of the manufacturing sector, the contribution of agriculture, forestry, and fisheries to economic growth is comparatively restricted. The pronounced adverse self-impact noted for AFF suggests that historical agricultural performance typically hinders future growth in this industry. This indicates a comprehensive structural transition in which labour and resources transition from agriculture to more productive sectors, such as manufacturing, as delineated in Lewis's dual-sector model (1954). This transition is characteristic of developing economies undergoing industrialisation, propelled by the superior incomes

and productivity linked to manufacturing compared to agriculture. This discovery corresponds with the empirical research of Johnston and Mellor (1961), who acknowledged that although agriculture is essential for supplying food, labour, and capital for industrial development, its significance wanes as countries advance and transition to manufacturing-driven growth. The attenuated effect of AFF on GDP suggests that, although agriculture is fundamental, it does not propel long-term economic growth to the same degree as industry or natural resources. This emphasises the necessity for modernisation and productivity enhancements in agriculture, as Bian and Liu (2024) noted, who promoted sustainable agricultural models to improve productivity and guarantee long-term food security and economic stability.

POLICY IMPLEMENTATION

A variety of policy ideas can bolster economic stability and prosperity in Thailand. Essential policies must prioritise sustainable management of natural resources, economic diversification, and the advancement of value-added manufacturing. Efficient resource extraction procedures and effective regulatory frameworks are crucial for TNR. Strategies to enhance GDP should encompass investments in infrastructure, education, and the establishment of a business-friendly climate to draw international investment. Enhancing agricultural techniques and optimising supply chain efficiencies are essential in the farming business. Facilitating access to financing and technology for smallholder farmers will augment productivity. Advancing research and development, implementing cutting-edge manufacturing technology, and establishing special economic zones can stimulate growth in the manufacturing sector. A unified policy strategy acknowledging sectoral interdependencies is crucial for cultivating a resilient and thriving economy. Consistent monitoring and assessment of policies will guarantee their continued effectiveness and adaptability to emerging issues.

FUTURE RESEARCH

Future research may analyze the impact of technological innovations in agriculture, which may yield insights into how modernisation initiatives might improve productivity and economic resilience. It may explore the efficacy of various industrial strategies, especially those focused on enhancing research and development and advanced manufacturing technologies. In addition, integrating a wider array of economic indicators, including employment rates, income inequality, and environmental sustainability, could yield a more holistic understanding in this research area.

CONCLUSION

This research explores the dynamic interrelationships between agriculture, manufacturing, and income within Thailand's economy, using a Bayesian Vector Autoregression (BVAR) model and time-series data from 1972 to 2020. The study aimed to uncover how total natural resource rents (TNR), GDP per capita, manufacturing value-added (MVA), and agriculture, forestry, and fishing value-added (AFF) interact over time, influencing economic growth. Key findings indicated that TNR, representing the contribution of natural resources, plays a substantial role in shaping Thailand's economy, particularly in driving GDP and manufacturing growth. Natural resources showed a strong self-reinforcing effect, underlining their persistent influence on the country's economic outcomes. Manufacturing emerged as a critical engine for growth, characterized by positive self-reinforcing dynamics and benefiting significantly from TNR and GDP growth. In contrast, agriculture exhibited a negative self-influence, indicating a sectoral decline in its capacity to drive future growth. The results suggest that their impacts differ while natural resources and manufacturing are essential for economic development. The diminishing role of agriculture emphasizes the need for modernization and improved productivity within this sector. Policymakers are encouraged to focus on sustainable resource management, technological innovation, and support for manufacturing, ensuring that the economic benefits of these sectors are maximized without leading to environmental degradation.

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REFERENCES

- Bewley, R. (2002). Forecast accuracy, coefficient bias and Bayesian vector autoregressions. *Mathematics and Computers in Simulation*, 59(1–3), 163–169. [https://doi.org/10.1016/s0378-4754\(01\)00404-9](https://doi.org/10.1016/s0378-4754(01)00404-9)
- Partridge, M. D., & Rickman, D. S. (1998). Generalizing the Bayesian vector autoregression approach for regional interindustry employment forecasting. *Journal of Business & Economic Statistics*, 16(1), 62–72. <https://doi.org/10.1080/07350015.1998.10524735>
- Ghatak, A. (1998). Vector autoregression modelling and forecasting growth of South Korea. *Journal of Applied Statistics*, 25(5), 579–592. <https://doi.org/10.1080/02664769822837>
- Spulbăr, C. (2012). Monetary policy analysis in Romania: A Bayesian VAR approach. *African Journal of Business Management*, 6(36). <https://doi.org/10.5897/ajbm11.1150>
- Aprigliano, V. (2020). A large Bayesian VAR with a block-specific shrinkage: A forecasting application for Italian industrial production. *Journal of Forecasting*, 39(8), 1291–1304. <https://doi.org/10.1002/for.2687>
- Bhowmik, R., Bhowmik, R., Sharif, A., Anwar, A., Raza, S. Q., The Cong, P., & Ha, N. N. (2024). Does environmental policy stringency alter the natural resources-emissions nexus? Evidence from G-7 countries. *Geoscience Frontiers*, 15(5), 101874. <https://doi.org/10.1016/j.gsf.2024.101874>
- Bian, L., & Liu, Z. (2024). Sustainable rural economy and food security: An integrated approach to the circular agricultural model. *Quality Assurance and Safety of Crops & Foods*, 16(2), 65–80. <https://doi.org/10.15586/qas.v16i2.1450>
- Gong, X., & Aslam, M. U. (2024). The role of natural resources and economic development in evaluating the environmental effects of biofuel and waste energy generation in the group of BRICS. *Applied Energy*, 372, 123846. <https://doi.org/10.1016/j.apenergy.2024.123846>
- Huang, X., Cao, B., Cao, Y., Li, J., & Ren, Y. (2024). The temporal and spatial evolution characteristics of the ecosystem service value and conversion rate in China's key state-owned forest regions. *Forests*, 15(5), 781. <https://doi.org/10.3390/f15050781>
- Işık, C., Ongan, S., Bulut, U., Islam, H., & Irfan, M. (2024). Exploring how economic growth, renewable energy, internet usage, and mineral rents influence CO2 emissions: A panel quantile regression analysis for 27 OECD countries. *Resources Policy*, 92, 105025. <https://doi.org/10.1016/j.resourpol.2024.105025>
- Khan, T., Wei, L., Khan, A., Fahlevi, M., Aljuaid, M., & Ali, S. (2024). Economic expansion and innovation: A comprehensive analysis of Pakistan's path to technological excellence. *PLOS ONE*, 19(4), e0300734. <https://doi.org/10.1371/journal.pone.0300734>
- Lastauskaite, A., & Krusinskas, R. (2024). The impact of production digitalization investments on European companies' financial performance. *Economies*, 12(6), 138. <https://doi.org/10.3390/economies12060138>
- Nupehewa, S., Liyanage, S., Polkotuwa, D., Thiyagarajah, M., Jayathilaka, R., & Lokeshwara, A. (2022). More than just investment: Causality analysis between foreign direct investment and economic growth. *PLOS ONE*, 17(11), 1–28.
- Sharma, M., Vadalkar, S., Antony, R., Chavan, G., & Tsagarakis, K. P. (2024). Can Industry 4.0-enabled smart manufacturing help firms in emerging economies move toward carbon-neutrality? *Computers & Industrial Engineering*, 192, 110238. <https://doi.org/10.1016/j.cie.2024.110238>
- Wang, S., Xing, L., Chen, X., & Song, M. (2024). Evaluating and enhancing natural resource asset management efficiency in China: A data envelopment analysis study. *Resources Policy*, 92, 105000. <https://doi.org/10.1016/j.resourpol.2024.105000>
- Wang, Z., & Sibt-E-Ali, M. (2024). Financial globalization and economic growth amid geopolitical risk: A study on China-Russia far East federal district. *Heliyon*, 10(10), e31098. <https://doi.org/10.1016/j.heliyon.2024.e31098>
- Yang, E., & Smith, J. W. (2024). Tourism supply and demand in the gateway communities of southeastern Utah (USA). *Journal of Destination Marketing & Management*, 32, 100899. <https://doi.org/10.1016/j.jdmm.2024.100899>

Zhou, X., Mahalik, M. K., Patel, G., & Gozgor, G. (2024). Effects of green energy and productivity on environmental sustainability in BRICS economies: The role of natural resources rents. *Resources Policy*, 92, 105026. <https://doi.org/10.1016/j.resourpol.2024.105026>

DYNAMIC RELATIONSHIPS AND STRUCTURAL BREAKS IN TECHNOLOGY STOCKS

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ABSTRACT

The stock market plays a crucial role in economic development by enabling companies to raise capital and offering investors opportunities to grow wealth. The technology sector has become a driving force in modern financial markets. However, the relationship between stock market indices, such as the S&P 500, and stock prices in the technology sector, especially when accounting for structural breaks, remains underexplored. This research examines the long-term relationship between the S&P 500 index and average stock prices in the technology sector, incorporating the impact of structural breaks by using data from 2019 to 2024 downloaded from the Yahoo Finance website. The findings reveal that the technology sector has a significant long-term relationship with the S&P 500, with short-term fluctuations also affecting this market index. Thus, this research suggests that policymakers should prioritize policies that support technological innovation to encourage the stock market.

Keywords: stock market, technology sector, structural breaks, Gregory-Hansen cointegration, Error Correction Model

INTRODUCTION

The stock market is integral to the financial system and crucial for a country's economic development. It enables companies to raise capital by selling shares and provides investors with opportunities to buy and sell these securities (Arynova, 2021; Zvyagintseva & Markov, 2022). Its significance can be understood through several key aspects. It was recognized that the stock market acts as a macroeconomic regulator, attracting foreign and domestic capital (Arynova, 2021) and stimulating economic growth. It also provides investors and hedge funds diverse tools and opportunities to grow wealth and engage in the economy (Alsulmi et al., 2022). Additionally, the stock market is crucial for redistributing funds across different economic sectors (Arynova, 2021). Furthermore, it aids in price discovery and ensures that capital flows to the most productive sectors (Gnahe, 2021).

Understanding stock market trends and their long-term relationship with various variables offers significant benefits. Predicting these trends helps elucidate the stock market's operational laws and economic impact (Weng et al., 2022). This knowledge is pivotal for investors, policymakers, and economists in making informed decisions (Liyanapathirana & Ranasinghe, 2020). However, the relationship between the stock market and macroeconomic variables varies across different sectors. Understanding the long-term relationship between the stock market and various variables aids in economic forecasting, guides investors in decision-making, and enables policymakers to devise effective strategies.

To identify long-term relationships, researchers use various econometric techniques. The ARDL model, as used in Sarfraz et al. (2021) and Sreenu (2023), is a popular method for examining long-term and short-term relationships between variables. Other approaches include wavelet analysis (Das, 2021), panel data analysis (Amogha & Suresh, 2019), and quantile ARDL models (Hashmi et al., 2022). These methods allow researchers to analyze the complex interactions between factors and stock market performance over extended periods. Prior research has extensively explored the long-term relationship between the stock market and various economic factors. However, the relationship between stock market indices and stock prices remains under-investigated with only a few studies, e.g., a work by Yao et al.

(2010), who studied banks in China found a unidirectional causality relationship between most bank stock prices and the market index. Therefore, this gap provides an opportunity for further research.

In addition, structural breaks are paramount when examining the long-term relationship between stock markets and other economic variables. Structural breaks are vital as they can profoundly affect the stability and reliability of long-term relationships between economic variables. The work by Wilson et al. (1998) emphasizes that neglecting structural breaks in macroeconomic data series may lead to erroneous conclusions. Furthermore, Abdennadher and Hallara (2018) identify that structural breaks are normally presented in the volatility series of most emerging stock markets, noting substantial effects on volatility behavior. Acknowledging these structural breaks allows for considering major economic events, policy changes, or market shifts that may alter these relationships over time.

This research contributes to expanding knowledge in this field by testing the long-term relationship between stock and stock price in the technology sector by incorporating structural breaks in light of the limitations in studying the long-term relationship between the stock market and stock prices in technology sectors. The subsequent sections are organized as follows to achieve this objective. Section 2 explores the concepts related to this research. Section 3 outlines the research methodology. Finally, the results of the analysis and discussions will be presented.

LITERATURE REVIEWS

This section explores previous research on stock market dynamics, focusing on the significance of structural breaks in time series data. Various studies highlight how structural breaks influence long-term relationships, forecasting accuracy, and model performance in financial markets. Understanding these breaks is crucial for accurate economic and stock market analysis.

Structural breaks are points in time where the behavior of a time series significantly changes, affecting its statistical properties (Doerr et al., 2016). These breaks are crucial in various fields, including econometrics, hydrology, seismology, engineering, and medicine, as they can lead to inconsistent estimates and poor forecasts if not properly accounted for in modeling (Baragona et al., 2013). Structural breaks can have profound implications for economic and financial modeling. These breaks can occur in various aspects of the data, including mean, variance, and higher-order moments (Fu et al., 2022). One key characteristic of structural breaks is their ability to inflate the number of factors identified by information criteria in factor models (Breitung & Eickmeier, 2010). This can lead to misspecification and incorrect estimation of models if not properly accounted for. Structural breaks can also be mistaken for long-range dependence in time series (Sibbertsen, 2004). In addition, structural breaks can significantly impact forecasting accuracy and model performance. When present, the in-sample fit of a model may provide a poor guide to ex-ante forecast performance, affecting both univariate and multivariate analyses (Fernández-Serrano & Robles-Fernández, 2008). In GARCH processes, for example, structural breaks can lead to systematic over- or under-prediction of volatility in different volatility regimes (Sichert, 2019). Additionally, structural breaks can vary across different groups or entities in panel data, necessitating models that can capture heterogeneous break patterns (Okui & Wang, 2020).

Structural breaks in a time series can occur in various forms: 1) Breaks in mean or intercept: These happen when there's a sudden change in the average level of the series. For example, Eo (2012) discusses models allowing for breaks in the intercept of autoregressive processes. Similarly, Check and Piger (2021) mention evidence of reductions in trend growth rates of production series, which can be interpreted as breaks in the mean. 2) Breaks in variance: These involve changes in the series' volatility. Eo (2012) supports an autoregressive model with two structural breaks in residual variance for postwar U.S. inflation. Check and Piger (2021) also report pervasive evidence for breaks in variance parameters across various macroeconomic time series. 3) Breaks in persistence: These refer to changes in the autoregressive structure of the series. Check and Piger (2021) notes strong evidence of changes in persistence for the price inflation series. Eo (2012) also allows for breaks in persistence parameters in its proposed model. 4) Multiple parameter breaks: Some models allow for simultaneous breaks in multiple parameters. Eo (2012) proposes a method that allows multiple parameters, such as intercept, persistence, and residual variance, to undergo mutually independent structural breaks at different dates. 5) Breaks in covariance/correlation structure (Aue & Horváth, 2012).

Structural breaks significantly affect various aspects of economic and financial analysis, as highlighted by multiple studies. These breaks can impact cointegrating relationships, market efficiency, causalities, and forecasting performance in oil prices (Chen et al., 2014). In stock and oil returns, accounting for

structural breaks within asymmetric GARCH models reduces volatility persistence and alters the impact of good and bad news on current volatility (Ewing & Malik, 2017; Ghoddusi et al., 2020; Kartsonakis-Mademlis & Dritsakis, 2020). Remarkably, the impact of structural breaks can vary across different contexts. For instance, in the Spanish interbank money market, the effects of structural breaks on forecasting accuracy were found to be relatively weak (Fernández-Serrano & Robles-Fernández, 2008). However, in the case of Bitcoin prices, incorporating structural breaks significantly reduced the half-life of volatility shocks from 319 to 34 days (Ghoddusi et al., 2020). Similarly, accounting for structural breaks in oil prices revealed that both good and bad news have a more substantial impact on volatility than previously estimated (Ewing & Malik, 2017). Also, structural breaks can affect the stability of relationships between variables, such as energy consumption and GDP (Lee & Chang, 2005), and influence the interpretation of common factors in factor models (Breitung & Eickmeier, 2009). Ignoring structural breaks may lead to biased analysis, overestimation of volatility persistence, and incorrect estimation of the impact of news on volatility (Ewing & Malik, 2017; Ghoddusi et al., 2020).

Several methods have been developed to identify and test for structural breaks, including CUSUM-based statistics, F-based statistics proposed by Bai and Perron, and empirical likelihood ratio statistics (Baragona et al., 2013). Additionally, specialized tests like the Perron tests have been designed to examine the level of integration in time series with one or two structural breaks, particularly useful for analyzing macroeconomic processes in transitional economies (Rybinski, 1997).

In financial time series, structural breaks are commonly observed in asset returns and volatility (Andreou & Ghysels, 2007). For instance, precious metal prices such as gold, silver, rhodium, palladium, and platinum have shown evidence of structural breaks, with changes in persistence and long-memory properties (Gil-Alana et al., 2015). Similarly, stock prices, like those of the American International Group, have experienced structural breaks (Cappelli et al., 2020). Structural breaks are not limited to financial data. They can also occur in macroeconomic time series, such as production series showing reductions in trend growth rates (Check & Piger, 2021). In New Zealand, structural breaks were detected in the Quarterly Gross Domestic Product data (Cappelli et al., 2008). Natural resource price series have also exhibited multiple structural breaks (Balcombe et al., 2011).

METHODOLOGY

The Gregory-Hansen Cointegration Test is a statistical method used to examine long-run relationships between variables while accounting for potential structural breaks in the data. This test extends traditional cointegration analysis by allowing for regime shifts or structural changes in the cointegrating relationship (Lucey & Voronkova, 2008; Yavuz, 2013). The test is particularly useful when standard cointegration tests, such as the Engle-Granger or Johansen, fail to detect cointegration due to structural breaks. The Gregory-Hansen test can identify cointegration with regime shifts in the relationship's intercept, slope, or time trend (Villanueva, 2005). This makes it more robust when economic or financial time series data may have experienced significant changes or breaks over time. One of the key advantages of the Gregory-Hansen test is its ability to simultaneously estimate the unknown breakpoint and test for cointegration (Schweikert, 2019). This feature allows researchers to identify both the existence of a long-run relationship and the timing of potential structural changes in that relationship. The test has been applied in various fields, including environmental economics (Yavuz, 2013; Yurtkuran, 2021), financial markets (Lucey & Voronkova, 2008; Miyazaki & Hamori, 2014), and international economics (Narayan & *, 2004; Narayan, 2010).

The Error Correction Model (ECM) is a statistical technique used in time series analysis to examine the short-run and long-run relationships between variables. It is particularly useful when dealing with non-stationary data and cointegrated variables. The Error Correction Model was applied in, e.g., Mensah and Arku (2024), which examined the factors contributing to external debt growth in Ghana. The study used both the autoregressive distributed lag (ARDL) model and the ECM to establish short-run and long-run relationships between external debt and various independent variables such as debt service, exchange rate, GDP, government expenditure, import, and trade openness. The ECM allowed the researchers to analyze how these variables influenced external debt over time, considering both immediate and delayed effects. The ECM is also used in other contexts. For instance, in Zhang et al. (2024), an error correction module (ECM) was proposed as part of an enhanced denoising algorithm for ice-covered transmission line images.

This research uses the Gregory-Hansen cointegration test to determine whether a long-run cointegrating relationship exists between the SPX and TSA while accounting for potential structural breaks in the

data. For this research, the Gregory-Hansen cointegration test is applied using three model specifications, i.e., the structural break represented by a change in the intercept, change in level and trend and change in regime. In addition, this research employs ECM to elaborate the long-run relationship between these two variables.

The Gregory-Hansen model tests for cointegration (Gregory & Hansen, 1996) with possible regime shifts, and can be formulated in three forms as follows:

Level Shift Model:

$$Y_t = \alpha_1 + \alpha_2 D_t(\tau) + \beta X_t + \dot{\epsilon}_t,$$

where Y represents SPX, X_t represents TSA, and $D_t(\tau)$ is a dummy variable that shifts from 0 to 1 after the structural breakpoint τ .

Level Shift with Trend Model:

$$Y_t = \alpha_1 + \alpha_2 D_t(\tau) + \gamma t + \beta X_t + \dot{\epsilon}_t$$

where t represents a linear time trend.

Regime Shift Model:

$$Y_t = \alpha_1 + \alpha_2 D_t(\tau) + \beta_1 X_t + \beta_2 X_t D_t(\tau) + \dot{\epsilon}_t$$

The general form of the ECM (Engle & Granger, 1987). used in this study can be written by:

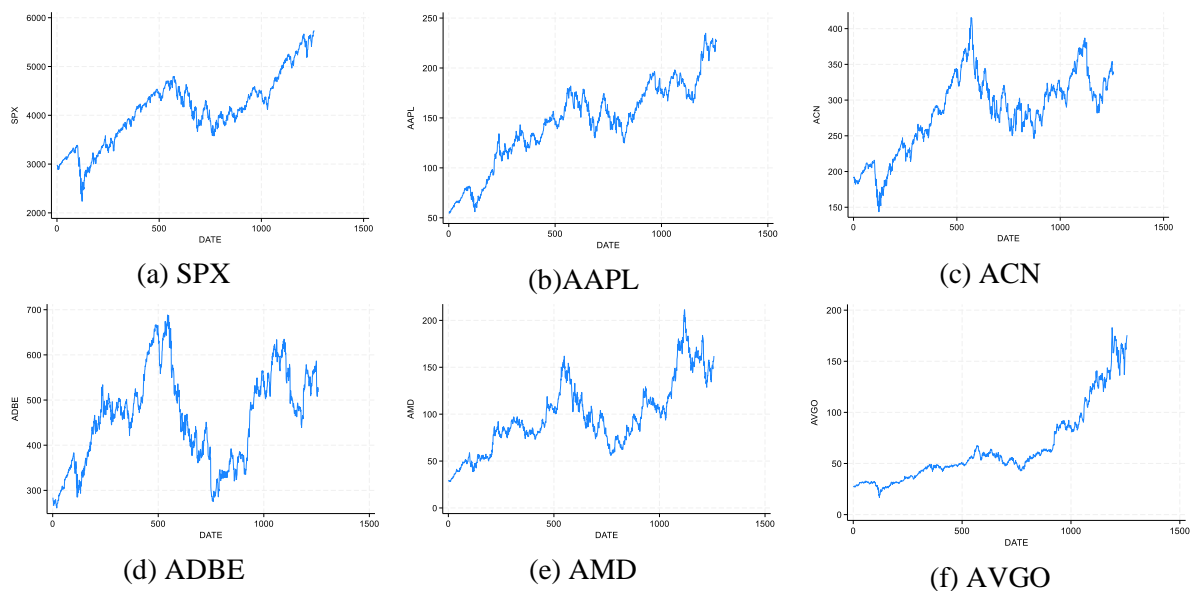
$$\Delta Y_t = \alpha + \sum_{i=1}^p \beta_i \Delta X_{t-i} + \lambda(ECT_{t-1}) + \dot{\epsilon}_t$$

where ΔY represents the change in the SPX at time t , ΔX_{t-i} represents changes in the TSA with a lag of i , λ is the adjustment coefficient representing how fast the system corrects to the long-run equilibrium, ECT_{t-1} is the error correction term from the long-run equilibrium relationship identified by the Gregory-Hansen cointegration test, and $\dot{\epsilon}_t$ is the error term.

This research utilizes daily data from Yahoo Finance for the period between 09/26/2019 and 09/25/2024, focusing on the stock prices of 10 major technology companies: AAPL (Apple Inc.), ACN (Accenture plc), ADBE (Adobe Inc.), AMD (Advanced Micro Devices, Inc.), AVGO (Broadcom Inc.), CRM (Salesforce, Inc.), CSCO (Cisco Systems, Inc.), MSFT (Microsoft Corporation), NVDA (NVIDIA Corporation), and ORCL (Oracle Corporation). These stock prices are used to calculate the Technology Sector Average (TSA). In addition, the S&P 500 Index (SPX) is employed as a representative of the broader stock market.

RESULT AND DISCUSSION

This section presents the findings derived from the analysis of average price of stocks in the technology sector and its relationship with market indices. Figure 1 express the time series plot of SPX and Stock Prices for Selected Technology Companies.



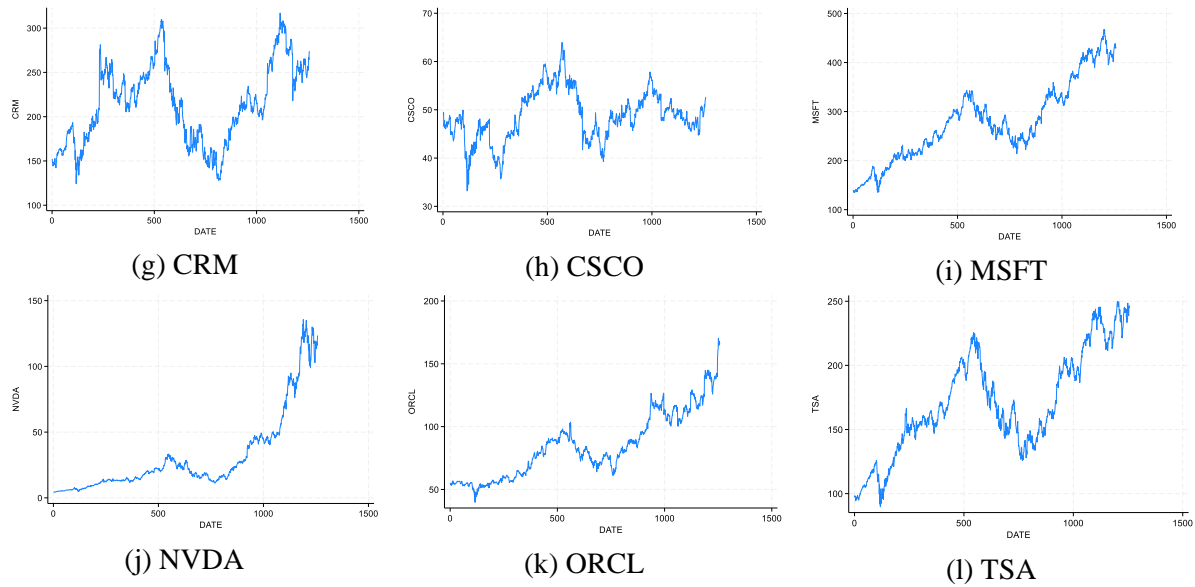


Figure 1 Time Series Plot of SPX and Stock Prices for Selected Technology Companies

Table 1 descriptive statistics

Variable	Obs	Mean	Std. dev.	Min	Max
SPX	1,258.000	4,109.306	705.057	2,237.400	5,732.930
AAPL	1,258.000	144.976	41.442	54.705	234.820
ACN	1,258.000	283.720	54.300	143.690	415.420
ADBE	1,258.000	461.870	103.327	261.090	688.370
AMD	1,258.000	97.878	37.449	28.230	211.380
AVGO	1,258.000	65.117	36.824	16.787	182.887
CRM	1,258.000	213.835	44.758	124.300	316.880
CSCO	1,258.000	48.741	5.174	33.200	63.960
MSFT	1,258.000	279.448	80.244	134.650	467.560
NVDA	1,258.000	31.443	30.813	4.294	135.580
ORCL	1,258.000	84.919	26.104	39.800	170.330
TSA	1,258.000	171.195	40.041	89.765	249.887

Table 1 shows that the S&P 500 Index (SPX) has an average value of 4,109.31 and a relatively high standard deviation of 705.06, indicating significant fluctuations in its value over the observed period. The minimum value of the index is 2,237.40, while the maximum value reaches 5,732.93, showcasing a broad range of variation in the index's performance. For the Technology Sector Average (TSA), it has a mean value of 171.20 with a standard deviation of 40.04, ranging from a minimum of 89.77 to a maximum of 249.89.

Table 2 Cumulative sum test for parameter stability

Type	Test statistic	Critical value		
		1%	5%	10%
Recursive	5.4474	1.143	0.9479	0.8499

Table 2 presents the results of the Cumulative Sum (CUSUM) test for parameter stability. Since the test statistic (5.4474) is much higher than the critical values at all significance levels, it indicates a significant instability in the model's parameters over the sample period.

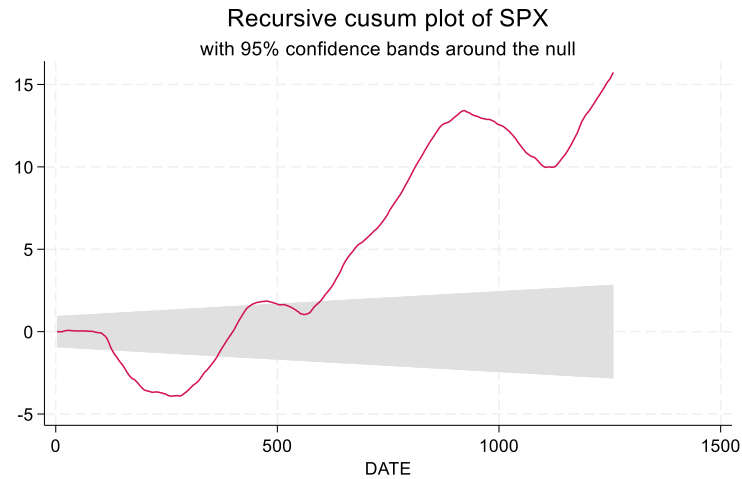


Figure 2 Recursive CUSUM plot

Figure 2 displays the Recursive CUSUM plot. It suggests that the parameters have become unstable.

Table 3 Gregory-Hansen Test for Cointegration with Regime Shifts (Model: Change in Level)

Test	Statistic	Breakpoint	Date	Asymptotic Critical Values (1%)	Asymptotic Critical Values (5%)	Asymptotic Critical Values (10%)
ADF	-2.22	336	336	-5.13	-4.61	-4.34
Zt	-2.3	337	337	-5.13	-4.61	-4.34
Za	-12.24	337	337	-50.07	-40.48	-36.19

Table 4 Gregory-Hansen Test for Cointegration with Regime Shifts (Model: Change in Level and Trend)

Test	Statistic	Breakpoint	Date	Asymptotic Critical Values (1%)	Asymptotic Critical Values (5%)	Asymptotic Critical Values (10%)
ADF	-3.01	656	656	-5.45	-4.99	-4.72
Zt	-2.92	664	664	-5.45	-4.99	-4.72
Za	-17.67	664	664	-57.28	-47.96	-43.22

Table 5 Gregory-Hansen Test for Cointegration with Regime Shifts (Model: Change in Regime)

Test	Statistic	Breakpoint	Date	Asymptotic Critical Values (1%)	Asymptotic Critical Values (5%)	Asymptotic Critical Values (10%)
ADF	-2.48	289	289	-5.47	-4.95	-4.68
Zt	-2.43	290	290	-5.47	-4.95	-4.68
Za	-14.18	290	290	-57.17	-47.04	-41.85

Table 3, Table 4, and Table 5 show the Gregory-Hansen cointegration. The change in level and trend model appears to be the most promising model for analyzing long-run relationships with structural breaks. Figure 3 shows the breakpoint.

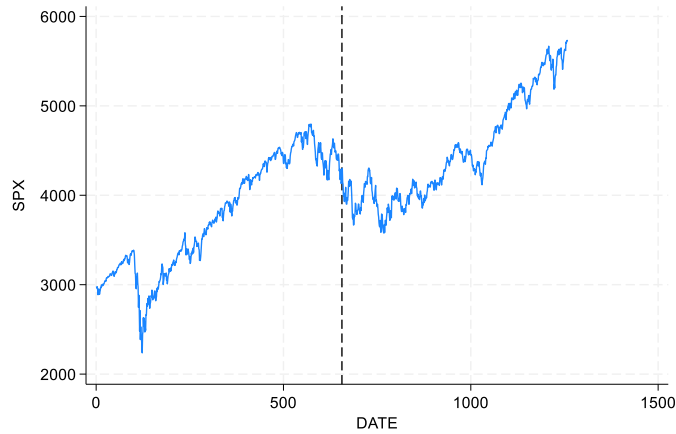


Figure 3 The breakpoint

Table 6 Lag-order selection criteria PSX

Lag	LL	LR	df	p	FPE	AIC	HQIC	SBIC
0	-	-	-	-	-	15.950	15.952	15.954
	9,999.620				494,885.000			
1	-	-	1.000	0.000	2,287.550	10.573	10.576	10.581
	6,627.340	6,744.600						
2	-	11.808*	1.000	0.001	2,269.720	10.565	10.570*	10.578*
	6,621.440							
3	-	3.384	1.000	0.066	2267.220*	10.564*	10.570	10.581
	6,619.750							
4	-	0.352	1.000	0.553	2,270.200	10.566	10.573	10.586
	6,619.570							

Table 7 Lag-order selection criteria TSA

Lag	LL	LR	df	p	FPE	AIC	HQIC	SBIC
0	-6,401.170	-	-	-	-	10.211	10.212	10.215
					1,592.280			
1	-3,088.450	6,625.400	1.000	0.000	8.094	4.929	4.932	4.937*
2	-3,086.290	4.323*	1.000	0.038	8.079*	4.927*	4.932*	4.939
3	-3,086.100	0.382	1.000	0.537	8.089	4.928	4.935	4.945
4	-3,085.610	0.987	1.000	0.321	8.096	4.929	4.937	4.950

Table 6 and Table 7 show that the optimal lag for PSX and TSA is 2 lags.

Table 8 Estimate the ECM with breakpoint

	D.SPX	Coefficient	Std. err.	t	P>t	[95% conf. interval]
ADJ						
	SPX					
	L1.	- 0.007	0.004	- 2.010	0.044	- 0.014 - 0.000
LR						
	TSA	21.577	4.513	4.780	0.000	12.723 30.432
	z	185.548	973.277	0.190	0.849	-1,723.892 2,094.987
	z_TSA	- 0.800	5.450	- 0.150	0.883	- 11.492 9.891
SR						
	SPX					
	LD.	0.007	0.028	0.250	0.806	- 0.049 0.063
	TSA					

D.SPX	Coefficient	Std. err.	t	P>t	[95% conf. interval]
D1.	14.205	0.256	55.480	0.000	13.703 14.708
LD.	- 0.379	0.477	- 0.800	0.427	- 1.315 0.556
_cons	3.357	5.970	0.560	0.574	- 8.355 15.069

Table 8 presents the estimates of the Error Correction Model (ECM) with a breakpoint. The error correction term (L1. SPX) has a coefficient of -0.007, which is statistically significant at the 5 percent level (p-value = 0.044). This negative coefficient indicates that any deviations from the long-run equilibrium are corrected over time at a rate of approximately 0.7 percent per period. In other words, the system slowly adjusts to equilibrium after a shock, showing that the SPX reverts toward its long-run relationship with the TSA. For the long-run relationship, the Technology Sector Average (TSA) coefficient is highly significant, with a value of 21.577 (p-value = 0.000). This suggests a strong positive relationship between the SPX and TSA in the long run. In terms of short-run dynamics, the first-differenced TSA (D1. TSA) also has a highly significant coefficient of 14.205 (p-value = 0.000), indicating that short-run changes in TSA have an immediate and strong positive effect on the SPX. Figure 4 shows the Recursive CUSUM plot for D.SPX.

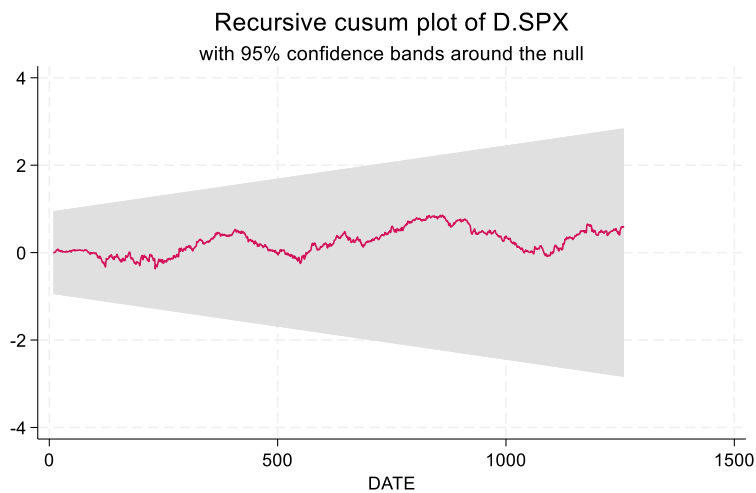


Figure 4 Recursive CUSUM plot for D.SPX

This result reinforces the findings from previous studies; the Error Correction Model (ECM) used in this study highlights that the Technology Sector Average (TSA) shows a strong positive relationship with SPX, confirming the role of the technology sector as a key driver of market performance and vice versa. This result is in line with Arynova (2021), who stressed that the stock market functions as a macroeconomic regulator, with certain sectors, such as technology, playing a pivotal role in attracting capital and driving growth, which typically encourages the stock market. Moreover, the short-run dynamics revealed by the ECM demonstrate that changes in the TSA have an immediate and significant impact on the SPX, underscoring the technology sector's influence on market fluctuations, as previously suggested by Chen et al. (2014).

POLICY IMPLICATION

The findings of this analysis have important policy implications, particularly for regulators, investors, and policymakers concerned with the stability and performance of the stock market, especially in the technology sector. Given the significant influence of the technology sector on the broader market policies aimed at fostering innovation and growth within this sector can have widespread economic benefits. Policymakers should prioritize creating a conducive environment for technological advancements, including investing in research and development, providing tax incentives, and supporting startups, as these measures could lead to enhanced market performance.

FUTURE RESEARCH

Future research could explore the effects of structural breaks on other sectors beyond technology, such as healthcare or energy, to assess whether similar long-run relationships exist between these sectors and the broader market. As this study relied on the Gregory-Hansen cointegration test to account for

structural breaks. Future studies could benefit from applying more advanced econometric techniques, such as Threshold Autoregressive (TAR) models or Markov-switching models, to capture more nuanced shifts in market relationships over time. These methods could offer a deeper understanding of how different types of structural breaks, such as policy changes or global events, impact market dynamics.

CONCLUSION

The stock market is an integral component of economic growth, with specific sectors, such as technology, serving as key drivers for attracting both domestic and foreign capital. This study aimed to explore the long-term relationship between stock prices in the technology sector and market indices while accounting for potential structural breaks. This study utilized the Gregory-Hansen cointegration test. The analysis drew on daily stock price data of prominent technology companies collected between 2019 and 2024 from Yahoo Finance. By employing three model specifications (change in level, change in trend, and full regime shift), the results confirmed that the technology sector substantially impacts the S&P 500. The significant findings from the Error Correction Model (ECM) indicate that deviations from long-run equilibrium are corrected slowly, and changes in the technology sector have both immediate and lasting effects on the broader market. The study found that short-term fluctuations in the technology sector are positively associated with the S&P 500, with the ECM showing that TSA (Technology Sector Average) had a positive and statistically significant effect on SPX in both the short and long term. Thus, this research suggests that policymakers should prioritize the technology sector when designing economic policies, as it significantly influences overall market performance.

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REFERENCE

- Abdennadher, E., & Hallara, S. (2018). Structural breaks and stock market volatility in emerging countries. *International Journal of Business and Research Management*, 1(1), 9–16. <https://doi.org/10.12691/ijbrm-1-1-2>
- Alsulmi, M., Al-Shahrani, N., & Ali, R. (2022). Machine learning-based decision-making for stock trading: Case study for automated trading in Saudi stock exchange. *Scientific Programming*, 2022, 1–14. <https://doi.org/10.1155/2022/6542862>
- Amogha, S., & Suresh, N. (2019). An empirical study of financial ratios affecting stock returns in the Indian stock market. *Journal of Engineering and Applied Sciences*, 14(3), 975–980. <https://doi.org/10.36478/jeasci.2019.975.980>
- Arynova, Z. A. (2021). Main trends in the development of the Kazakh securities market. *Bulletin of the Innovative University of Eurasia*, 84(4), 35–45. <https://doi.org/10.37788/2021-4/35-45>
- Baragona, R., Battaglia, F., & Cucina, D. (2013). Empirical likelihood for break detection in time series. *Electronic Journal of Statistics*, 7, 1906–1928. <https://doi.org/10.1214/13-ejs873>
- Breitung, J., & Eickmeier, S. (2010). Testing for structural breaks in dynamic factor models. *Journal of Econometrics*, 157(2), 301–312. <https://doi.org/10.1016/j.jeconom.2009.12.003>
- Chen, P. F., Lee, C. C., & Zeng, J. H. (2014). The relationship between spot and futures oil prices: Do structural breaks matter? *Energy Economics*, 43, 206–217. <https://doi.org/10.1016/j.eneco.2014.03.006>
- Das, S. (2021). The impact of macroeconomic variables on the stock market in India: Evidence from a wavelet approach. *Economic Modelling*, 95, 72–85. <https://doi.org/10.1016/j.econmod.2020.11.010>
- Doerr, B., Fischer, P., Hilbert, A., & Witt, C. (2016). Detecting structural breaks in time series via genetic algorithms. *Soft Computing*, 21(16), 4707–4720. <https://doi.org/10.1007/s00500-016-2079-0>
- Engle, R. F., & Granger, C. W. J. (1987). Co-integration and error correction: Representation, estimation, and testing. *Econometrica*, 55(2), 251–276. <https://doi.org/10.2307/1913236>

- Eo, Y. (2012). Bayesian inference about the types of structural breaks when there are different breaks in many parameters. *SSRN Electronic Journal*. <https://doi.org/10.2139/ssrn.2011825>
- Fernández-Serrano, J. L., & Robles-Fernández, M. D. (2008). Time-series model forecasts and structural breaks: Evidence from Spanish pre-EMU interest rates. *Applied Economics*, 40(13), 1707–1721. <https://doi.org/10.1080/00036840600895640>
- Gregory, W., & Hansen, E. (1996). Residual-based tests for cointegration in models with regime shifts. *Journal of Econometrics*, 70(1), 99–126.
- Liyanapathirana, B. J., & Ranasinghe, R. P. K. C. M. (2020). Stock market measures and market performance. *Journal of Economic Science Research*, 3(2). <https://doi.org/10.30564/jesr.v3i2.1672>
- Lucey, B. M., & Voronkova, S. (2008). Russian equity market linkages before and after the 1998 crisis: Evidence from stochastic and regime-switching cointegration tests. *Journal of International Money and Finance*, 27(8), 1303–1324. <https://doi.org/10.1016/j.jimonfin.2008.07.004>
- Sarfraz, S., Ahmad, M., & Husnain, M. (2021). Long run and short run co-movement among oil prices and stock market liquidity: Evidence from the emerging equity market of Pakistan. *Sustainable Business and Society in Emerging Economies*, 3(3), 231–241. <https://doi.org/10.26710/sbsee.v3i3.1913>
- Sichert, T. (2019). Structural breaks in GARCH processes do matter. *SSRN Electronic Journal*. <https://doi.org/10.2139/ssrn.3486536>
- Wilson, P. J., Okunev, J., & Webb, J. J. (1998). Step interventions and market integration: Tests in the U.S., U.K., and Australian property markets. *The Journal of Real Estate Finance and Economics*, 16(1), 91–123. <https://doi.org/10.1023/a:1007741516833>
- Yao, S., Luo, D., & Morgan, S. (2010). Bank share prices and stock market integration in Greater China. *Journal of the Asia Pacific Economy*, 15(4), 388–395. <https://doi.org/10.1080/13547860.2010.516152>

TOBACCO GROWTH IMPROVEMENT BY INDOLE ACETIC ACID (IAA) FOR THE CONTROL OF SOIL ORGANIC POLLUTION

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Abstract

To improve the growth of tobacco (*Nicotiana tabacum*) seedlings by Indole Acetic Acid (IAA) hormone was the reason behind this study. Seedlings of *N. tabacum* treated with equal quantities of IAA hormone (0.7%) were grown in 1kgs of vermiculate, perlite, planting soil, sand, and equal mixture of all media. The set up were treated equally with water and organic manure. Control set up was made with a mixture of different rooting media without IAA. Data on shoot development were noted for 6 weeks and root length was measured on the day of harvest. The parameters measured were analysed statistically using ANOVA, and it was found out that root and shoot lengths were significant at $p>0.05$ in the entire rooting media and the highest percentage development (49 and 51%) respectively for root and stem respectively, was observed in the rooting media that has equal measure of each constituent (i.e. the mixed constituents). Germination rate among the media were 100, 70, 60, 50 and 40% for mixed, sand, planting soil and vermiculate, perlite and control respectively. Different sections of mature stem tested with IAA hormone were not significant in their root and stem development, although basal cutting stems tend to mature faster than epical. This therefore means that propagating *N. tabacum* by seedlings can be optimally achieved through mixture of 0.7% of IAA in a collection of different rooting media.

Key words: *Nicotiana tabacum*, Indole Acetic acid, Root formation, Rooting media, Growth enhancement

1.0 Introduction

Tobacco is an important commercial and agricultural plants growth in several part of the globe because of its economic need. This is a plant with a common name of several plants in the genus *Nicotiana* of the family *Solanaceae*, and the general term for any product prepared from the cured leaves of these plants. More than 70 species of tobacco are known, but the chief commercial crop is *Nicotiana tabacum*. (Singh *et al.* 2009). Tobacco is a plant (*Nicotiana tabacum* and *Nicotiana rustica*) that contains nicotine, an addictive drug with both stimulant and depressant effects. Tobacco leaves are used to make products that can be consumed in different ways: smoked in cigarettes, cigars or pipes. smoked in loose form in hookahs. All forms of tobacco are harmful, and there is no safe level of exposure to tobacco. Cigarette smoking is the most common form of tobacco use and the reason is because it contains nicotine because of the highly addictive stimulant alkaloid nicotine as well as harmful alkaloids. Tobacco use is a cause or risk factor for many deadly diseases, hence is always advised that tobacco smoking is dangerous to health.

Indole acetic acid (IAA) is the main auxin in plants, regulating growth and developmental processes such as cell division and elongation, tissue differentiation, apical dominance, and responses to light, gravity, and pathogens. IAA stimulates overproduction of root hairs and lateral roots in plants and release of saccharides from plant cell walls during the elongation (Sosnowski *et al.* 2023). Saccharides are a source of nutrients for microorganisms and can increase the colonization ability of plant-associated bacteria, this is because IAA production is a major property of rhizosphere bacteria that stimulate and facilitate plant growth. Indoleacetic acid (IAA) is a molecule that is synthesized by plants and a few microbes (Ansari *et al.* 2023). In plants, IAA plays a key role in both root and shoot development. The hormone moves from one part of the plant to another by a designated importer (AUX1) and efflux pumps (PIN1–7). IAA also regulates geotropism by accumulating on the underside of shoots and roots. In shoots, IAA causes cell elongation on the underside of the shoot, causing it to bend upwards, away from

the force of gravity. In roots, IAA inhibits cell growth, causing roots to grow downwards, towards the force of gravity.

The medicinal properties of plants lie in their phytochemical components like alkaloids, flavonoids, tannins in addition to other phenolics that co-opt as to producing definite physiological functions to the body of man and animals (Taiwo et al. 2000; Che Man 2010). However, analysis of extracts of *N. tabacum* were found to be rich in flavonoid and flavonones, triterpene, terpenic compounds, chalcone, steroids as well as peroxidase isoenzymes (Anup et al. 2011; Anyasi et al. 2019; Raymond Anyasi and Anyasi, 2020). It is also rich in carbohydrates, high content of total proteins in addition to high percentage of nitrogen. All these contribute to the high phytochemical properties of the plant. *N. tabacum* is therefore grown as a medicinal plant for the treatment of skin wounds especially in Indonesia (Metwally and Ekejuba 1981; Phan et al. 1996). In South Africa for example, the leaf of *N. tabacum* is used for the production of tobacco by the tobacco companies. However, because everyone deserves a fair and just opportunity to be as healthy as possible, this is known as health equity. Therefore, achieving health equity means addressing system-wide problems, unfair practices, and unjust conditions that have a negative impact on the health of specific groups. To achieve health equity, it is important to eliminate health disparities which are differences in health outcomes that are closely linked with social, economic, and/or environmental factors, that affect the entire people of the globe (Taiwo et al, 2000). To improve health equity, we must consider the role of commercial tobacco (Phan et al. 1996; Akinmoladun et al., 2007; Anup et al., 2011). *N. tabacum* has also been implicated by its diuretic, hepatotropic and astringent properties (Weninger and Robenean 1988; Iwu 1993).

N. tabacum can be propagated mainly by seeds, this is one of the significant agronomic properties of the plant (Tanhan et al., 2007; Anyasi et al. 2019). However, it has been reported that germination of seeds from weeds are most likely affected by soil compositions especially in the field study, therefore such propagation is aided by agronomic factors that enhances the growth and multiplication of such plant (Adebayo et al., 2005; Agbo and Obi 2007). Moreover, as some other types of propagation such as stem cuttings propagation prolongs hybridization of genome as segregation through recombinant gene is avoided, this may not be possible in some plants for example in the tobacco plant we are studying.

The success of rooting has been attributed amongst other factors to the rooting medium as well as the presence of rooting hormone and its concentration (Al-Saqri and Alderson 1996; Hartmann et al. 1997). Influences of rooting media and hormone on rooting in different kinds of plant have been documented and its effects in structure propagations were elucidated (Akwatulira et al. 2011). These media combination used in the rooting of the seedlings provide physical support as well as oxygen and water to the plant seeds (Larsen and Guse 1997). However, IAA; an auxin containing product was reported to stimulate adventitious roots in of some plants (Araya et al. 2007). This was buttressed by the study by Rao et al. (2005) which reported that IAA was the leading plants hormone used to promote the formation of roots in Tomatoes. Hence with the quest for a systematic search for specific useful factors from plants like *N. tabacum*, even though most plants can root without hormone, there is need for an improved method of propagation and growth for such nutraceutical plants. This will therefore form a rational approach towards drug and nutritional research. The aim of this study was to evaluate the effect of IAA hormone and rooting media for optimal rooting of propagated *N. tabacum*.

2.0 Materials and methods

Seeds of *N. tabacum* plants was collected from the greenhouse at the University of South Africa in Pretoria (25°46'1"S, 28°12'2"E) and 1439m above sea level. The experiment took place in polyvinyl chloride (PVC) pots with dimensions 30x25x30 at a garden at the University of South Africa at Florida Campus. The pots contain 1kgs of different rooting medium that has been mixed with equal volume of organic manure collected at the animal farm of the University of Pretoria in Onderstepoort. Inside each pot was made holes designed to contain equal weight of IAA hormone (0.7%), for the plants. The set up was made in a complete randomized design containing a 3x4 factorial treatment model (Jeruto et al. 2008). The rooting media used here were planting soil and humus in the ration of 2:1 (w/w). About thirty-six plantlets were used in each set of rooting media and IAA hormone concentration by volume percentage. Then sets of water treated seedlings were sawn into holes containing the IAA hormone in the rooting media and were replicated by three. Random allocation of plant seedlings to the rooting media using random digit from a table was employed as to eliminate bias (Johnson and Bhattacharyya 2006).

2.1 Rooting media

The rooting media was homogenized by hand, mixed with equal volume of organic manure and air dried on an impervious polythene sheet for 24 hours, there were pasteurized and fumigated, measured into the PVC pots with the hole containing about 0.7% of IAA hormone. This concentration was chosen because of its optimum performance from other unpublished trials.

2.2 Propagation of the seedlings

The 10.0 cm Plantlets with lateral buds were about 360 collected at tale end of the afternoon when the weather was moist and were kept in a bow containing water (Agbo and Obi 2007). The bases were made squared using sharp sickle to spread the rooting. For each of the cuttings, about half of it was dipped into the IAA hormone that has been made into hole in each of the pots as to soak the powder. Excess of it was shaken off the base of the cuttings and the hormone was manually made to concentrate at the base. The plantlets were then inserted into the soil to about 6 cm, watered and maintained to about 70% humidity (Tanhan *et al.* 2007). Fungicides were sprayed onto the plants to control infections (Yeboah and Amoah 2009). The set up was allowed to grow for six weeks while monitoring in between days to remove any invading weeds. Data on shoot development was taken at interval of weeks and root length was measured on the day of harvest after weeks.

2.3 Data collection

Data collection which commenced on the first week after propagation continued till the sixth week and the parameters measured were survived seedlings, length of shootings/buds, and the root length, number, and weight of the plant on the day of harvest.

2.4 Data analysis

The data collected was analysed using Microsoft excel to obtain the mean number and percentage of plants that were able to form developed root and sprouted shoots from the series of transplanted seedlings. The data was then imported into SPSS version 13.0 and was analysed using analysis of variance (ANOVA) and standard deviation for the length of shoot and roots. The significance effects were determined at 5% level of significance.

3.0 Results

N. tabacum seedlings treated with concentration of 0.7% (w/w) IAA hormone propagated in different growth media recorded the highest mean number of the seedlings that developed roots and sprouted shoots in the set up with equal mixtures of the 4 growth media with organic manure. While the stem seedlings propagated in the perlite and control recorded the least mean rooted (2 each) and sprouted shoots (4 and 3) as recorded in Table 3.1. Amazingly, perlite and vermiculate maintained almost equal numbers of shoot developed (4 and 3 respectively) like in the root (2 each). However, significant difference existed among the different media with reference to their mean rate of development and formation of root and shoot. The efficacy of IAA hormone to the development of root and shoots was noticed by the difference between the treated samples and the controls without the hormone. There was significance difference between the two samples.

Number and length of roots developed among different rooting medium and the concentration of hormone were not significant (Table 1.0) but shoot lengths and number per sprouted stem was significant. Increase in shoot length occurred in this order: mixture>vermiculate>perlite>planting soil>sand>control while increase in root length were in the order: mixture>vermiculate>perlite>planting soil>sand>control. But it made a turnaround in the number that rooted and shooted within the rooting media, i.e., sand and planting soil had the same mean number of roots (4) and a little difference in Shoots (6 and 12). The control media maintained equal numbers. In fresh weight of the plants (apical and basal), there were higher weight measurement in the basal sections than the apical ones, though not significant. Equally, set up containing the mixture of the rooting media still maintained the highest weight followed by sand, perlite, planting soil, vermiculate and the control. The same sequence was also followed in their dry weights. In sand however, there were greater number of root numbers while in other rooting media had the same number of roots. Shoot and root length of mixture of rooting media and vermiculate were synonymous with each other and were almost significant with the rest of the medium. Root lengths were 34 and 33mm for mixture and vermiculate respectively, 39 and 37mm in sand and planting soil. The shoot length was 41mm in both sand and vermiculate, while 43mm all in planting soil and mixture respectively. The set up containing equal mixtures of all media had 100% germination rate compared to

70, 60 50 and 40% for sand; planting soil/vermiculate; perlite and control respectively. However, the rest of the media demonstrated improved significant effects in all the parameters measures compared to the control.

Discussion

The rooting medium supplement that has mixtures of planting soil, perlite, sand and vermiculate at equal proportion enabled highest development of root and shoot in a cutting of *N. tabacum*. This improved effect could be attributed to the fact that the combined nutrient supplement of the entire rooting media acted optimally with the IAA hormone concentration added which created the enabling soil condition for example, optimum aeration and moisture level (Kalyoncu and Ozer 2000; Akwatulira *et al.* 2011). Meanwhile dose application of IAA hormone was shown to be an aid to improved moisture content in the soil for an optimal rooting and shooting development of cuttings (Milleton *et al.* 1980; Leakey *et al.*, 1982; Aminah *et al.* 2006; Akwatulira *et al.* 2011; Raymond Anyasi and Anyasi 2020). However, most of these past studies maintained their IBA hormone concentration to about 0.7-0.8% of the rooting media used while this study based its IAA measurement on the weight of the cuttings. Moreover, the control sample of rooting medium supported low development of root and shoot than the auxin treated samples in the entire experiment. This could perhaps be because soil resistant to root penetration is dependent on amongst other factors on water content, structure and strength of soil as well as bulk densities though these were not measured in the rooting media (Amri *et al.* 2009). Soils do not possess the required aeration porosity for optimal gas exchange required for rooting of the cuttings resulting in poor rooting in the control. Poor rooting numbers in control could also be attributed to the feel of anoxia which is an effect of low oxygen in the soil (Hartmann *et al.* 2002). Low incidence of rooting was found in the control samples. Non-theless, there are instances where optimum concentration of IAA in the soil has resulted in the failure of the development of roots by stem cuttings as was reported by Griffin and Shroeder (2004). That was an indication of the sensitivity of root formations to hormone formulations (Akwatulira *et al.* 2011; Anyasi 2023). It has also been reported that rooting hormone to a certain instance could be inhibitory to the development of roots in the cutting especially during the initiation stage (Akwatulira *et al.* 2011). This then means that different rooting media accommodates different concentration of auxin for optimal growth of plants.

Conclusions

Mixture of various rooting media in the right proportion with 0.7% of IAA hormone has been proven to be effective in the root and shoot development of cuttings of tobacco irrespective of the position of the cuttings. Although the individual medium did not have high incidences in most of the parameters measured, but there were able to support root and shoot development as well. Therefore, there is need for a study of IAA concentration effects on the media as to be able to determine if concentration was not the factor responsible for the low root and shoot development. This will promote mass production of *N. tabacum* especially in areas that the plants do not occur naturally.

Acknowledgements

Wish to express my appreciation to the University of South Africa and National Research Foundation for their assistance in this project.

Tables and Figures

Table 1.0 Number of rooted and shooted seedlings within rooting media. Values are mean of replicates (Numbers with same superscript within same row are not statistically significant at $p=0.05$)

Rooting media	Number of cuttings		IAA hormone concentration
	Rooted	Shooted	
Planting soil	4±0.75 ^a	12±2.55 ^b	0.7
Control	2±0.69 ^a	3±0.00 ^a	0.7

Table 2.0 Rate of germination of shoots among rooting media with 0.7% concentration of IAA hormone. Values are mean of replicates (Numbers with same superscript within same row are not statistically significant at $p=0.05$)

Rooting media	IAA hormone concentration (%)	Rate of germination (%)
Planting soil	0.7 ^a	60 ^b
Control	0.7 ^a	40 ^a

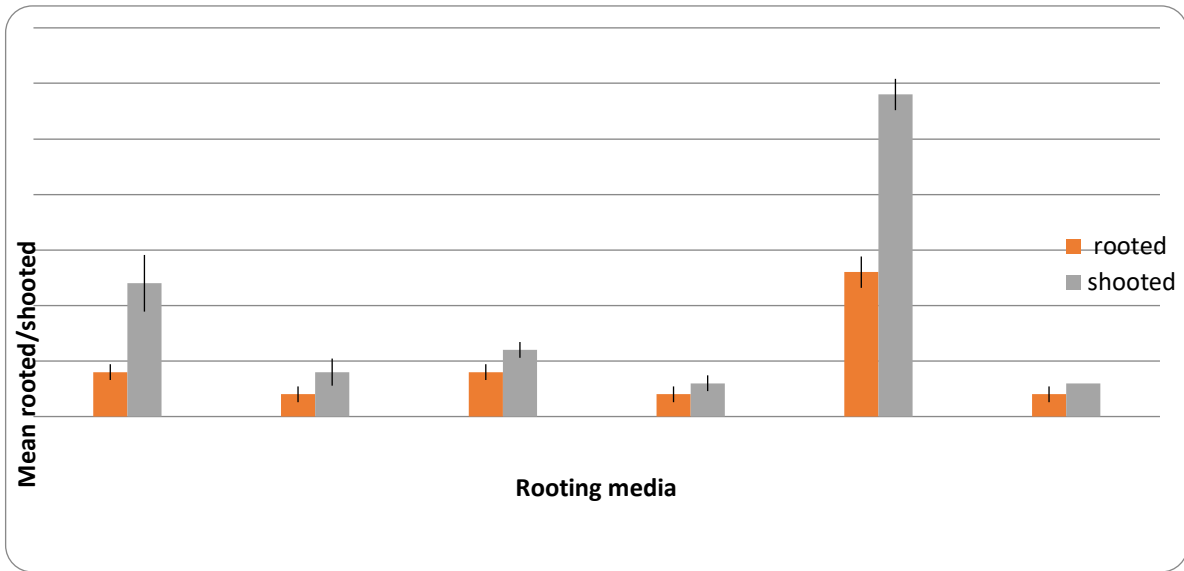


Figure 1.0 Bar chart representation of the means values of rooted and shooted seedlings within rooting media (The error bars represent the standard error from the mean).

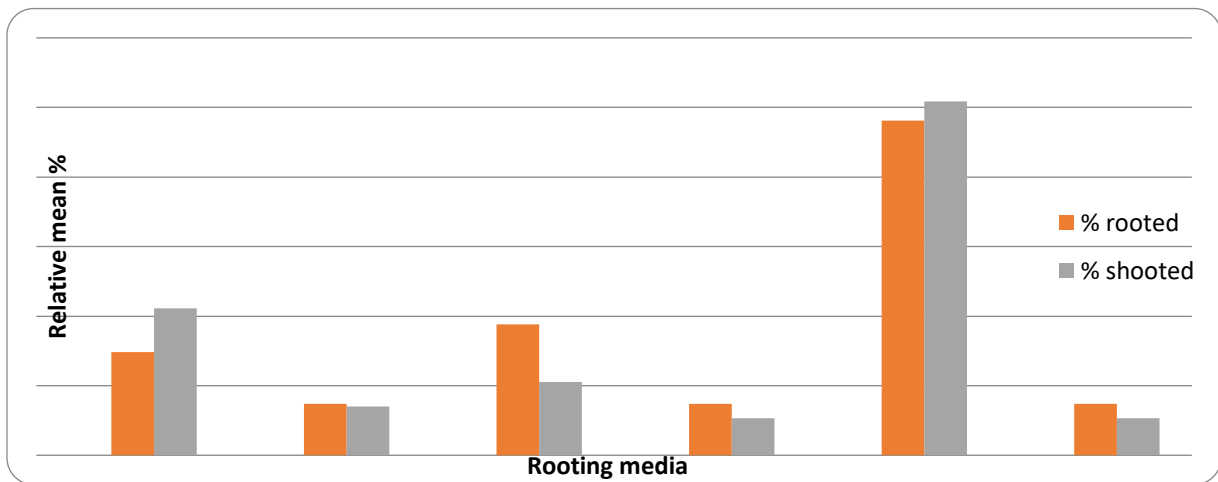


Figure 2.0 Relative mean percentage of the rooted and shooted seedlings among the rooting media.

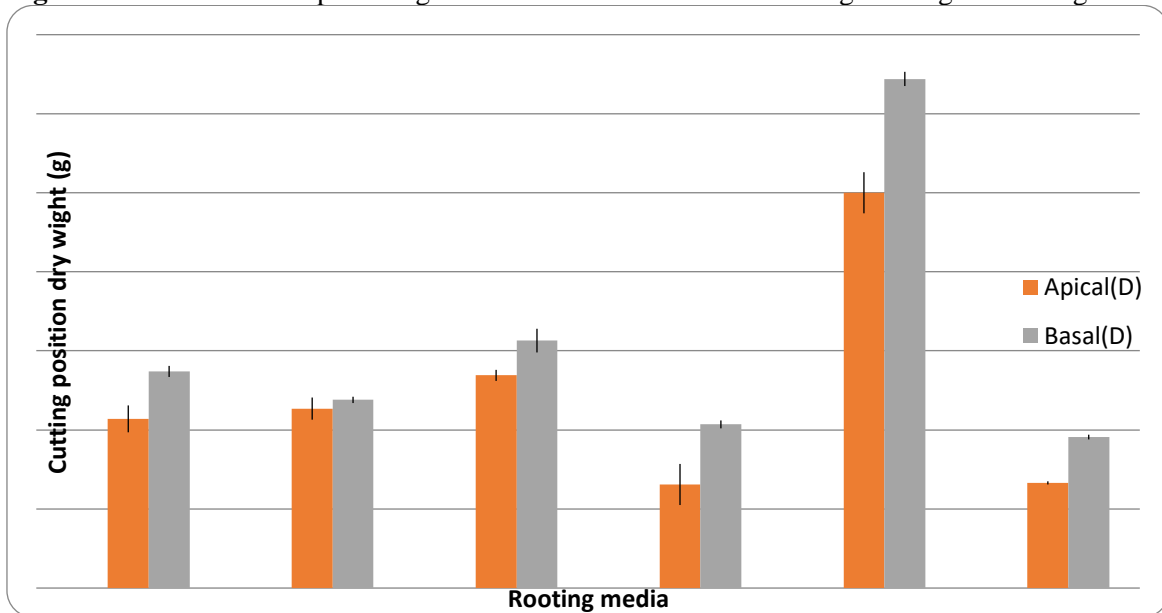


Figure 3.0 Dry weight of Cutting positions within different rooting media (The error bars represent the standard error from the mean)

References

- Adebayo, O.B., Lawal, O.I., Alabi, B.S., Owolade, O.F. 2005. Allelopathic effects of siam weed (*Chromolaena odorata*) on seed germination and seedling performance of selected crop and weed species. Fourth World Congress on Allelopathy 2005 “Establishing the scientific base”. Charles Sturt University, Wagga Wagga- New Australia, pp. 197-198.
- Agbo, C.U., Obi, I.U. 2007. Variability in propagation potentials of stem cuttings of different physiological ages of *Gongronema latifolia* Benth. *World Journal of Agricultural Science*, 3(5): 576-581.
- Akinmoladun, A.C., Ibukun, E.O., Dan-Ologe, I.A. 2007. Phytochemical constituents and antioxidants properties of extracts from the leaves of *Chromolaena odorata*, *Scientific Research and Essay*, 2(6): 191-194.
- Akwatulira, F., Gwali, S., Okullo, J.B.L., Ssegawa, P., Tumwebaza, F.B., Mbwabo, J.R. Muchugi, A. 2011. Influence of rooting media and indole-3-butyric acid (IBA) concentration on rooting and shooting formation on *Warburgia Ugandensis* stem cuttings, *African Journal of Plant Soil*, 5(8): 421-429.
- Al-Saqri, F., Alderson, P.G. 1996. Effects of IBA, cutting type and rooting media on rooting of *Rosa centifolia*. *Journal of Horticultural Science*, 71,729-737.
- Aminah, H., Nor Hasnita, R.M.N., Hamzah, M. 2006. Effects of Indolebutyric acid concentrations and media on rooting of leafy cuttings of *Shorea parvifolia* and *Shorea macroptera*. *Journal of Tropical Forest Science*, 18(1): 1-7.
- Amri, E., Lyarun, H.V.M, Nyomora, A.S., Kanyek, Z.L. 2009. Evaluation of provenances and rooting media for rooting ability of African Blackwood (*Dalbergia melanoxylon* Guill. and Perr.) stem cuttings. *Research Journal of Agriculture and Biological Science*, 5(4): 524-532.
- Ansari, M.B., Megala, D., Ankita S., Anirudha, C., Lovkush, S., Pooraniammal, B., Manoj, Choudhary., Muhammad, A.S., Jailani, A.A.K. 2023. Microbial Exudates as Biostimulants: Role in Plant Growth Promotion and Stress Mitigation. *Journal of Xenobiotics* 13(4): 572-603.
- Anup, K.C., Sujit, R., Umesh, K.P. 2011. *Chromolaena odorata* (L.): An overview. *Journal of Pharmacy Research*, 4(3): 573-576.
- Anyasi R.O. 2023. Studying the growth of *Chromolaena odorata* in two soil samples under greenhouse condition. Proceedings of the ISPEC 11th International Conference on Agriculture, Animal Sciences and Rural Development, Mus, Turkiye, March 03-05, 2023. Pg 591-608
- Anyasi, R.O., Atagana, H.I. and Sutherland, R. 2019. Comparative study of the colonization of *Chromolaena* and tobacco plants by *Bacteria safensis* CS4 using different methods of inoculation. *Pakistan Journal of Biological Science*, 22(7): 309-317.
- Anyasi, R.O., Atagana, H.I., Agbo, D.C. and Anyasi Raymond, J.O. 2024. Modelling of the growth of tobacco by Indole Acetic Acid (IAA) used to control soil organic pollution. Proceedings of the 6th International Conference on Global Practice on Multidisciplinary Scientific Studies, Lisbon, Portugal, April 09-16. Pg 2229-2240.
- Raymond Anyasi, J.O. and Anyasi, R.O. 2020. Use of Bacterial Endophyte as a Control for White Aphid's Infestation in Tobacco Plant Sumerianz *Journal of Agriculture and Vetrinary*. 2(10): 88-95.
- Araya, H.T., Soundy, P., du Toit, E.S., Mudau, F.N. 2007. Influence of cutting position, medium, hormone and season on rooting of Bush tea (*Athrixia phylicoides* DC). Stem cuttings. *Medicinal and Aromatic Plants Science and Biotechnology*, 1: 243-252.
- Che Man, N.B. 2010. Phytochemical analysis of the leaves of *Chromolaena odorata* (Asteraceae). BSc Hons. Thesis, Faculty of Applied Sciences-University of Technology, Mara, pp 9-12.
- Griffin, J.J., Schroeder, K.R. 2004. Propagation of *Ulmus parvifolia* “Emerald Prairies” by stem cuttings. *Journal of (2 Environmental Horticulture*, 22): 55-57.
- Hartmann, H.T., Kester, D.E., Davies, F.T. Jr., Geneve, L.R. 1997. Plant propagation: Principles and Practices (6th Edn), Prentice Hall International Edition, Englewood Cliffs, New Jersey, USA, pp 880.
- Iwu, M.M. 1993. Handbook of African Medicinal Plants, CRC Press Inc., Boca Raton. pp. 181-182.
- Jeruto, P., Lukhoba, C., Ouma, G., Mutai, C. 2008. Propagation of some endangered Indigenous trees from the South Nandi District of Kenya using cheap, non-mist Technology. *ARPN Journal of Agriculture and Biological Sciences*, 3(3): 1-6.
- Johnson, R.A., Bhattacharyya, G.K. 2006. Statistics: Principles and Methods. 5th Edition. John Wiley and Sons, USA, p. 688

- Kalyoncu, H., Ozer, E. 2000. Gilaburu'nun (*Viburnum opulus* L.), green side köklendirilmesi steels and to obtain seedlings. II. *National Nursery Symposium* (25-29 September 2000). Almond-Edema, Izmir, 1: 1-10
- Larsen, F.E., Guse, W.E. 1997. Propagating deciduous and evergreen shrubs, trees and vines with stem cuttings. A Pacific Northwest Cooperative Extension Publication, Washington, USA, p. 10.
- Leakey, R.R.B., Chapman, V.R., Longman, K.A. 1982. Physiological studies for tree improvement and conservation. Some factors affecting root initiation of *Triplochiton scleroxylon* K.. *Ecological Management*, 4: 53-66.
- Metwally, A.M., Ekejuba, E.C. 1981. Methoxylated flavonols and flavones from *Eupatorium odoratum*I. *Planta Medica*, 42: 403.
- Millette, W., Jarvis, B.C., Booth, A. 1980. The role of auxins in leaves and boron dependant on rooting stem cuttings of *Phaseolus aureus* Roxb. *New Phytology*, 84: 251-259.
- Montesano R, Orci L. 1988. Transforming growth factor β 3 stimulates collagen-matrix contraction by fibroblasts: Implications for wound healing. *Proceedings of the National Academy of Sciences*, 85:4894-4897.
- Phan, T. T., Wang, L., See, P., Grayer, R.J., Chan, S.Y., & Lee, S.T. 2001. "Phenolic compounds of *Chromolaena odorata* protect cultured skin cells from oxidative damage: implication for cutaneous wound healing." *Biological and Pharmaceutical Bulletin*. 24(12): 1373-1379.
- Phan, T.T., Hughes, M.A., Cherry, G.W., Le, T.T., Pharm, H.M. 1996. An aqueous extract of the leave of *Chromolaena odorata* (Formerly *Eupatorium odoratum*) (Eupolin) inhibits hydrated collagen lattice contraction by normal dermal fibroblasts. *The Journal of Alternative and Complementary Medicine*, 2(3): 335-343.
- Rao, V. K., Kasula, K., Umate, P., Sree, T., A. V. Rao, A.V., Abbagani, S. 2005. Introduction of multiple shoots from leaf segments, *in vitro* flowering and fruiting of dwarf tomato. *Journal of Plant Physiology*, 162(8): 959-962.
- Singh, S., Thorat, V., Kaushik, C.P., Raj, K., Eapen, S., D'Souza, S.F. 2009. Potential of *Chromolaena odorata* for phytoremediation of ^{137}Cs from solution and low level nuclear waste. *Journal of Hazardous Material*, 162: 743-745.
- Sosnowski, J., Milena, T., and Vilianna, V. 2023. "The Impact of Auxin and Cytokinin on the Growth and Development of Selected Crops" *Agriculture* 13(3): 724.
- Taiwo, O.B., Olajide, O.A., Soyannwo, O.O., Makinde, J.M. 2000. Antiinflammatory, antipyretic and antispasmodic properties of *Chromolaena odorata*. *Pharmaceutical Biology*, 38: 367-370.
- Tanhan, P., Kruatrachue, M., Pokethitiyook, P., Chaiyarat, R. 2007. Uptake and accumulation of cadmium, lead and zinc by siam weed [*Chromolaena odorata* (L) King & Robinson]. *Chemosphere*, 68:323-329.
- Tanhan, P., Pokethitiyook, P., Kruatrachue, M., Chaiyarat, R., Upatham, S. 2011. Effects of soil amendments and EDTA on lead uptake by *Chromolaena odorata*: Greenhouse and field trial experiments. *International Journal of Phytoremediation*, 13: 897-911.
- Wniger, B., Robinean, L. 1988. Elements for Caribbean Pharmacopoeia. *Proceedings of TRAMIL workshop*, Cuba. Pp 16-23.
- Yeboah, J.S.T.L., Amoah, F.M. 2009. The rooting performance of Shea tree (*Vitellaria paradoxa* C.F. Gaertn) cuttings leached in water and application of rooting hormone in different media. *Journal of Plant Science*, 4(1): 10-14.

**MADEN ATIKLARININ ÇEVRE DOSTU BETON ÜRETİMİNDEKİ PUZOLANİK
POTANSİYELİ
THE POZZOLANIC POTENTIAL OF MINE WASTES IN ENVIRONMENTALLY
FRIENDLY CONCRETE PRODUCTION**

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Abstract

Industrial production continues to increase at a great pace in many fields today. One of these areas is undoubtedly the mining industry. In addition to the products it contributes to the economy, the mining industry also generates a considerable amount of waste products. These wastes are either stored inert or cause serious environmental pollution because they cannot be recycled. In recent years, studies in concrete technology have been carried out on the partial or complete use of industrial wastes in concrete or cement production instead of traditional materials due to environmental factors. With these studies, both the search for solutions to environmental pollution and storage problems and the introduction of more economical and sustainable new materials to the concrete industry are tried. The pozzolanic properties of a material are of great importance for its use in the concrete industry or cement production. In this study, it was investigated whether the mining waste of Gümüşhane region have pozzolanic properties in order to determine their usability in concrete technology. The sample obtained from the mine waste site were ground to cement size. In order to determine its pozzolanic activity, pozzolan+cement mixtures were prepared at different ratios (0%; 10%; 20%; 30% and 40%) and strength activity indices were determined at the end of 7/28 days. In addition, X-ray diffraction (XRF) analysis was performed to determine the chemical composition of the mine waste to be used as pozzolan and the pozzolanic activity of the mine waste was investigated in the light of the data obtained.

Keywords: Environmental pollution, mechanical property, mine waste, pozzolanic activity, strength activity index

Özet

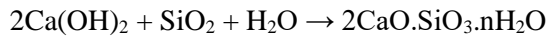
Günümüzde pek çok alanda endüstriyel üretim büyük bir hızda artarak devam etmektedir. Bu alanlardan biri de kuşkusuz maden endüstrisidir. Maden endüstrisi ekonomiye katkı sunduğu ürünlerinin yanı sıra azımsanmayacak ölçüde de pek çok atık ürün ortaya çıkarmaktadır. Bu atıklar ya atıl olarak depolanmakta ya da geri dönüştürülemediği için ciddi boyutlarda çevre kirliliğine sebep olmaktadır. Son yıllarda beton teknolojisinde çevresel etkenlerden dolayı geleneksel malzemeler yerine endüstriyel atıkların beton ya da çimento üretiminde kısmen ya da tamamen kullanımı konusunda çalışmalar yapılmaktadır. Bu çalışmalar ile hem çevre kirliliğine ve depolama sorunlarına

çözüm arayışı hem de daha ekonomik ve sürdürülebilir yeni malzemelerin beton endüstrisine kazandırılmasına çalışılmaktadır. Bir malzemenin beton endüstrisinde ya da çimento üretiminde kullanılabilmesinde puzolanik özellikli olmasının önemi büyüktür. Bu çalışmada da Gümüşhane yöresinden temin edilen maden atığının beton teknolojisinde kullanılabilirliğinin belirlenmesi amacıyla puzolanik özellikli olup olmadığı araştırılmıştır. Maden atık sahasından temin edilen numunelerin puzolanik aktivitelerinin belirlenebilmesi amacıyla farklı oranlarda (%0; %10; %20; %30 ve %40) maden atığı+çimento karışımları hazırlanarak 7/28 gün sonunda dayanım aktivite indeksleri belirlenmiştir. Ayrıca, puzolan olarak kullanılacak olan maden atığının (MA) kimyasal bileşimini belirlemek için X-ışını kırınımı (XRF) analizi yapılmış ve elde edilen veriler ışığında maden atığının puzolanik aktivite özelliği araştırılmıştır.

Anahtar Kelimeler: Çevre kirliliği, dayanım aktivite indeksi, maden atığı, mekanik özellik, puzolanik aktivite

1. GİRİŞ

Dünya üzerindeki hızlı nüfus artışı beraberinde büyük ölçekte yapı ihtiyacına sebep olmaktadır. Bunun sonucu olarak çimento üretimi her geçen gün hızla artmaktadır. Çimentonun üretim sürecinde doğal kaynakların hızla tüketilmesi ve çevreye salınan CO₂ miktarı düşünüldüğünde çok ciddi bir çevresel sorun ortaya çıkmaktadır. Bir taraftan artan yapılaşma ihtiyacının karşılanması diğer taraftan çevre kirliliğinin önlenmesi için çimentoya alternatif bağlayıcı geliştirilmesi kaçınılmaz olmaktadır. Aynı zamanda, dünya üzerindeki endüstriyel gelişme insanlık için yararlı olabildiği gibi bazı sorunları da beraberinde getirmektedir. Bu sorunlardan en önemlisi oluşan atık maddelerdir (Beycioğlu ve ark. 2008). Atıkların depolanma sorunları, oluşan atıkların azaltılması, mevcut atıkların çeşitli endüstri kollarında, özellikle yapı endüstrisinde ham madde kaynağı olarak değerlendirilmesi ve kullanılmış ham maddelerin yeniden kullanılması gibi atık yönetimi konuları pek çok araştırmacının ilgi odağı olmakta ve giderek önem kazanmaya başlamıştır (Akbulut ve Gürer 2006). Bu kapsamda özellikle puzolanik aktiviteye sahip olan doğal ve/veya yapay endüstriyel atıkların bağlayıcı olarak kullanılabilirliği üzerine yapılan çalışmalar gün geçtikçe artarak devam etmektedir. Puzolanik aktivite, puzolanın yapısında bulunan aktif silisin, Ca(OH)₂ ve su ile reaksiyona girerek çimentonun hidrasyonu sonucu oluşan C-S-H jel ürünleri oluşturabilme yeteneği olarak tanımlanmaktadır. Bu reaksiyon sonucu çimentonun hidrasyonu ile oluşan C-S-H jellerinin yanı sıra çok daha az çimento kullanımına karşın yeni C-S-H jelleri oluşmakta ve dayanım artışı meydana gelmektedir (Erdoğan, 2013). Bir başka ifadeyle, bu reaksiyon sonunda reaksiyona girmeyen portlandit (Ca(OH)₂) miktarı azalırken serbest CH'ler puzolanlarla reaksiyona girerek kalsiyum silika hidrat (C-S-H) miktarını artırırlar (Külekçi vd., 2021; Massazza, 1993). Puzolanlar içerdikleri reaktif silis ile çimento hidrasyonu sonucu ortaya çıkan serbest kireç arasında sulu ortamda aşağıdaki kimyasal reaksiyona girerek kalsiyum silikat hidratları oluştururlar.



Bu reaksiyon temel puzolanik reaksiyon olarak bilinir. Oldukça yavaş gelişen bu reaksiyon sonucu, portland çimentosunun silikatlı bileşenlerine benzer hidrate ürünler oluşur. Ancak, bu reaksiyon hem serbest kireç oluşumunu beklemesi hem de oldukça yavaş seyreden bir reaksiyon sonucu puzolanik etkiyle mukavemet kazanma olayını uzun surede gerçekleştirir (Aksüt vd., 2022; Yalçın ve Guru, 2006). Puzolanların uzun surede iyi bir reaksiyon göstererek daha iyi bir içyapı ve dayanım kazanması beklenir (Çullu vd., 2016).

Türkiye'deki çimento endüstrisinde optimum değerlerle kullanımlarına yönelik bilimsel veri sağlamayı amaçlayan bu çalışma öncelikle, sürdürülebilir çimentoya puzolanik anlamda katkıda bulunabilen yerel ve doğal kaynakların aktif olarak kullanımını sağlayabilmek amacıyla gerçekleştirilmiştir. Bu nedenle çalışmanın amacı; Gümüşhane yöresinden temin edilen maden atığının (MA) fiziksel ve kimyasal özelliklerini belirlemek ve sürdürülebilir katkılı çimento üretimlerinde puzolan olarak kullanım potansiyeline sahip olup olmadığını incelemektir. Puzolanik aktivitelerinin belirlenebilmesi amacıyla farklı oranlarda (%0; %10; %20; %30 ve %40) puzolan+çimento karışımları hazırlanarak 7/28 gün sonunda dayanım aktivite indeksleri belirlenmiştir. Ayrıca, Puzolan olarak kullanılacak olan maden atığının kimyasal bileşimini belirlemek için X-ışını kırınımı (XRF) analizi yapılmış ve elde edilen veriler ışığında maden atığının puzolanik aktivite özelliği araştırılmıştır.

2. MATERYAL VE YÖNTEM

2.1. Materyal

Bu çalışmada çimento, standart kum ve Gümüşhane yöresinden temin edilen maden atığı kullanılmıştır. Ayrıca, numunelerin üretiminde içerisinde zararlı olabilecek organik madde ve mineral tuzları barındırmayan su kullanılmıştır.

2.1.1 Çimento

Deneylerde çimento olarak Gümüşhane çimento fabrikasından temin edilen CEM I 42.5 R tipi Portland çimentosu (PÇ) kullanılmıştır. CEM I 42.5 R Çimentosunun kimyasal bileşimleri Tablo 1’de diğer özellikleri ise Tablo 2’de verilmiştir.

2.1.2 Standart Kum

Puzolanik aktivite testlerinde, CEN standart kumu olarak anılan, tercihen yuvarlak tanecikli ve silisyum dioksit miktarı en az %98 olan, doğal silis kumu kullanılmıştır. Standart kumun kimyasal bileşimleri Tablo 1’de verilmiştir.

2.1.3. Maden Atığı

Deneyel çalışmalarda, çimentoya ikame olarak Gümüşhane yöresinden alınan maden atığı kullanılmıştır (Şekil-1). Kimyasal bileşimleri Tablo 1’de fiziksel özellikleri ise Tablo 2’de verilmiştir.



Şekil 1. Çalışma alanından temin edilen numune

Tablo 1. Hammaddelerin Kimyasal Özellikleri, % m

Hammadde	SiO ₂	Al ₂ O ₃	Fe ₂ O ₃	MgO	CaO	Na ₂ O	K ₂ O	Toplam
Maden atığı	8.14	1.45	7.59	17.41	27.67	0.17	0.19	62.62
Standart Kum	92.1	2.02	0.43	0.03	0.2	0.93	1.3	97.01
Çimento	19.71	4.67	3.25	1.70	63.12	0.25	0.93	93.63

Tablo 2. CEM I 42.5 R Çimentosunun özellikleri

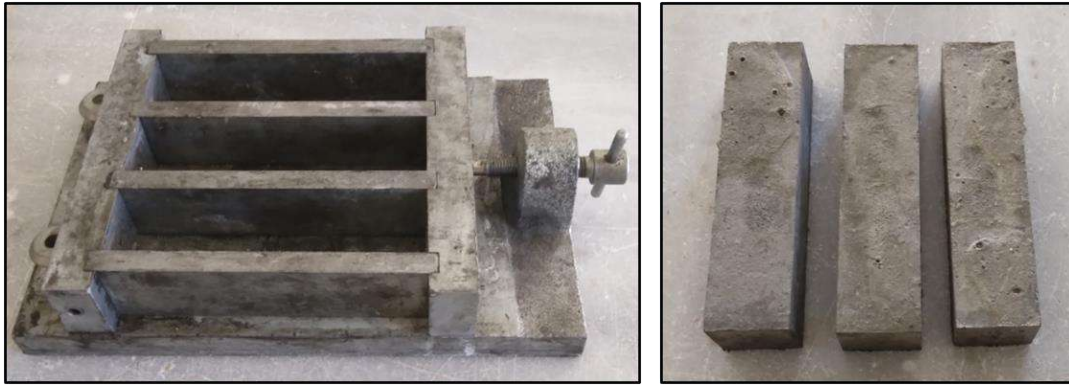
Fiziksel Özellikler	Sınır Değerler	Basınç Dayanımı (MPa)	Kimyasal Özellikler	Sınır Değerler	
Piriz Başlama Suresi (dakika)	≥ 60	2 Günlük	≥ 20	Kızdırma Kaybı	≤ % 5.0
Genleşme (mm)	≤ 10	7 Günlük	-	Çözünmeyen Kalıntı	≤ % 5.0
		28 Günlük	≥ 42.5	Sülfat (SO ₃)	≤ % 4.0
				Klorür Muhtevası	≤ % 0.10

2.2. Yöntem

Maden atığının puzolan olarak kullanımı sırasında, bu malzemenin özgül yüzey alanı (Blaine), yoğunluğu, kimyasal bileşimi ve mineralojik yapısının puzolanik aktivite üzerinde büyük bir etkisi olduğu bilinmektedir. Bu çalışmada, maden atığının puzolanik aktivitesini etkileyen bu parametreleri belirlemek için aşağıdaki yöntemler uygulanmıştır.

2.2.1. Numune Dökümü

Puzolanik aktivite testi için maden atığından farklı oranlarda (%0; %10 ; %20; %30 ve %40) alınarak harçlar hazırlanmıştır. Her bir harç grubu için, TS 25 (2008) tras standardına göre 40x40x160 mm boyutlarında üçer adet kare prizma numune hazırlanmış (Şekil-2) ve deney sonuçları bu üç numunenin aritmetik ortalaması alınarak değerlendirilmiştir. Bu doğrultuda deney programı oluşturulmuş ve sonuçlar Tablo-3'te sunulmuştur.



Şekil 2. Eğilmede çekme ve basınç dayanımı deneylerinde kullanılan prizma numuneler ve numune üretim kalıpları

Tablo 3. Deney Programı

Deneyin amacı	Deneyin türü	Sıcaklık (°C)	Süre (gün)	Üretilen numune adedi
Puzolanik aktivite deneyi	TS 25'te tanımlı harç karışımı	21	7/28	-
Harç bileşenleri oranlarının puzolanik aktiviteye etkisinin incelenmesi	Kütlece %0 MA	21	7/28	6
	Kütlece %10 MA	21	7/28	6
	Kütlece %20 MA	21	7/28	6
	Kütlece %30 MA	21	7/28	6
	Kütlece %40 MA	21	7/28	6
Toplam				30

2.2.2. Eğilmede Çekme Dayanımı ile Basınç Dayanımının Ölçümü

Basınç dayanımı deneyleri, MFL System marka cihaz kullanılarak TS EN 12390-3 (2003) ve TS EN 196-1 (2016) standartlarına uygun olarak, eğilme dayanımı deneyinde kırılan parçalar kullanılarak gerçekleştirilmiştir. Tüm deneylerde, cihazın yükleme hızı 0.05 kN/sn olarak sabit tutulmuştur. Eğilmede çekme dayanımı testinde de 7/28 günlük numuneler kullanılmıştır. TS EN 12390-3 (2003) standardına uygun olarak ayarlanan eğilme basınç presi ile otomatik kırma işlemi gerçekleştirilmiş ve kırılma yükleri ile basınç gerilmeleri (eğilmede çekme ve basınç dayanımları) belirlenmiştir (Şekil 3).



Şekil 3. Prizmatik Numune Örnekleri Üzerinde Yapılan Eğilmede Çekme ve Basınç Dayanımı Deneyleri

2.2.3. Fiziksel ve Kimyasal Analiz ile Blaine Değerleri

Öncelikle, maden atığının fiziksel özellikleri kapsamında yoğunluğu TS EN 197-1 (2012) standardına göre, özgül yüzey (Blaine) değeri ise TS EN 196-6 (2010) standardına göre belirlenmiştir. Pozolan olarak kullanılacak olan atığın kimyasal bileşimini belirlemek amacıyla X-Işını Kırınımı (XRF) analizi yapılmış ve elde edilen veriler Tablo-4'te sunulmuştur.

Tablo 4. Maden atığının fiziksel ve kimyasal kompozisyonu

Maden atığı	SiO ₂ (%)	Al ₂ O ₃ (%)	Fe ₂ O ₃ (%)	CaO (%)	MgO (%)	SO ₃ (%)	K ₂ O (%)	Na ₂ O (%)	Yoğunluk (gr/cm ³)	Blaine (cm ² /gr)
	8.14	1.45	7.59	27.67	17.41	0.33	0.19	0.17	2.91	4250

Puzolanik aktivite, puzolanik malzemeye yapılan deneyler sonucunda tayin edilmektedir. ASTM C 618 (2012) standardına göre kütlece (%0; %10; %20; %30 ve %40) oranında referans çimento+puzolan (atık) ile hazırlanmış karışımlar ile sadece referans çimento ile hazırlanan karışımlar üzerinde deneyler yapılarak atığın farklı oranlardaki puzolanik aktivitesi belirlenmiştir. Puzolanik aktivite, “dayanım aktivite indeksi” olarak adlandırılan bir değer hesaplanmasıyla ifade edilmektedir.

$$\text{Dayanım aktivite indeksi} = (A/B) \times 100$$

Burada;

A: Puzolanlı harç numunelerinin ortalama basınç dayanımı,

B: Kontrol harç numunelerinin ortalama basınç dayanımı

Bir malzemenin puzolan olarak değerlendirilebilmesi için gerekli koşullar:

1. ASTM C618 Standardına göre 45 µm göz açıklıklı elek üzerinde kalan miktarın mak. %34 olması ve TS 25 standardına göre özgül yüzey/blaine değerinin min. 3000 cm²/g olması gerektiği belirtilmiştir.
2. Kimyasal içerik olarak (Tablo 5);

Tablo 5. ASTM C 618 ve TS 25 Standartlarındaki Kimyasal İçerik Değerleri (% m)

	TS 25	ASTM C618
SiO ₂ + Al ₂ O ₃ + Fe ₂ O ₃	70	70
SO ₃ , maks.	5	4
Nemlilik, maks.	3	3
Kızdırma kaybı, maks.	10	10
MgO, maks.	5	-
Na ₂ O olarak alkaliler, maks.	1.5	1.5

3. Dayanım aktivite indeksi ASTM C618 Standardına göre 7 ve 28 günlük min. %75, TS 25 Standardına göre ise min. %70 olması ve su ihtiyacının yine aynı standarda göre maks. %115 olması gerektiği belirtilmiştir.

3. ARAŞTIRMA VE BULGULAR

3.1. Fiziksel ve Kimyasal Analiz Bulguları

Maden atık malzemesi, düzensiz yapıdaki (amorf) hücreli gözenekli yüzeylere sahip parçacıklar şeklinde olup yüksek miktarda sönmemiş kireç (CaO) içermektedir. Standartlar tarafından belirlenen sınır değerler şu şekilde açıklanmıştır:

1. maddede belirtilen ASTM C618 (2012) Standardına göre 45 µm göz açıklıklı elek üzerinde kalan miktarın kütlece mak. %34 olması koşulu;

Tablo 6. Maden Atığının Fiziksel Özellikleri

Elek çapları			Özgül kütle (g/cm ³)	Blaine (cm ² /g)
32µ	45µ	90µ		
Kalan kütle oranları (% m)				
35.60	26.10	10.02	2.91	4250

Elekte kalan kütle oranı %26.10 < %34 olduğundan koşulu sağlıyor.

1. maddede belirtilen özgül yüzey/blaine değerinin min. 3000 cm²/g olması; 4250 cm²/g > 3000 cm²/g olduğundan koşulu sağlıyor.

2. Kimyasal içerik olarak gerekli sınır koşulların sağlanması durumu (Tablo 7);

Tablo 7. Maden Atığına Ait Kimyasal İçerikler (% m)

	SiO ₂	Al ₂ O ₃	Fe ₂ O ₃	CaO	MgO	SO ₃	K ₂ O	Na ₂ O	Kızdırma kaybı	Reaktif silis
Maden Atığı	8.14	1.45	7.59	27.67	17.41	0.33	0.19	0.17	29.97	3.21

a. SiO₂+Al₂O₃+Fe₂O₃=8.14+1.45+7.59= %17.18 < %70 (Bkz. Tablo 5) olduğundan koşulu sağlamıyor.

b. SO₃= %0.33 < %4 (Bkz. Tablo 5) olduğundan koşulu sağlıyor.

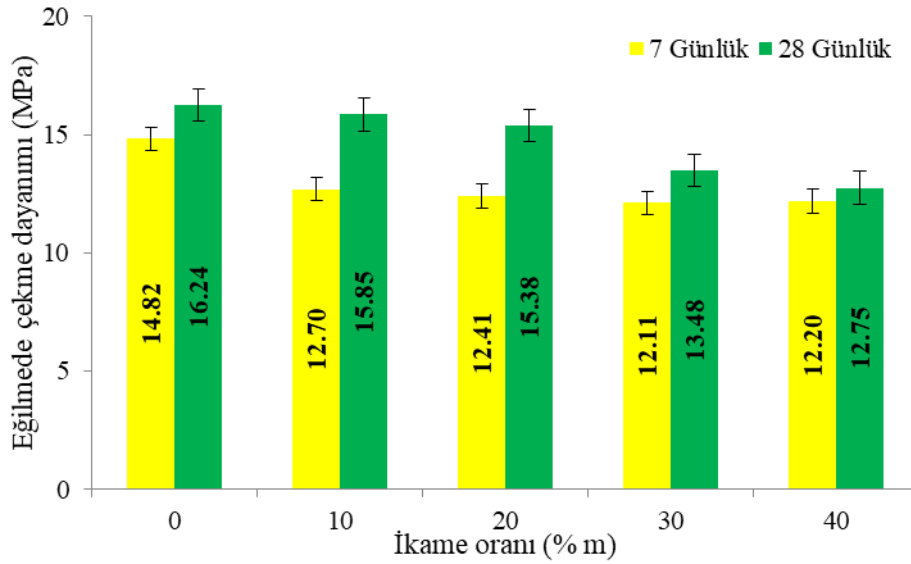
c. Kızdırma kaybı = %29.97 > %10 (Bkz. Tablo 5) olduğundan koşulu sağlamıyor.

d. MgO= %17.41 > %5 (Bkz. Tablo 5) olduğundan koşulu sağlamıyor.

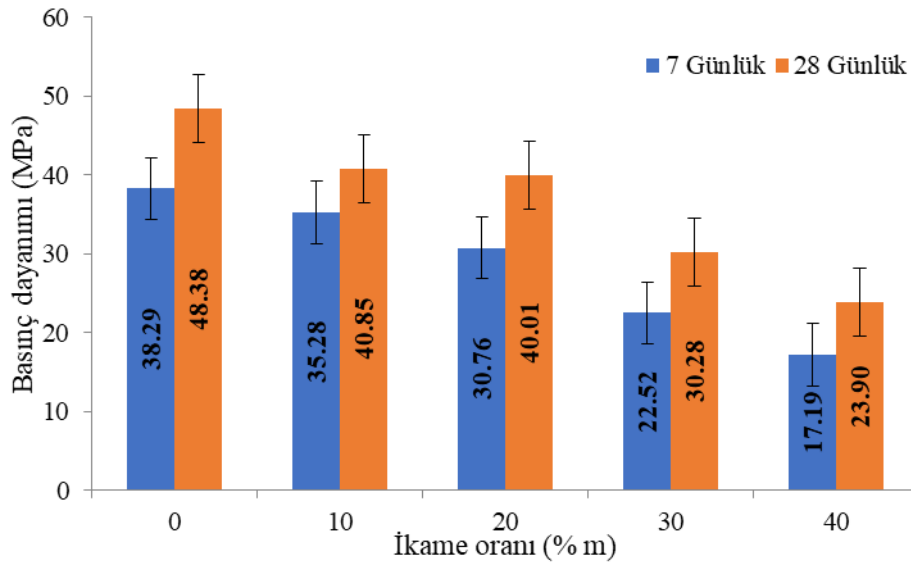
e. Na₂O+K₂O= %0.36 < %1.5 (Bkz. Tablo 5) olduğundan koşulu sağlıyor.

3.2. Eğilmede Çekme ve Basınç Dayanımı Bulguları

TS EN 196-1 (2016) standardına göre, kütlece farklı oranlarda (%0; %10; %20; %30 ve %40) maden atığı kullanılarak dökülen prizmatik numunelerin 7 ve 28 günlük eğilmede çekme ve basınç dayanım değerleri hesaplanmış ve sonuçlar Şekil-4 ve Şekil-5'te gösterilmiştir.



Şekil 4. Maden Atığının Farklı Kütle Oranlarındaki (%m; %0; %10; %20; %30 ve %40) 7 ve 28 Günlük Eğilmede Çekme Dayanımı Değerleri



Şekil 5. Maden Atığının Farklı Kütle Oranlarındaki (%m; %0; %10; %20; %30 ve %40) 7 ve 28 Günlük Basınç Dayanımı Değerleri

3. Maddede belirtilen dayanım aktivite indeksinin ASTM C618 (2012)'ye göre 7 ve 28 günlük min. %75, TS 25 (2008)'e göre %70 olması koşulu;

Eğilmede çekme dayanımı değeri için;

7 günlük; Dayanım aktivite indeksi = $(12.41/14.82) \times 100 = \%83.74 > \%75 \& \%70$ olduğundan koşulu sağlıyor.

28 günlük; Dayanım aktivite indeksi = $(15.38/16.24) \times 100 = \%94.7 > \%75 \& \%70$ olduğundan koşulu sağlıyor.

Basınç dayanımı değeri için;

7 günlük; Dayanım aktivite indeksi = $(30.76/38.29) \times 100 = \%80.33 > \%75 \& \%70$ olduğundan koşulu sağlıyor.

28 günlük; Dayanım aktivite indeksi = $(40.01/48.38) \times 100 = \%82.70 > \%75 \& \%70$ olduğundan koşulu sağlıyor.

Su ihtiyacının yine aynı standarda belirtilen katkısız olarak dökülen numuneye göre maks. %115 olması koşulu;

Herhangi bir su ihtiyacı gözlenmemiştir.

7 günlük ve 28 günlük dayanım değerleri arasında belirgin bir fark olduğu Şekil 4'ten anlaşılmaktadır. 28 günlük dayanım değerleri genel olarak daha yüksek çıkmıştır. Bu, malzemenin zamanla dayanım kazandığını göstermektedir (Şekil 4). 0% ikame oranı en yüksek dayanım değerleri bu grupta gözlenmiştir. 7 günlük 14.82 MPa ve 28 günlük 16.24 MPa değerleriyle diğer ikame oranlarına göre en iyi performansı göstermektedir. 10% ve 20% ikame oranı olan gruplarda dayanım değerlerinde hafif bir düşüş gözlenmekte ancak yine de yüksek değerler elde edilmiştir. 10% ikame oranında 7 günlük 12.70 MPa ve 28 günlük 15.85 MPa değerleri, 20% ikame oranında ise 7 günlük 12.41 MPa ve 28 günlük 15.38 MPa değerleri elde edilmiştir. İkame oranı arttıkça eğilmede çekme dayanımı değerlerinde azalma gözlenmiştir. Bu durum, maden atığının artan oranının malzemenin dayanımını olumsuz etkilediğini göstermektedir.

Şekil 5 incelendiğinde ise genel olarak 7 günlük ve 28 günlük basınç dayanım değerleri arasında belirgin bir fark görülmektedir. 28 günlük dayanım değerleri genel olarak daha yüksek çıkmıştır. Bu, malzemenin zamanla dayanım kazandığını göstermektedir. En yüksek basınç dayanımı değerleri %0 katkılı grupta gözlenmiştir. 7 günlük 38.29 MPa ve 28 günlük 48.38 MPa değerleriyle diğer ikame oranlarına göre en iyi performansı göstermiştir. İkame oranı arttıkça basınç dayanımı değerlerinde azalma gözlenmiştir. Bu durum, maden atığının artan oranının malzemenin dayanımını olumsuz etkilediğini göstermektedir.

4. SONUÇ

1. Maksimum tane boyutu 100µ olan bu malzeme, TS 25 standardı uyarınca, 90 µ'luk elek üzerinde en çok %10 kütle kalıntısı bırakacak incelikte doğal olarak bulunmaktadır. Maden atığının ayrıca öğütülmesine gerek olmadığından, elde edilecek son ürünün oluşum enerjisini (embodied energy) artırmayacağından bir kazanım oluşturmaktadır.

2. Puzolanik aktivite deneyleri ile belirlenen, maden atığı+çimento karışımlarının 7 ve 28 günlük ortalama eğilmede çekme ve basınç dayanımı değerleri incelendiğinde maden atığı miktarının artırılması her iki dayanımın değerini de düşürdüğünü göstermektedir.

3. Maden atığının içerdiği yüksek CaO, MA'nın harç içerisinde kütlece %20 oranına kadar artırılmasıyla dayanıma olumlu etki etmektedir.

4. Maden atığı ikamesinin artmasıyla malzemenin eğilmede çekme dayanımında düşüş yaşanmıştır. En iyi performans kontrol grubunda (0% ikame) görülmüştür. 28 günlük dayanım değerleri her zaman 7 günlük değerlerden daha yüksek olmuş, bu da malzemenin zamanla dayanım kazandığını göstermektedir.

5. Maden atığı ikamesinin artmasıyla malzemenin basınç dayanımında düşüş yaşanmıştır. En iyi performans kontrol grubunda (0% ikame) görülmektedir. 28 günlük dayanım değerleri her zaman 7 günlük değerlerden daha yüksek çıkmış, bu da malzemenin zamanla dayanım kazandığını göstermektedir.

Puzolanik malzemenin yeterli aktiviteyi gösterebilmesi için, yeterince ince taneli olması, amorf yapıya sahip olması ve yeterli miktarda "silis + alümin + demir oksit" içermesi gerekmektedir. Malzeme ince tanelidir. Buna karşın yeterli amorf yapıda (silis miktarı yüksek) değildir. Üstelik oldukça düşük miktarda "silis + alümin + demir oksit" toplamı içermektedir. Puzolan olarak değerlendirilemez. Ancak, ince tanecik yapısına ve yüksek özgül yüzey alanına sahip olmasının yanı sıra yüksek CaO içeriği sayesinde mineral katkı olarak beton üretiminde değerlendirilebilir. Çalışma sonucunda elde

edilen veriler, MA katkılı beton üretiminin düşük maliyet, enerji etkinliği ve CO₂ emisyonlarındaki azalma ile çok yönlü yarar sağlayacağını göstermektedir.

KAYNAKÇA

- Akbulut H, Güner C (2006). Atık Mermerlerin Asfalt Kaplamalarda Agrega Olarak Değerlendirilmesi. İMO Teknik Dergi, 261: 3943-3960
- Aksüt, Y. S., Külekçi, G., Çullu, M. ve Vural, A., (2022). Investigation of Pozzolanic Activity of Old Mine Slag (Antic Slag), 7th International Congress on Innovative Scientific Approaches Held on May 19-20, 2022 / samsun.
- ASTM C 618, (2012) Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete, American Society for Testing and Materials.
- Beycioğlu A, Başyigit C ve Subaşı S (2008). Endüstriyel Atıkların İnşaat Sektöründe Kullanımı ile Geri Kazanılması ve Çevresel Etkilerinin Azaltılması. Çevre Sorunları Sempozyumu. s: 1386-1394, Kocaeli
- Çullu, M., Bolat, H., Vural, A., & Tuncer, E. (2016). Investigation of pozzolanic activity of volcanic rocks from the northeast of the Black Sea, Science and Engineering of Composite Materials 23 (3), 315-323.
- Erdoğan T. Y., (2013). Beton. ODTÜ Yayını. Ankara
- Külekçi, G., Yılmaz, A.O., & Çullu, M. (2021). EXPERIMENTAL INVESTIGATION OF THE USABILITY OF CONSTRUCTION WASTE AS AGGREGATE, Journal of Mining and Environment 12 (1), 63-76.
- Massazza, F. (1993). Pozzolanic Cement, Cement and Concrete Composites, v:15, pp: 185-214.
- TS EN 12390-3, 2003. Beton-Sertleşmiş Beton Deneyleri - Bölüm 3: Deney Numunelerinde Basınç Dayanımının Tespiti, Türk Standartları Enstitüsü, Ankara.
- TS 196-6, (2010). Çimento deney yöntemleri - Bölüm 6: İncelik tayini, Türk Standartları Enstitüsü, Ankara.
- TS EN 197-1, (2012). Türk standartları, Çimento - Bölüm 1: Genel çimentolar - Bileşim, özellikler ve uygunluk kriterleri, Türk Standartları Enstitüsü, Ankara.
- TS EN 196-1, (2016). Türk standartları, "çimento deney metotları - bölüm 1: dayanım tayini", birinci baskı, Türk Standartları Enstitüsü, Ankara.
- TS 25, (2008). Doğal puzolan (tras) - Çimento ve betonda kullanılan - tarifler, gerekler ve uygunluk kriterleri. Türk Standartları Enstitüsü, Ankara.

**MATEMATİK ÖĞRETMEN ADAYLARININ UZUNLUK ÖLÇÜLERİNİ GÜNLÜK
HAYATLA İLİŞKİLENDİRMEYE YÖNELİK MATERYAL ÖRNEKLERİ
EXAMPLES OF MATERIALS USED BY PROSPECTIVE MATHEMATICS TEACHERS TO
RELATE LENGTH MEASUREMENTS TO DAILY LIFE**

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Abstract

It is known that one of the important sub-learning areas in the Mathematics Curriculum is measurement. Measuring length is an important part of learning measurement topics such as area, perimeter and volume. The concept of length is the first step of measurement and is frequently used in daily life. If length measurement is not understood conceptually, students may use rote methods and experience misconceptions. The concept of length measurement, which is also very important for the development of different mathematical skills, is also important because of its relationship with different subjects of mathematics. In addition to calculating the length of a rope or a road we travel, the concept of measuring length is important because it forms the basis for other basic units of measurement that we frequently encounter in daily life such as area and volume. Therefore, it is important for students to make sense of mathematical concepts by giving examples from daily life in the teaching-learning process. In addition to the examples given in the classroom, the materials used by teachers while giving these examples are also important for understanding the subject. It is also very important that teachers, who are responsible for the flow of the lesson in the classroom, can manage this process well. In the light of this information, this study was conducted to determine the thoughts of pre-service teachers about using materials to associate length measurements with daily life. The research was conducted with the case study method, which is one of the qualitative research types. In line with this purpose, the study group, which was determined by appropriate sampling method, consists of 54 pre-service mathematics teachers studying at a Faculty of Education in Istanbul in the 2023-2024 academic year. As a data collection tool, a questionnaire form with open-ended questions about giving examples of items-materials used in daily life to teach the concept of length was used. The data were analyzed using qualitative methods. The findings obtained from the analysis were discussed in the context of associating length measurements with daily life in the context of the related literature.

Keywords: Length measurement, daily life, pre-service mathematicsteacher

Özet

Matematik Öğretim Programı'nda yer alan önemli alt öğrenme alanlarından birisinin ölçme olduğu bilinmektedir. Uzunluk ölçme; alan, çevre ve hacim gibi ölçme konularının öğrenilmesinde önemli bir yer teşkil etmektedir. Uzunluk kavramı, ölçme konusunun ilk basamağı olup günlük hayatta da oldukça sık kullanılmaktadır. Uzunluk ölçmenin kavramsal olarak anlaşılması durumunda öğrenciler, ezbere yöntemler kullanabilir, kavram yanılgıları yaşayabilir. Aynı zamanda farklı matematiksel becerilerin gelişimi için de oldukça önemli olan uzunluk ölçme kavramı matematiğin farklı konuları ile olan ilişkisi nedeniyle de ayrıca bir önem arz etmektedir. Bir ipin, gittiğimiz yolun, uzunluğunu hesaplamamızın yanı sıra alan, hacim gibi günlük hayatta da sıklıkla karşımıza çıkan diğer temel ölçüm birimlerine de temel oluşturması açısından uzunluk ölçme konusu önem taşımaktadır. Dolayısıyla öğretme-öğrenme sürecinde günlük hayattan örnekler verilerek öğrencilerin matematik kavramları anlamlandırmaları önemlidir. Sınıf içerisinde verilen örneklerin yanında bu örnekleri verirken öğretmenlerin kullandıkları materyaller de konunun anlaşılabilmesi için ayrıca bir önem teşkil

etmektedir. Sınıf içerisinde ders akışından sorumlu olan öğretmenlerin bu süreci iyi yönetebilmesi de oldukça önemlidir. Bu bilgiler ışığında, öğretmen adaylarının uzunluk ölçülerini günlük hayatla ilişkilendirmeye yönelik materyal kullanmaya ilişkin düşüncelerini belirlemek amacıyla bu araştırma gerçekleştirilmiştir. Nitel araştırma türlerinden birisi olan durum çalışması yöntemi ile araştırma gerçekleştirilmiştir. Bu amaç doğrultusunda uygun örnekleme yöntemi ile belirlenen çalışma grubunu;2023-2024 eğitim öğretim yılında İstanbul ilindeki bir Eğitim Fakültesindeki öğrenim görmekte olan 54 matematik öğretmen adayı oluşturmaktadır. Veri toplama aracı olarak uzunluk kavramını öğretmek için günlük hayatta kullanılan eşyalar-materyaller ile ilgili örnekler vermelerine dair açık uçlu soruların bulunduğu bir anket formu kullanılmıştır. Veriler nitel yöntemler kullanılarak analiz edilmiştir. Analizlerden elde edilen bulgular, öğretmen adaylarının uzunluk ölçülerini günlük hayatla ilişkilendirme bağlamında ilgili alan yazın eşliğinde tartışılmıştır.

Anahtar kelimeler: Uzunluk ölçme, günlük hayat, matematik öğretmen adayı

GİRİŞ

Ölçme kavramı günlük hayatta sıklıkla karşımıza çıkmakta olan bir beceridir. Pazarda yaptığımız alışverişte kilo hesabı yapmadan, gideceğimiz yolun kaç kilometre olduğunu hesaplamaya kadar birçok farklı durumda kullandığımız bu beceri uzunluk, alan, hacim, kapasite gibi farklı alt başlıklarda karşımıza çıkmaktadır. En genel anlamıyla ölçme sürekli bir büyüklüğe sayısal değerler verme işi olarak ifade edilebilir (Smith III vd., 2013).

Ölçme kavramı günlük hayatın içerisinde çoğunlukla yer edinmesinin yanı sıra çeşitli matematiksel konuların öğretiminde de önemli bir role sahiptir. Kesirler, oran orantı, cebir öğretimi gibi konularda da problem durumlarında yer edinen bu konuların derinlemesine öğrenilmesinde de rol sahibidir. Örneğin, cebir karolarını kullanarak gerçekleştirdiğimiz alan modelinde ya da oran orantı kavramını anlatırken ifade ettiğimiz birimli oran kavramında ölçmeye yönelik ifadeleri kullanmakta olduğumuzu görebiliriz.

Günlük hayatın vazgeçilmez bir parçası olması, matematiğin farklı konularıyla olan bu ilişkileri sebebiyle de ölçme kavramı farklı matematik programlarında kendine yer edinmiştir. NCTM (2000) matematiğin alt öğrenme alanlarından birisinin de ölçme olduğunu belirtirken, ülkemizde okutulmakta olan matematik dersi öğretim programında da alt öğrenme alanlarından birisi olarak karşımıza çıkmaktadır (MEB, 2018). Gerçekleştirilen yeni müfredat çalışmaları sonucunda ortaya konan Türkiye Yüzyılı Maarif Model Matematik Dersi Öğretim Müfredatında da çeşitli sınıf seviyelerinde ve farklı temalarda ölçmeye yönelik öğrenme çıktılarının bulunduğu görülmektedir (MEB, 2024). Bu kazanımlar ve öğrenme çıktıları incelendiğinde öğrencilerin ölçmeye yönelik karşılaştıkları ilk kavramın uzunluk ölçme olduğu görülmektedir. Nitekim farklı ülkelerde okutulan öğretim programları da ele alındığında öğrencilerin henüz okul öncesi dönemdeyken bile uzunluk ölçme ile karşılaştıklarını söyleyebilmek mümkündür.

Uzunluk ölçme ilkökullarda öğrencilerin ölçmeye yönelik öğrendikleri ilk konu olmasıyla birçok farklı kavramsal yapının öğretilmesi için de temel teşkil etmektedir. Örneğin, alan hacim gibi temel kavramların öğretiminde de uzunluk ölçme kavramından yararlanılmaktadır (Lehrer, Jaslow, Curtis, 2003; Stephan ve Clements, 2003). Bunun yanı sıra geometrik şekillerin tanıtılması gibi konularda da uzunluk ölçmeden faydalanılır (Bozkurt, Özmantar ve Güzel, 2018). Karenin dört kenar uzunluğunun eşit olması gerektiği, çeşitkenar üçgenin tüm kenar uzunluklarının farklı olması gerektiği gibi tanımlarda uzunluk ölçmeden faydalanılmaktadır.

Tüm bu durumlar değerlendirildiğinde uzunluk ölçme ye yönelik öğretim sürecinin öğrencilerin hem matematiksel olarak gelişebilmesi hem de günlük hayat becerilerinden birini kazanabilmeleri için oldukça önemli olduğu söylenebilir. Bu noktada öğrenim sürecinde önemli bir yerde olan öğretmenlerin uzunluk ölçme öğretiminde üstlendiği roller oldukça önemlidir. Öğretmenler uzunluk ölçmeye yönelik öğretimi gerçekleştirirken öğrencilerin konuyu kavramsal olarak daha iyi anlayabilmeleri için günlük hayat örneklerini sınıf içerisinde kullanabilmelidir. Kuşkusuz bu örneklerin kullanımında çeşitli materyallerden yararlanabiliyor olmaları da öğretmenlerin dersin akışında daha verimli bir yol izlemelerine neden olacaktır. Bu amaç doğrultusunda çalışmanın amacı matematik öğretmen adaylarının uzunluk ölçülerini günlük hayatla ilişkilendirmeye yönelik materyal örneklerini incelemek olarak belirlenmiştir.

ARAŞTIRMA VE BULGULAR

Araştırmanın Modeli

Nitel araştırmalarda olaylar ya da durumlar objektif ve detaylı bir şekilde ele alınır (Yıldırım ve Şimşek, 2016). Bu bağlamda çalışmada mevcut durum küçük bir grup üzerinden elde edilen verilerle ortaya konmaya çalışılmıştır. Bu nedenle çalışma nitel araştırma türlerinden birisi olan durum çalışması yöntemi ile gerçekleştirilmiştir. Çalışmadaki amaç öğretmen adaylarının mevcut görüşlerini ortaya çıkartılarak yorumlanmasıyla alanyazına katkıda bulunmaktır.

Çalışma Grubu

Araştırmanın çalışma grubu belirlenirken uygun örnekleme yönteminden yararlanılmıştır. Uygun örnekleme yöntemi olasılığa dayalı olmayan örnekleme yöntemlerinden birisidir. Bu yöntemde mekan, zaman, çalışmanın amacına uygunluk gibi çeşitli faktörlerin elverişlilik durumuna göre örneklem seçimi gerçekleştirilir (Özmen ve Karamustafaoğlu, 2019). Bu kapsamda araştırmanın örneklemini İstanbul'da bir devlet üniversitesinin Eğitim Fakültesi'nde İlköğretim Matematik Öğretmenliği lisans programında eğitim öğretimine devam eden 54 son sınıf öğrencisi oluşturmaktadır. Çalışmaya katılan öğretmen adaylarının tamamının matematik öğretiminde ilişkilendirme dersini almış olmalarına dikkat edilmiştir.

Veri Toplama Aracı

Araştırma kapsamında çalışmayı gerçekleştiren araştırmacılar tarafından oluşturulan anket formu kullanılmıştır. Formun içeriğinde öğretmen adaylarına uzunluk kavramını öğretmen için günlük hayatta kullanılan eşyalar-materyaller ile ilgili örnekler vermelerine dair açık uçlu sorular bulunmaktadır.

Verilerin Analizi

Matematik öğretmeni adayları ile yapılan görüşmelerden elde edilen çıktılar içerik analizi yöntemi ile analiz edilmiştir. Katılımcılardan elde edilen veriler incelenerek benzer olduğu düşünülen ifadeler çalışmayı gerçekleştiren araştırmacılar tarafından kodlanmıştır. Benzer kodlar tek bir temada toplanabiliyorsa bir temanın altına yerleştirilmiştir. İlgili tema ve kodlar bulgular kısmında belirtilmiştir. Tema ve kodların daha iyi anlaşılabilmesi için öğretmen adaylarının verdiği cevaplardan doğrudan alıntılar çalışma kapsamında sunulmuştur. Katılımcıların isimleri; Katılımcı 1, Katılımcı 2, ... (K1, K2,...) şeklinde ifade edilmiştir

Bulgular

Araştırma kapsamında öğretmen adaylarından elde edilen veriler Tablo 1'de sunulmuştur.

Tablo 1.Uzunluk Ölçme Öğretiminde Kullanılan Materyal Örnekleri

Tema	Kod	Frekans
Standart Birimlere Yönelik Ölçme Araçları	Cetvel	35
	Metre	22
	Mezura	16
	Otomobillerdeki Kilometre Hesaplayıcı	1
Standart Birimlere Yönelik Olmayan Ölçme Araçları	Adım sayımı	15
	Karış	8
Günlük Materyalleri	Kulaç	5
	İp	10
	Kalem	4
	Kitap	3
	Bahçe hortumu	2
	Kâğıt şeritler	2
	Merdiven Modeli	2
	Defter	2
	Masa	2
	Hayat	

Oyun Hamuru	1
Bina Planları	1
Kumaş Ruloları	1
Kova	1
Kumaş Şeritleri	1
Sebze Meyveler	1
Sandalye	1
Ağaç	1
Kaşık	1
Kilometre Taşı	1
Milimetrik Kağıtlar	1
Boy beden ölçümü	1
Uzunluğu bilinen tel	1

Öğretmen adaylarının uzunluk ölçme öğretiminde sınıf içerisinde kullanılacak materyallere verdikleri örnekler incelendiğinde çoğunlukla standart birimlere yönelik ölçme araçları ile ilgili ifadelerinin bulunduğu görülmektedir. Özellikle cetvel, metre ve mezura gibi araçların sıklıkla öğretmen adayları tarafından tercih edilmekte olduğu görülmektedir. Bu cevaplara örnek olarak K51 kodlu öğretmen adayı “*Cetvel ve metre çubuğu: Cetveller ve metre çubukları, uzunluk ölçümlerini görselleştirmek için en temel materyallerden biridir. Öğrencilere cetveller ve metre çubukları kullanarak farklı nesnelere uzunluklarını ölçmeyi öğretebiliriz.*” cevabını verirken, K33 ise “*Öğrencilerden bir cetvel isteyip görüp görebilecekleri her şeyin uzunluğunu ölçmelerini isteyebiliriz.*” ifadesiyle sınıf içerisinde standart ölçme araçlarının kullanılmasına yönelik vurguda bulunmuştur.

Öğretmen adaylarının cevapları değerlendirildiğinde standart olmayan birimlerin kullanımına yönelik ifadelerin de bulunduğu saptanmıştır. Öğretmen adaylarının özellikle adım ile ölçmeye yönelik vurguları bulunmaktadır. Örneğin K6 kodlu öğretmen adayı “*Adım sayımı: Bir yürüyüş sırasında veya koşu antrenmanında mesafeyi ölçmek için kullanılabilir.*” ifadesinde bulunmuştur. Adım sayısını bir birim olarak kullanmanın yanı sıra kulaç ve karış da öğretmen adayları tarafından verilen örnekler arasında yer almaktadır. K22 “*Karış, kulaç, adım uzunluk ölçmede kullanılan bir materyal olarak gösterilebilir.*” ifadesinde bulunurken; K43 “*Kulaç, adım, ile sınıfın boyunu standart olmayan ölçme araçlarıyla ölçtürüp standart ölçü birimlerine geçiş yapabiliriz.*” ifadesini kullanmıştır.

Öğretmen adayları bu örneklerin yanı sıra ölçme öğretiminde günlük hayat materyallerinin de kullanılabilmesine yönelik çeşitli örnekler de kullanmışlardır. Bu örnekler içerisinde öğretmen adaylarının sıklıkla ifade ettikleri materyal ip olmuştur. Örneğin, K54 kodlu öğrenci adayı “*Farklı uzunluklarda ip keserek, öğrenciler bu parçaları ölçüp karşılaştırarak uzunluk kavramını öğrenebilirler.*” ifadesiyle ip kullanılarak sınıf içerisinde uzunluk ölçmeye yönelik kurulabilecek bir etkinlik örneği vermiştir. İp cevabı dışında öğretmen adaylarının kalem, defter, silgi, kumaş ruloları, ya da kumaş şeritler gibi çeşitli örneklerin de sınıf içerisinde kullanılabilmesini belirtmiştir. Bu cevaplara örnek olarak K38 “*silgi, kalem, defter gibi aynı nesneyi hiç boşluk bırakmadan art arda sıralayarak standart olmayan ölçme birimleri olarak kullanılmış olur.*” ifadesiyle günlük hayat materyallerine örneklerini sunmuştur.

SONUÇ

Ölçmeye yönelik öğretimin en önemli anahtar faktörlerden birisi de günlük hayat ilişkilendirilmesinin gerçekleştirilebilmesidir. Bu ilişkilendirmelerin yapılabilmesinde sınıf içerisindeki uygulayıcı rolü bulunan öğretmenlerin ve öğretmen adaylarının büyük önemi bulunmaktadır. Çalışmadan elde edilen bulgular değerlendirildiğinde öğretmen adaylarının ölçme öğretiminde günlük hayat ilişkilendirmesi gerçekleştirirken çoğunlukla cetvel, metre gibi standart birimlere yönelik ölçme araçlarından yararlandıkları görülmektedir. Günlük hayatta da sıklıkla kullanılan bu araçların öğretmen adayları tarafından sınıf içerisinde de kullanılması dikkat çekicidir. Ayrıca öğretmen adaylarının günlük hayatta kullanımı bulunan materyalleri ölçme öğretiminde kullanılabilmesini belirttikleri belirlenmiştir. Verilen örnekler içinde en sık rastlanan materyal ip olmuştur. İp örneğinin yanı sıra kitap kalem gibi sınıf içerisinde rahatlıkla bulunabilecek materyallerle ölçme öğretimi gerçekleştirilebileceğini belirten öğretmen adayları da olmuştur. Bunun yanı sıra karış, adım gibi standart olmayan birimlere yönelik günlük hayat örneklerinin de öğretmen adayları tarafından tercih

edildiği saptanmıştır. Bu kısımda özellikle standart olmayan birimler ile ölçme yapmanın önemini vurgulamakta fayda vardır. Avcı ve Dere (2002) standart olmayan birimler ile ölçüm yapmanın standart birimlerin gerekliliğini anlama konusu için oldukça önemli olduğunu belirtmektedir. Bu nedenle özellikle bu araçların standart ölçü birimleri ile ölçme yapmadan önce öğrenciler tarafından deneyimlenmesi oldukça önemlidir.

Çalışma kapsamında elde edilen bulgular ışığında öğretmen adaylarının farklı araçlar ile uzunluk ölçme kavramının öğretilebileceğini düşünmekte oldukları görülmektedir. Fakat verilen örnekler değerlendirildiğinde genellikle aynı örneklerin verildiği saptanmıştır. Bu nedenle özellikle öğretmen adaylarının eğitiminde ölçme öğretimini gerçekleştirirken kullanabilecekleri materyaller konusunda deneyim kazanmaları sağlanabilir. Çalışma kapsamında öğretmen adayların kullanabilecekleri materyaller sorulmuştur. Fakat bu materyalleri dersin hangi aşamalarında ve nasıl kullanacaklarına yönelik detaylı çalışmalar gerçekleştirilebilir.

KAYNAKÇA

- AVCI, N., & DERE, H. (2002). Okulöncesi Çocuğu ve Matematik. *Ulusal Fen Bilimleri ve Matematik Eğitimi Kongresi (6-18 Eylül 2002), Ankara*, 262.
- Bozkurt, A., Özmantar, M. F., & Güzel, M. (2018). Uzunluk ölçme ve farklı uzunlukları karşılaştırmaya dair öğrenci düşüncülerinin incelenmesi. *International Journal of Educational Studies in Mathematics*, 5(2), 39-55.
- Lehrer, R., Jaslow, L., & Curtis, C. (2003). Developing an understanding of measurement in the elementary grades. *Learning and teaching measurement*, 1, 100-121.
- Millî Eğitim Bakanlığı (MEB). (2024). *2024 Ortaokul Matematik Dersi Öğretim Programı*. Ankara.
- Millî Eğitim Bakanlığı. Talim ve Terbiye Kurulu Başkanlığı. (2018). *Matematik Dersi Öğretim Programı*
- National Council of Teachers of Mathematics (2000). *Principles and standarts for school mathematics*. Reston/VA: National Council of Teachers of Mathematics.
- Özmen, H., & Karamustafaoğlu, O. (2019). Eğitimde araştırma yöntemleri. *Ankara: Pegem Akademi*, 2.
- Smith III, J. P., Males, L. M., Dietiker, L. C., Lee, K., & Mosier, A. (2013). Curricular treatments of length measurement in the United States: Do they address known learning challenges?. *Cognition and Instruction*, 31(4), 388-433.
- Stephan, M., & Clements, D. H. (2003). LENGTH MEASUREMENT. *Yearbook*, (2), 1.
- Yıldırım, A. ve Şimşek, H. (2016). *Sosyal bilimlerde nitel araştırma yöntemleri*. Seçkin Yayınları.

**A CONSIDERATION OF THE WATER SOURCES DEPICTED ON THE MOSAICS OF
PAPHLAGONIA HADRIANOPOLIS
PAPHLAGONIA HADRIANOPOLIS'İ MOZAIKLERİNDE GÖRÜLEN SU KAYNAKLARI
HAKKINDA BİR DEĞERLENDİRME**

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Özet

Paphlagonia Hadrianopolis'i olarak bilinen antik kent günümüzde Karabük İli, Eskipazar İlçesi'nde yer almaktadır. Antik kentte ilk bilimsel çalışmalar 2003 yılında Karadeniz Ereğli Müzesi'nin Dört Nehir Kilisesi'nde yaptığı kurtarma kazılarıyla başlamıştır. 2006 yılında ise kazı başkanlığı tarafından çalışmalar başlatılmıştır. Kazı çalışmalarına günümüzde de devam edilmektedir. Yapılan çalışmalar sonucunda toplamda altı yapının kazısı tamamlanmıştır. Güney Nekropolü'nde ve Kare Planlı Yapı'da ise kazı çalışmalarına devam edilmektedir. Kazısı tamamlanmış yapılar Güney Hamamı, Kuzeybatı Hamamı, Dört Nehir Kilisesi, Chora Kilisesi, Kuzey Batı Nekropol Kilisesi, Geç Roma Konutu (domus)'dur. Kazısı tamamlanan yapılarda eşsiz mozaikler ortaya çıkarılmış olup, mozaiklerde çeşitli ikonografik sahneler mevcuttur. Ayrıca çalışmalarda kentte çok önemli küçük buluntulara ulaşılmıştır. Küçük buluntular kentteki iskanın bilinenden daha eski bir döneme ait olduğunu işaret etmiştir. Ayrıca Hadrianopolis'in Roma İmparatorluk döneminde çok önemli bir kent olduğunu gösteren buluntulara da ulaşılmıştır. Kentteki çalışmalarda epigrafik buluntular da Hadrianopolis'in Roma Dönemi'nde önemli bir ticaret merkezi olduğunu belirtmektedir. Kentteki ölü gömme gelenekleri kentin Phrygia Bölgesi'nin yoğun etkisinde kaldığını da göstermiştir. Kentteki mozaiklerde su kaynakları sıklıkla işlenmiştir. Su kaynaklarının mozaiklerde işlenmesi kentteki yoğun olarak görülen su kaynaklarıyla mı ilişkilidir? Bu çalışmada mozaiklerde görülen su kaynaklarının Eskipazar'da yer alan su kaynaklarıyla ilişkileri değerlendirilecektir.

Anahtar Kelimeler: Paphlagonia, Mozaik, Su Kaynağı, Roma.

Abstract

The ancient city known as Hadrianopolis of Paphlagonia is located in Eskipazar District of Karabük Province. The first scientific studies in the ancient city started in 2003 with the rescue excavations carried out by the Karadeniz Ereğli Museum in the Four Rivers Church. In 2006, excavations were initiated by the excavation directorate. Excavations continue today. As a result of the excavations, a total of six structures were excavated. Excavations continue in the South Necropolis and the Square Planned Building. The excavated buildings are the Southern Bath, the Northwest Bath, the Church of the Four Rivers, the Chora Church, the Northwest Necropolis Church, and the Late Roman Residence (domus). Unique mosaics have been uncovered in the excavated buildings and the mosaics include various iconographic scenes. In addition, very important small finds were found in the city. The small finds indicate that the settlement in the city belongs to an earlier period than known. The finds also indicate that Hadrianopolis was a very important city during the Roman Imperial period. The epigraphic finds also indicate that Hadrianopolis was an important trade center during the Roman Period. The burial customs in the city also show that the city was heavily influenced by the Phrygia Region. Water sources are frequently depicted on the mosaics in the city. Is the depiction of water sources on the mosaics related to the intensive water sources in the city? In this study, the relationship between the water sources seen in the mosaics and the water sources in Eskipazar will be evaluated.

Keywords: Paphlagonia, Mosaic, Water Source, Roman.

Paphlagonian Hadrianopolis is located in a valley between Budaklar Village and Hacamatlar Neighborhood, 3,5 km west of Eskipazar district center in Karabük province. It can be said that Hadrianopolis was a Southern Paphlagonian city located on the border of Paphlagonia, Bithynia and

Galatia regions. Karabük province and its surroundings have been inhabited since the early periods and it is seen that Hadrianopolis was the most important settlement established by Rome in the region (Çelikbaş ve Verim, 2021: 80) (Fig.1).

Settlements to the Paphlagonia's southwestern city Hadrianopolis happened in the Late Hellenistic, Roman and Early Byzantine times. Just as the other Paphlagonian settlements, the city has a core area and a chora that concentrates around this area. Nine buildings structures have been discovered brought out as a result of the scientific studies that have been conducted in the Hadrianopolis ancient city from 2003 up to now. A military tower, city wall, fountain, three churches, two baths and a house (domus) were discovered and the restoration and conservation work of these buildings are still in progress (Fig. 2).

In Hadrianopolis, mosaic decorations were found in all structures that of the excavated completely or partially. The mosaics have floral, geometric and figurative decorations. The most important of the mosaics related to water resources, which the subject of this study, were made in the Four Rivers Church. Excavations at the Four Rivers Church were carried out by the Karadeniz Ereğli Museum in 2003. Four Rivers Church, was built in the city centre of Paphlagonian Hadrianopolis, in the area called Dut dibi. it was called Hadrianopolis The Four River Church due to the mosaic panel consist of four sacred rivers. The church was built in a frequently used threenave basilical plan with a semicircle shaped apsis, protruding to the east, and two rectangular narthexes in its west. The excavations revealed that the naos, bema and apse floors of the church were adorned with mosaics. In addition to the findings from excavations, it was concluded that church was built in the V.-VI. centuries based on its architectural and ornamental characteristics.

To the east of the central nave is a rectangular panel. Surrounded by a monochrome border on four sides, the panel depicts four figures. The personifications seen in the naos of the Four Rivers Church are, from north to south, ΓΕΩΝ (Geon), ΦΙΣΟΝ (Phison), ΤΙΓΡΙΣ (Tigris) and ΕΥΦΡΑΤΗΣ (Euphrates); their names are written in their upper left corners (Fig. 3-4). These personifications are the rivers mentioned in the Torah and believed to exist in heaven. According to the creation account in the Torah, the God made a garden in Eden and placed Adam, the first human being he had created, in this garden with all kinds of trees and plants (Albright 1922: 16). From Eden, a river watered the garden and this river was divided into four branches (Giorgi 2005: 24). Of the four tributaries, the Phison surrounds Havilah (Arabian Peninsula), the Geon surrounds Ethiopia (Africa), and the Tigris and Euphrates surround Assyria (Anatolia and Mesopotamia) (Donnelly 2006: 183). It is well known that the Tigris is the Tigris and the Euphrates is the Euphrates. Exactly which rivers Phison and Geon correspond to is disputed. It is suggested that Geon may be the Nile River, while Phison may be a dried up river in the Arabian Peninsula (Brown 1884: 3-11). He is shown holding a cornucopia in his left hand, symbolizing fertility, and in a greeting position with his right hand. Phison and Tigris are shown without beards, while Geon and Euphrates are shown with beards. The water (stream) coming out of the cornucopias held by the figures has turned into a stream by forming a puddle below the waist of the figures (Verim 2021: 53). Another scene related to the water source in Hadrianopolis is also found in the Four Rivers Church. In the center of the south nave, in a rectangular panel measuring 88 x 83 cm, a bull figure is depicted on a yellow background, drinking water from the puddle below (Fig. 4). The silhouette of the bull depicted in realist style is reflected in the water. Around the bull's neck is a yellow bell with a red chain/tip. The reflection of the bell in the water is colored red and pink.

Hadrianopolis is located in a valley formed by the Eskipazar Stream. It can be said that the region has rich water resources. Eskipazar Stream gives life to Hadrianopolis. In addition, it also has resources such as hot spring and mineral water. Archaeological documents also support the importance of water resources in Hadrianopolis. During the excavations in the Southern Necropolis of Hadrianopolis, various burial gifts were discovered. A Roman provincial coin of Hadrianopolis belong to Marcus Aurelius,

which was left in a tomb for Charon, has a personification of a river god on the reverse (Çelikbaş and Oyarçin 2022: Cat.1). The legend KEZIOC just below the river god on the coin must be the Roman name of the Eskipazar Stream. Another coin of Marcus Aurelius, also found in the South Necropolis, has Asclepius on the reverse. In addition, an inscription from the 2nd century AD, which was used as a spolia in the Square

structure, was found to be dedicated to Asclepius. It must not be a coincidence that Asclepius is mentioned on the provincial coin of Hadrianopolis and that the dedicatory inscription was discovered. It is highly probable that the Akkaya Hot Spring, located within the territory of Hadrianopolis, is related to the presence of the cult of Asclepius in the city. The fact that Hadrianopolis had various water sources led to the depiction of water-related scenes on the mosaics. As a continuation of the tradition of engraving river gods on Roman coins, river personifications were made in the Four Rivers Church. In other words, the presence of the river, hot spring, mineral water in the city affected Roman coin with river god and river personifications on mosaics in the Byzantine period. The fact that Eskipazar has a wide variety of water resources has been one of the main factors in the selection of the region as a settlement from the early periods until the end of Byzantium.

BIBLIOGRAPHY

1. Albright, W. F. The Location of the Garden of Eden, *The American Journal of Semitic Languages and Literatures*, 39/1, (1922), 15-31.
2. Brown, F. A Recent Theory of the Garden of Eden, *The Old Testament Student* 4/1, (1884), 1-12.
3. Çelikbaş, E. " Paphlagonia Hadrianopolisi'nin Yerel Özellikleri ve Çevre Bölgelerle Olan Kültürel Bağlarına Bir Bakış." *BYZAS*. Sayı: 26, (2021), 165-179.
4. Çelikbaş, E. and Oyarçin, K. "Roman Provincial Coins of Paphlagonian Hadrianopolis" *The Numismatic Chronicle* 182, (2022), 179-190.
5. Çelikbaş, E. and Verim, E. "Hadrianopolis Kuzeybatı Nekropol Kilisesi'nin Bema ve Apsis Mozaikleri", *JMR*, 14, (2021), 79-100.
6. Donnely, I. *Atlantis The Antediluvian World*, (2006), Teddington.
7. Giorgi, R. *Angels and Demons in Art*, (2005), California.
8. Keleş, V. 2021. "Tarihi ve Lokalizasyonu", *Paphlagonia Hadrianopolis'i (2010-2014 Sezonları)*, Edi. V.Keleş, E.Çelikbaş, A.Yılmaz, Ankara: Bilgin Kültür Sanat Yayınları. 3-8.
9. Matthews, R. - Metcalfe, M. – Cottica, D. (2009), *Landscapes with Figures: Paphlagonia Through the Hellenistic, Roman and Byzantine Periods, 330 BC-AD 1453, At Empires' Edge: Project Paphlagonia, Regional Survey in North-Central Turkey, (Ankara 2009)* 175-227.
10. Verim, E. "Dört Nehir Kilisesi (Kilise B)", *Paphlagonia Hadrianopolis'i: 2010-2014 Sezonları*, Edi.: V.Keleş-E.Çelikbaş-A.Yılmaz, Ankara: Bilgin Kültür Sanat Yayınları, (2021), 45-88.

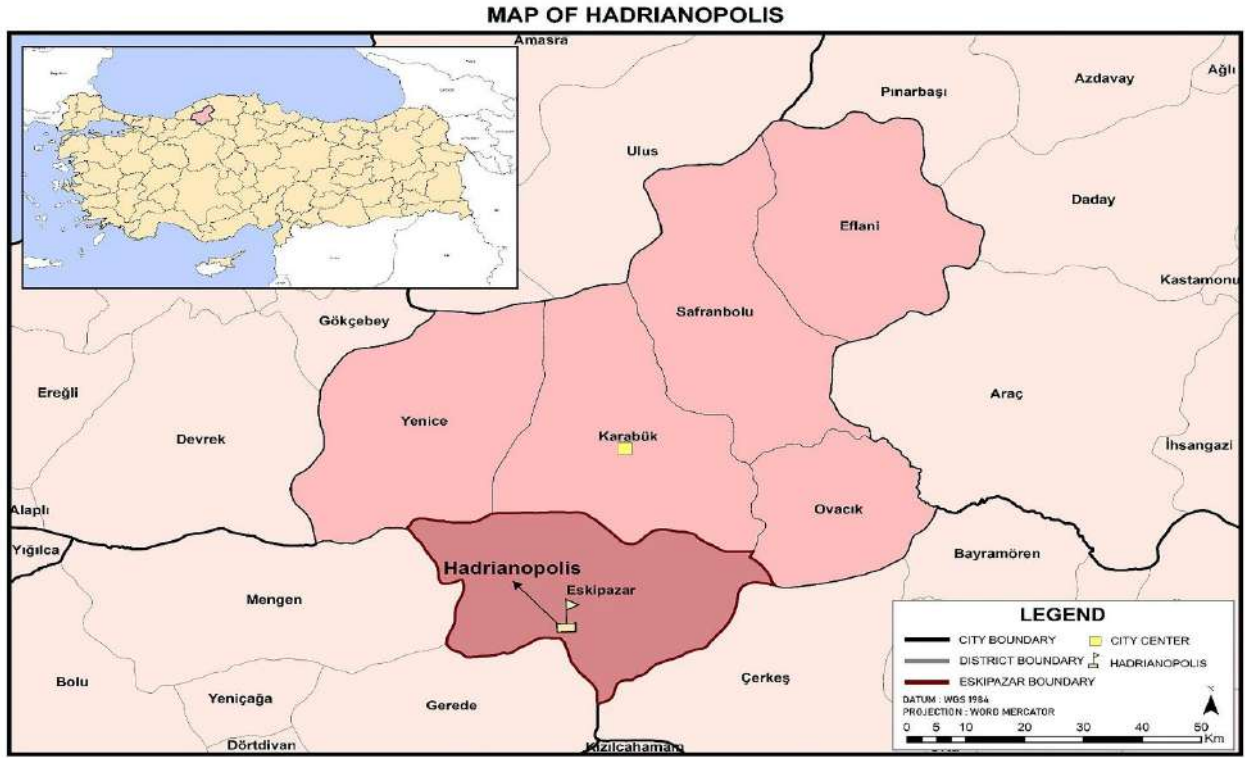


Figure 1: Map of Eskipazar

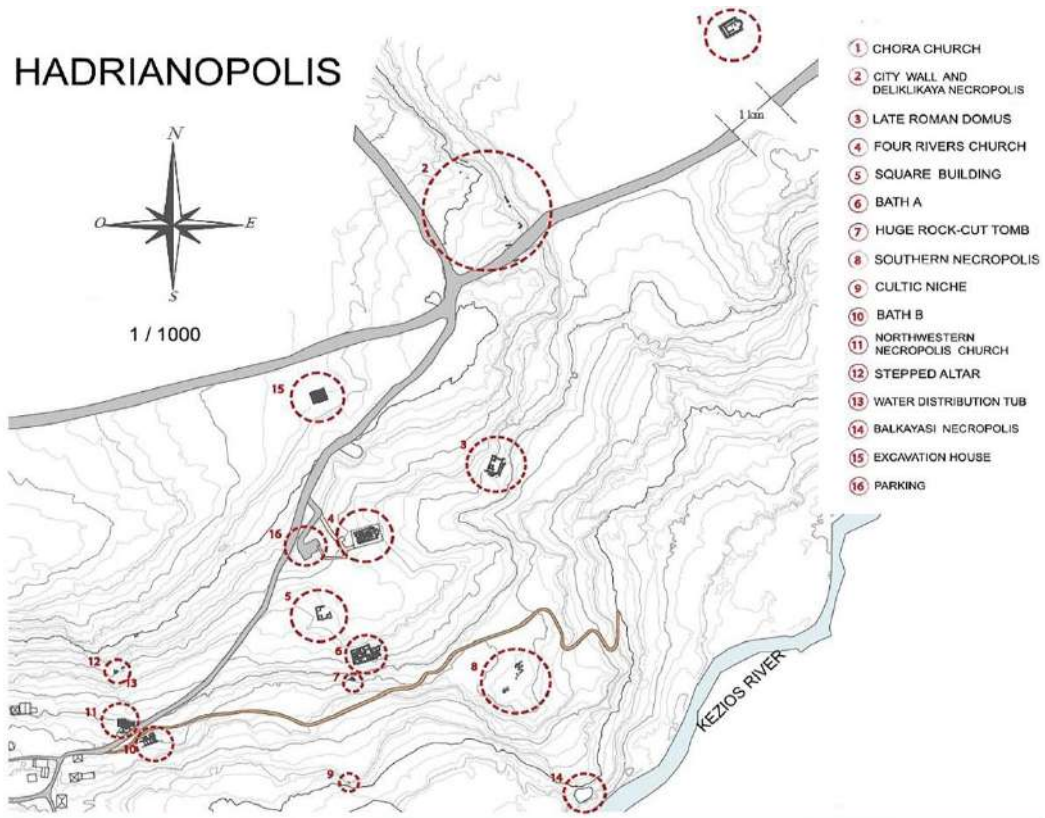


Figure 2: City plan of Hadrianopolis



Figure 3: Personifications of Four Rivers



Figure 4: Bull figure

MISPRONUNCIATION OF ENGLISH CONSONANTS /s/ AND /h/ PRECEDING CONSONANTS AND VOWELS BY AFGHAN STUDENTS

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ABSTRACT

This study investigated the causes of misarticulation of the English phonemes /s/ and /h/ among Afghan English language learners as a foreign/second language. The findings indicated that Afghan students misarticulated the phoneme /s/ when preceded by consonants and the phoneme /h/ when preceded by vowels. A detailed comparative analysis of the consonant and vowel systems of both Farsi/Dari and English was conducted to determine the similarities and differences between the two languages. This comparative review revealed that, although there were some similarities in the sound systems, key differences contribute to mispronunciations. The study specifically examined the use of the phonemes /s/ and /h/ to identify the underlying reasons for these misarticulations. To address these challenges, a two-month pronunciation class was implemented, involving three classes per week. The results demonstrated that Afghan students tended to insert a schwa /ə/ before the phoneme /s/ when it was preceded by other consonants, particularly when these consonants were voiced rather than voiceless. Additionally, the variation in place and manner of articulation for /s/ and /h/ between Farsi/Dari and English posed significant challenges for accurate pronunciation. Stress patterns, specifically primary and secondary stress on syllables, also contributed to misarticulations when /s/ followed a consonant. The influence of the phonological structure and syllable patterns of Farsi/Dari was shown to have a direct impact on students' pronunciation of English phonemes. Interestingly, when /s/ preceded vowel sounds, Afghan students did not misarticulate the phoneme, likely due to the shared syllable structures between Farsi/Dari and English in this context. Consequently, no schwa was inserted in these cases. The two-month class showed positive results, successfully improving the students' articulation of both the /s/ and /h/ phonemes.

Key words: *Afghan students, Farsi/Dari, misarticulation, phonemes, Shewa, voiced and voiceless.*

INTRODUCTION

It is widely accepted that native English speakers can easily identify foreign accents, such as those of Pakistani, Indian, and Dari speakers, which may affect the intelligibility of certain phonemes. However, these accents primarily signal that the speaker is not a native English speaker. English, as the current global lingua franca, holds a vital role in business, science, media, and other fields worldwide. As a result, English is regarded as an official or second language in many countries, prompting people from both developed and developing nations to study it. Afghanistan is one such country, where the younger generation increasingly enrolls in English language courses in an effort to learn the language correctly and in its standard form. Given this context, research on accurate pronunciation in English has become a pressing necessity.

One of the most significant challenges for second or foreign language learners of English is mastering acceptable pronunciation that ensures intelligibility among both native and non-

native speakers. While learners may excel in other linguistic components such as syntax, grammar, semantics, and morphology, they often struggle with phonology. As noted by Avery and Ehrlich (1992), "The nature of a foreign accent is determined to a large extent by the learners' first language (L1). In other words, the sound system and syllable structure of the L1 have some influence on the speech or production of the second language (L2)" (p. 2). Swan and Smith (1987) further support this view, explaining that "the pronunciation errors made by second language learners are not merely random attempts to produce unfamiliar sounds, but rather reflections of their native language sound system"(p. x).

During my M.A. studies in a linguistics class at Selcuk University, Konya, Turkey, Dr. Nazli GÜNDÜZ observed that Afghan students mispronounced certain English words containing the phonemes /s/ and /h/. This observation got my attention, especially given my passion for applied linguistics, specifically phonetics. I decided to explore whether previous research had examined this issue in Afghanistan or elsewhere. My preliminary investigation revealed that while some linguists have conducted comparative studies on Farsi/Dari phonemes, they did not thoroughly address the causes of misarticulation, nor did they propose effective solutions. This gap in the literature motivated me to conduct an in-depth study of the misarticulation of the phonemes /s/ and /h/, specifically when preceded by vowel and consonant phonemes, with the aim of identifying problematic areas and suggesting potential solutions.

Mahjani (2003), in her M.A. thesis, "An Instrumental Study of Prosodic Features and Intonation in Modern Farsi (Persian)," states, "During the last two decades of the 20th century, such experimental investigations have been made for many languages, both European and non-European ones" (p. 9). Inspired by this research, I recognized the potential value of studying the articulation of /s/ and /h/ phonemes by Afghan speakers of English, both for learners and teachers of English in Afghanistan. Afghan learners of English frequently mispronounce the phoneme /s/ at the beginning of words when followed by another consonant, often inserting a schwa /ə/ sound in front of it, despite the fact that English does not have a schwa before the /s/ in such contexts. Conversely, these learners do not mispronounce /s/ when followed by vowel sounds. Additionally, Afghan students tend to misarticulate the phoneme /h/ when followed by vowel sounds, as evidenced in their pronunciation of the word "happened," which is often pronounced without the /h/, producing "appened" instead. These pronunciation errors suggest that the phonological system of their native language, Farsi/Dari, has a profound influence on their articulation of English phonemes.

In short, as an Afghan English teacher, I am motivated to investigate the phonological structures of both English and Farsi/Dari in order to uncover the reasons behind these misarticulations. Afghan students, for example, tend to articulate the phoneme /h/ as a long "ee" or "a" sound. While they generally pronounce most English phonemes accurately, the misarticulations discussed here warrant focused research.

The Aim of the Research

This study aimed to understand why Afghan students misarticulate the phonemes /s/ and /h/ by comparing the phonological structures of English and Farsi/Dari. Through this comparative analysis, the study identifies the underlying causes of mispronunciations, offer insights into overcoming these errors, and propose practical solutions for improving the pronunciation of Afghan students learning English as a second or foreign language in schools and universities across Afghanistan.

Significance of the Research

This error analysis is of significant relevance to both teachers and learners of English as a second or foreign language, particularly for Farsi/Dari speakers, as it examines the phonetic structures of Farsi/Dari and English. The study emphasizes key instances of misarticulation of the English phonemes /s/ and /h/ by Afghan students. The findings are not only beneficial for

language teachers and learners but also provide a deeper understanding of the phonological differences that contribute to difficulties in articulating specific English phonemes.

Given the limited research on the Farsi/Dari language in the field of linguistics, this study offers valuable insights into its phonological similarities and differences with English. It serves as a critical resource for Afghan English teachers, helping them understand the underlying causes of mispronunciation, particularly of the phonemes /s/ and /h/ when these occur before consonants or vowel sounds. Furthermore, this research paves the way for future linguistic studies on Farsi/Dari in comparison with English. It holds particular value for Farsi/Dari phonologists and linguists interested in exploring the phonological features of less-studied languages, contributing to a broader understanding of cross-linguistic phonetic challenges.

The Research Questions

This study explores the phonological characteristics of Afghan students learning English as a second or foreign language with a specific focus on the articulation of the phonemes /s/ and /h/. Throughout this study, the research intended to answer the following research questions:

1. To analyze how Afghan students pronounce the phoneme /s/ when it precedes vowel sounds in texts specifically designed for this study.
2. To investigate whether Afghan students accurately pronounce the phoneme /s/ when it precedes other consonants and, in cases of mispronunciation, to identify the underlying causes and propose corrective solutions.
3. To examine the articulation of the glottal phoneme /h/ in selected texts and word lists, determining whether any mispronunciation can be attributed to interference from the students' native language

Literature Review

In this chapter, an overview of the consonant and vowel structures, as well as the sound systems of Farsi/Dari and English, is provided. The researcher also presents detailed information on the articulation of the phonemes /s/ and /h/ in both languages, alongside a review of contrastive analysis and error analysis methodologies. Based on the collected data, a comparative analysis of the phonetic and phonological aspects of the consonant letters and sound systems in Farsi/Dari and English is conducted. This comparison aims to highlight the differences and similarities between the two languages, particularly in relation to the articulation of the target phonemes.

A Brief Introduction to Farsi/Dari Language

Farsi/Dari refers to the language that is popularly known as Persian or Farsi. These different names have been used throughout history and refer to the same language. There are two theories regarding the origin of the word "Dari." The first theory is that the word Dari comes from the word Darbar, which means court, courts of kings. It has been argued that this language was very respected and chosen as a language for communications at royal courts of kings. Hence, it is known as the language of courts, or Darbari. Later in time, the word Darbari was shortened and evolved to Dari, which still has the same meaning as Darbari. The second theory relates the origin of the word Dari to the word Dara (Valley). Many accomplished language researchers admit that the language Dari itself was born in Khorassan (current Afghanistan), a mountainous area where people live in numerous valleys (Dara). Therefore, the name Dari was coined to refer to the language spoken by people of the valleys (Dara) or in the valleys (Museen, 1995, pp. 1–3). Farsi/Dari is a widely used language in Central Asia. It is the official language of Iran, Tajikistan, and Afghanistan. Farsi/Dari is a branch of the Indo-Aryan languages, a subfamily of the Indo-European languages. There are three different periods in the development of Aryan languages: The Old, Middle, and Modern Periods.

Old Farsi/Dari and Avestan represent the earliest stages of linguistic development in the region, once spoken in ancient Bactria. Old Farsi/Dari was used until approximately the 3rd century BC, followed by Middle Farsi/Dari, which was spoken from the 3rd to the 9th century and was closely

related to several Central Asian languages such as Sogdian, Choresmian, and Parthian (Dehgani, 2006, p. 10). Modern Farsi/Dari began evolving in the 9th century as a continuation of the Khorasan standard language, which incorporated significant elements from both Parthian and Middle Farsi/Dari. Today, Modern Farsi/Dari has a much simpler grammatical structure than its earlier forms. Following the Arab conquest in the 7th century, the language adopted the Arabic script with slight modifications and absorbed a substantial amount of Arabic vocabulary. Afghanistan is home to a diverse range of ethnic groups, each speaking its own language, such as Farsi/Dari, Pashto, Uzbek, Turkmen, Pashae, and Nuristani, among others. However, Farsi/Dari and Pashto serve as the two official languages of the country. Farsi/Dari is widely taught in schools and universities, with Radio Afghanistan promoting a standardized pronunciation of the literary language. The Persian spoken in Tehran is often used as a model for formal speech, though some colloquial variants align more closely with Tajik. There are only minor lexical differences between the literary forms of Farsi/Dari used in Iran and Afghanistan. Despite both Farsi/Dari and Pashto being official languages, Farsi/Dari holds special social prestige due to its historical significance and is often the preferred medium of communication among speakers of different linguistic backgrounds (Khanlari, 2006, pp. 1–5).

Background of Farsi/Dari Vowels

According to Yamin (2005), the Farsi/Dari language contains eight vowel sounds, categorized into three tense vowels [i:, u:, a:] and five lax vowels [e, i, a, u, o]. The distinction between these two sets lies in vowel length, with tense vowels being long and lax vowels being short. These vowels occur in specific positions within words, as outlined below:

1. The vowel /a:/ appears in three positions. At the beginning of words, it is represented as /ā a:/, producing a long sound. In the middle and at the end, it appears as /ʾ a/, which also represents a long sound.
2. The vowel /æ/ occurs at the beginning of words as /ʾ æ/, producing a short sound. At the end of words, it is represented by the letter /ɔ/, but in the middle of words, there is no specific letter for it, so the “fatha” symbol /ō / is used to indicate its presence.
3. The vowel /I/ is written at the beginning of words with the letter /ʾ/. It does not occur at the end of words, and in the middle, it lacks a letter representation, so the symbol /ʾ/ “kasra ya zaber” is used.
4. The vowel /e/ rarely appears at the beginning of a word, but when it does, it is accompanied by “alef” /ʾ/. In contrast, in the middle and at the end of words, it appears as (ya / ɛ), known as passive (ya).
5. The vowel /i:/ occurs in all positions—initial, medial, and final. Unlike the previous vowel, /i:/ is called active (ya / ɪ), and is clearly pronounced in Farsi/Dari.

Note: When /i:/, corresponding to Farsi/Dari vowel (ya / ɪ), occurs at the beginning of a word, the letter /ʾ/ is added before /ɪ/ at the word's beginning. ایستگاه /I:stga/ means station.

6. The vowel /u/ appears at the beginning of a word as “Alef Maznoon” /ʾ/. In the middle of a word, it often lacks a grapheme, indicated instead by the “zama” [ō] sound. It can also appear as Farsi/Dari waw / ɔ / in the middle, where it is known as “madola waw,” representing the “zama” / ō / sound from the preceding letter. This vowel rarely appears at the end of a word.
7. The vowel /o/ occurs in the middle and at the end of words, represented by the letter / ɔ /.
8. The vowel /u:/ occurs both medially and finally, represented by the active waw “ ɔ ” in Farsi/Dari.

Azim (1996) notes that certain Farsi/Dari dialects spoken in Afghanistan have a similar vowel system, where short /a/, short /i/, and short /u/ serve as allophones of these vowels. The phonetic short /a/ is commonly pronounced in the middle of words in regions such as Badakhshan, Takhar, Andarab, and Panjsheer provinces, while in Parwan and Pagman provinces, /a/ is pronounced at the end of words (p. 14).

In addition to the earlier discussion of Farsi/Dari vowels and their usage, Negari (2005), an Iranian scholar, offers insight into the historical evolution of vowel pronunciation in her work "Persian Language and its Disorderliness Pronunciation." According to Negari, Middle Persian had eight vowels, three of which were short [a, u, I], and five were long [a:, i:, u:, e, o]. However, contemporary Persian vowel sounds in Iran have evolved to include six vowels: [a, e, o, a:, i:, u:]. The distinction between short vowels [a, i, u] and long vowels [a:, i:, u:] in Farsi lies primarily in quantity. This means that the articulation time for long vowels is approximately twice as long as that for short vowels. Today, however, the difference between the vowel pairs [a, e, u] and [a:, o, i:, u:] is not merely quantitative but also qualitative, indicating a change in the manner of articulation. For example, the vowels [a] and [a:], [e] and [i:], and [o] and [u:] differ in both their quality and articulation (p. 3).

Unlike Farsi/Dari, modern Persian (spoken primarily in Iran) has six vowels, with three classified as tense [i:, u:, a:] and three as lax [a, e, o]. As Shademan (2002) notes, "the distinction between these two sets of vowels is sometimes attributed to vowel length, with lax vowels being short and tense vowels being long" (p. 2). Persian employs only three alphabetical characters to represent all six vowels: /ā/, /ǎ/, and /ʌ/. The character /ā/ corresponds to the long or tense vowel /a:/, while the characters /ʌ/ and /ǎ/ are used in combination to represent the other five vowels. This creates ambiguity in pronunciation, making it challenging for learners to distinguish between vowels such as [e, a] or [o]. For example, the Farsi/Dari word مهر can be pronounced in multiple ways: *mer* (meaning "affection"), *mor* (meaning "seal"), or *mar* (meaning "wedding gift"). This complexity highlights the intricacies of the Persian vowel system, which differs significantly from other languages such as English.

Consequently, in order to guess correctly or understand Persian, one must consider the context and overall meaning of the sentence. The six Persian vowels are distinguished by both the position of the tongue—whether high, mid, or low—and the place of articulation in the mouth—whether the sound is produced in the front or back (Dehghani, 2006, p. 6).

This highlights the significance of understanding the phonetic context in Persian, as the same written form may result in multiple possible pronunciations, emphasizing the need for contextual clues for accurate interpretation.

Background of Farsi/Dari Consonants

The origin of the Farsi/Dari alphabet is rooted in the Arabic script, though Farsi/Dari has four additional letters that are not present in the Arabic alphabet. In their works, *Inadequacy and Difficulties of Alphabets* (Negari, 2005) and *Farsi Language and its Disorderliness of Pronunciation* (Farkhari, 2004), both scholars divide the Farsi/Dari alphabet into three distinct groups:

1. **Farsi/Dari-specific letters:** These include /cheh/ چ [tʃ], /zh/ ژ [ʒ], /peh/ پ [p], and /gaf/ گ [g].
2. **Pure Arabic letters:** These are eight letters used in both Farsi/Dari and Arabic, including /se/ س [s], /he/ ح [h], /sa:d/ ص [s], /za:d/ ض [z], /ta:/ ط [t], /za:/ ظ [z], /ayn/ ع [ʕ, ʔ], and /qaf/ ق [q].
3. **Shared letters between Arabic and Farsi/Dari:** The remaining letters are common to both languages but are subject to variation in pronunciation depending on the context (Negari, pp. 1–3; Farkhari, pp. 10–11).

Farsi/Dari contains 32 letters in total. Before delving into the discussion of its consonant letters, I present the complete set of consonants in the following table for clarity.

English	Farsi/Dari pronunciation	Farsi/DariScript	IAP symbol	Examples
A	Alef	/ a/	ا, آ	Apple

B	Be	/ b/	ب	book / as expected /b/
P	Pe	/ p/	پ	pocket / as expected /p/
T	Te	/ t/	ت	teacher / as expected /t/
S	Se	/ s/	ث	think / like th in thing / /
J	Jim	/ dʒ/	ج	Japanese
Ch	Cheh	/ tʃ/	چ	Chinese
H	He	/ h/	ح	Hassan / like whispered /h/
Kh	Khe	/ x/	خ	Khan
D	Dal	/ d/	د	danish / as expected /d/
Z	Zal	/ z/	ذ	Like th in these / /
R	Re	/ r/	ر	Russian
Z	Ze	/ z/	ز	Zulu / as expected /z/
J	Je / zhe	/ ʒ/	ژ	pleasure
S	Sin	/ s/	س	Spanish / as expected /s/
Sh	Shin	/ ʃ/	ش	shadow
S	Sad	/ s/	ص	supper / emphatic /s/
Z	Zad	/ z/	ض	danish / emphatic /d/
T	Ta	/ t/	ط	tagalog / emphatic /t/
Z	Za	/ z/	ظ	That / emphatic /dh or z/
ʻ, ʔ	Ayn	/ ʔ/	ع	ali
Q & G	Qein / gein	/ ɣ/	غ	ghulam
F	Fe	/ f/	ف	Farsi
Q	Qaf	/ q/ or / ɣ/	ق	Qum
K	Kaf	/ k/	ک	kurdish / as expected /k/
G	Gaf	/ g/	گ	Golf
L	Lam	/ l/	ل	language / as expected /l/
M	Mim	/ m/	م	mandarin / as expected /m/
N	Nun	/ n/	ن	Norwegian/ as expected /n/
V	Vav	/ v/	و	wolof / like w or long u:
H	He	/ h/	ه	Haft / as expected /h/
Y	Ye	/ j/	ی	yes / like y or long i:

Table 1: Farsi/Dari Letters which were adopted from Anwari & Giwee (1996)

In the study of Farsi/Dari phonetics and phonology, the Farsi/Dari alphabet, derived from Arabic, consists of thirty-two letters. Among these, there are twenty-three consonant sounds and eight vowel sounds. The vowel system includes five lax vowels: [a, e, o, u, i], and three tense vowels: [a:, i:, u:]. Additionally, there are two diphthongs: [ei] and [ou]. In total, Farsi/Dari encompasses thirty-three phonemes (Yamin, 2005, pp. 41–49).

In his book *Modern Farsi/Dari Grammar*, Yamin (2005) outlines the consonant phonemes of Farsi/Dari, identifying seven stops or plosives: [p, t, b, d, k, g, q]. Of these, four are voiceless: [p] (bilabial), [t] (alveolar), [k] (velar), and [q] (velar). The remaining three stops are voiced: [b] (bilabial), [d] (alveolar), and [g] (velar).

In addition to these plosives, Farsi/Dari features eight fricative phonemes: [f, s, z, ʃ, ʒ, x, ɣ, h] (Yamin, 2005, p. 28). According to Aitken (2006) in *Guide to Arabic Pronunciation*, the phonetic representation of the letter "q" does not have a direct English equivalent (pp. 1–4). Conversely, Shademan (2002) in her thesis *Epenthetic Vowel Harmony in Farsi* identifies [ɣ] as the phonetic representation of the letter "q" (pp. 6, 10, 12).

Among the eight fricative phonemes, five are voiceless: [f] (labio-dental), [s] (alveolar), [ʃ] (palatal), [x] (velar), and [h] (glottal). The three voiced fricatives are [z] (alveolar), [ʒ] (palatal), and [ɣ] (velar). Farsi/Dari also includes two affricate phonemes: [dʒ] (voiced palatal) and [tʃ]

(voiceless palatal). Moreover, Farsi/Dari has two nasal phonemes: [m] (voiced bilabial) and [n] (voiced alveolar), and two liquid consonants: [l] (alveolar) and [r] (alveolar). The language also features two approximants or glides: [j] (palatal) and [w] (bilabial) (Yamin & Negari, 2005, pp. 1–10, 40–50).

The syllable structure of Farsi/Dari generally prohibits starting a syllable with a vowel; syllables must begin with a consonant. Notably, Farsi/Dari does not permit sequences of two consonants before a vowel and restricts the final syllable of a word to a maximum of two consonants. An example illustrating these constraints will be presented below:

CV	“ma” /ma:/	meaning “we”
CVC	“mar” /ma:r/	meaning “snake”
CVCC	“marg” /mærg/	“meaning” death

Table 2: Farsi/Dari Syllable Structure

Farsi/Dari Phoneme /s/

In the Farsi/Dari alphabet, there are three phonemes that correspond to the English phoneme /s/: /س/ (si:n), /ث/ (se), and /ص/ (sa:d). These phonemes differ slightly in their place and manner of articulation. Specifically, the phoneme /س/ (si:n) is articulated similarly to the English /s/, produced at the same place of articulation. The phoneme /ث/ (se) corresponds to an interdental fricative sound /θ/ in English, as in "thing" (/θɪŋ/). The phoneme /ص/ (sa:d) represents a thicker or more emphatic sound compared to the English /s/ and is pronounced with a more palatal quality.

Examples of these phonemes in Farsi/Dari and their English phonetic equivalents include: /سالم/ (sa:lem) translates to "healthy", /صابون/ (sa:bun) translates to "soap", and /ثابت/ (sa:bet) translates to "stable". The distinctions among these phonemes affect how they are perceived when translated into English. Specifically, /ص/ (sa:d) is pronounced with greater emphasis compared to the English /s/, while /ث/ (se) is articulated as an interdental fricative /θ/. These variations influence how Farsi/Dari speakers might pronounce English words containing the /s/ sound (Dehghani & Aitken, 2006, pp. 1–4).

Farsi/Dari Phoneme /h/

In Farsi/Dari, there are two phonemes that correspond to the English phoneme /h/ such as /ح/ (ħa) and /ه/ (he). As a result, words that include these phonemes are rendered with the English /h/ sound. For instance, /همه/ (hame) translates to "everyone" and /حزب/ (hezab) translates to "party". These phonemes create potential confusion in writing, spelling, and pronunciation due to the lack of a unified standard for their representation. This variation can lead to uncertainty in learning and using the language. The distinction between /ح/ and /ه/ in Farsi/Dari does not have a direct and consistent correlation in English, adding complexity to the process of accurate representation and understanding.

It is essential to note that while both phonemes can represent the /h/ sound in English, there is no definitive or widely accepted guideline for preferring one form over the other in written and spoken contexts. Therefore, accurate representation and understanding in Farsi/Dari involve recognizing these phonemic nuances and their impact on language learning.

The glottal stop, represented by /ʔ/, is produced by the complete closure of the glottis, whereas the phoneme /h/ is a fricative that involves only a partial closure at the glottis. The glottal stop occurs from the area immediately in front of the glottis, creating a brief interruption of airflow. In contrast, /h/ is articulated with a constriction that allows for continuous airflow and creates a friction sound.

Both the glottal stop and the /h/ phoneme are present in English and Farsi/Dari; however, their occurrence in English is generally more restricted compared to Farsi/Dari. The glottal stop is used in English primarily in specific contexts, such as the interruption in the pronunciation of

the word "uh-oh," while /h/ appears more regularly in various positions within words. In Farsi/Dari, these sounds are used more extensively and in a wider range of phonetic environments (Bashiri, 1991, pp. 4-11).

Background of English Vowels

It is pertinent to explore the etymology of the term "vowel" in phonetics. A vowel is defined as a sound in spoken language produced with an open vocal tract, such that there is no significant build-up of air pressure above the glottis. The term "vowel" is derived from the Latin word *vocalis*, which means "speaking," itself stemming from *vox* or *vocis*, meaning "voice." This reflects the intrinsic association of vowels with voiced sounds: vowels are articulated with vocal cord vibration (Newmark, 1979, p. 15).

Bloomfield (1979) further elaborates on vowels as "modifications of voice-sound that involve no closure, friction, or contact of the tongue or lips" (p. 2). Despite these definitions, there remains considerable debate among linguists regarding the precise number of vowel sounds in English. While some sources assert there are twelve vowels, others propose eleven or even more. For the purposes of this study, I will focus on the twelve vowel sounds commonly recognized in phonetic descriptions, as illustrated in the figure below (Aitchison, 1999, pp. 234-235).

The classification of vowel sounds provides detailed insights into their articulation in terms of place and manner within the oral cavity. The vowel /i:/ is characterized as a long, close, front, unrounded sound, whereas /ɪ/ is a short, nearly half-close, palatal front vowel. Similarly, the vowel /e/ is produced as a short, front vowel with articulation between half-open and half-close positions, while /æ/ is an unrounded, short vowel articulated between half-open and open positions. The vowel /ʌ/ shares the same place of articulation with /æ/, but it differs in that /ʌ/ is a short, unrounded central vowel. In contrast, the vowel /a:/ is a long, open, unrounded sound with velar articulation, while /ɒ/ is a short, nearly open, velar back rounded vowel. The vowel /ɔ:/ occupies a position between half-open and half-close as a long, rounded sound, whereas /ʊ/ is a short, nearly half-open and half-close rounded velar vowel.

Additionally, two other long vowels are present in this system. The vowel /u:/ is a long, nearly close, rounded back velar sound, while /ɜ:/ is a long, nearly half-close, unrounded central vowel. Lastly, the vowel /ə/ is a short, unrounded central sound, articulated between half-close and open positions (Andrew & Aitchison, 1999, pp. 40-101).

Background of English Consonants

Sousa (2005) notes that the English alphabet, derived from Latin, consists of twenty-six letters, including twenty-four consonants, twelve vowels, and eight diphthongs, which collectively represent a total of forty-four phonemes (p. 37). The table below outlines the place and manner of articulation for the consonant sounds in English.

The English consonant sounds reveals that there are seven plosives (or stop) consonants, articulated by a complete blockage of airflow in the oral cavity, followed by a sudden release. Of these, four are voiceless /p, t, k, ʔ/, and three are voiced /b, d, g/. The consonants /k/ and /g/ are produced when the back of the tongue makes contact with the velum, momentarily blocking the airflow, making them velar plosives, as in *keep* and *game*. Other examples include bilabial plosives /p/ and /b/, and alveolar plosives /t/ and /d/, as in *peak*, *beat*, *team*, and *deem*. The voiceless glottal stop /ʔ/, articulated by tightly closing and then releasing the vocal cords, is produced in the glottal region, as in *geography* /dʒɪʔɒgrəfi/.

English contains nine fricative sounds, which occur when two articulators come close together but do not completely obstruct the airflow, instead forcing it through a narrow constriction. These include the labiodental fricatives /f/ and /v/, as in *feet* and *very*; the dental fricatives /θ/ and /ð/, as in *think* and *this*; the alveolar fricatives /s/ and /z/, as in *seen* and *zip*; the palatal fricatives /ʃ/ as in *sheep* and /ʒ/ as in *measure*; and the glottal fricative /h/ as in *happy*. Of these

fricatives, five are voiceless /f, θ, s, ʃ, h/, and the remaining four are voiced /v, z, ð, ʒ/ (Andrew, 1999, pp. 31-39).

Additionally, English features two affricate sounds: the voiceless /tʃ/ and the voiced /dʒ/. These sounds begin as plosives, with a complete blockage of airflow, and transition into a fricative-like release, producing a combination of plosive and fricative qualities. Both are typically classified as palato-alveolar or postalveolar affricates, as their articulation occurs between the alveolar ridge and the hard palate (Adrian, A. et al., 2001, pp. 75-78).

The nasal consonants /m, n/ and /ŋ/ share the same manner of articulation but differ in their places of articulation. The bilabial nasal /m/, alveolar nasal /n/, and velar nasal /ŋ/ are all voiced. As Chomsky and Halle (1968) explain, "English nasal consonants block the airstream completely during articulation, but are not classified as plosives due to the distinct manner of their release" (p. 15).

The liquids in English, classified as approximants, include the lateral /l/ and the rhotic /r/, produced in the alveolar and postalveolar regions, as in *hard* and *far*. The /l/ sound has two primary allophonic variations: the "clear" /l/, which occurs in prevocalic positions (e.g., *lake*, *look*), and the "dark" /l/, which appears in final or post-vocalic positions (e.g., *kill*, *rule*, *belt*). In the clear /l/, the tongue tip touches the alveolar ridge, while in the dark /l/, the body of the tongue rises toward the soft palate, altering its resonance (Demirezen et al., 1987, pp. 16-17, 54).

Finally, English includes two approximant or semivowel sounds: /w/ and /j/, both of which are voiced. The bilabial-velar approximant /w/ is a rounded sound, while the palatal approximant /j/ is unrounded. Chomsky and Halle (1968) explain that "when articulating a glide, the articulatory organs begin in a vowel-like position but quickly transition to another sound. Unlike vowels, glides cannot appear syllable-finally, precede a consonant, or occur without following a genuine vowel sound" (pp. 8-15). In the case of /w/, its articulation at the beginning of words resembles the vowel /u/, as in *win* and *wet*. Conversely, the articulation of /j/ at word onset resembles the short vowel /i/, but it transitions to another vocalic sound, as in *yes* and *young* (Bloomfield, 1979, pp. 3-8).

English Phoneme /s/

The English phoneme /s/ is a voiceless alveolar fricative, produced by positioning the blade of the tongue against the alveolar ridge. The breath stream is directed through a narrow groove formed by the tongue, striking the teeth to create a characteristic hissing sound. This phoneme occurs in various positions within words, appearing at the beginning, middle, and end, as exemplified by *speaks*, *test*, and *talks*.

Although the phoneme /s/ is commonly represented by the letter "s," as in *sun* or *bus*, this orthographic representation is inconsistent, as the letter "s" can also represent other phonemes. In addition to /s/, the letter "s" frequently denotes the phoneme /z/, as in *rose*, *is*, *dogs*, *dessert*, and *reason*. It may also stand for the postalveolar fricatives /ʃ/ and /ʒ/, as in *sure*, *sugar*, *measure*, and *pleasure*. Furthermore, when the letter "s" is followed by the letter "c," the two letters can represent the phoneme sequence /sk/, as in *scold*, or the "c" may be silent, as in *science* and *scent*.

When doubled, as in *kiss*, *lesson*, *dress*, and *kindness*, one instance of the letter "s" is silent. Additionally, when "c" precedes the phonemes /ɪ/, /e/, or /j/, it is pronounced as /s/ rather than /k/, as seen in *circle*, *cent*, *cycle*, and *face*. In certain words, the phoneme /s/ is silent altogether, as in *corps*, *island*, and *viscount* (Radford, 1999, pp. 31-47).

English Phoneme /h/

The English glottal phoneme /h/ is a voiceless fricative produced by allowing air to pass freely through the mouth during exhalation. English features two glottal phonemes: the glottal stop /ʔ/ and the glottal fricative /h/. The /h/ phoneme, often described as a hissing sound, is articulated by spreading the vocal folds and letting the air flow through the glottis. It appears in initial,

medial, and final word positions, although omitting /h/—especially in initial positions—is often viewed as a marker of limited education. For example, /h/ is silent in initial and medial positions in words such as *hour*, *heir*, *honor*, and *honest*, as well as in the medial position of words like *vehicle* and *annihilate*.

Even among educated speakers, the initial /h/ may be dropped in unstressed or weak forms of certain personal pronouns, such as *he*, *him*, and *her*, as well as in possessive *his* and in the verb *have*. Additionally, /h/ is silent in final positions in certain contexts, as in the interjection *ah* and the word *shah*. In words of Greek origin where traditional spelling has preserved /h/ following /r/, such as *rhapsody*, *rhetoric*, *rheumatism*, *rhinoceros*, *rhombus*, *rhyme*, and *rhythm*, the /h/ sound is no longer pronounced.

The phoneme /h/ typically precedes vowel sounds. In the digraph /wh/, the /h/ sound follows the semi-vowel /w/, as in *who*, *whom*, and *whose*. The phoneme /h/ is relatively consistent in words where it appears initially, as in *hat*, though it is silent in some cases, such as *heir*, *honor*, *honest*, and *hour*. Furthermore, /h/ becomes silent when following the phonemes /g/, /k/, and /r/, as in *ghost*, *rhyme*, and *khaki*.

The phoneme /h/ also forms digraphs with other consonants, producing six notable combinations: /sh/, /th/, /wh/, /ch/, /ph/, and /gh/. The digraph /gh/ can be particularly confusing, as it sometimes represents the sound /f/, as in *enough* and *laugh*, while in other cases it remains silent, as in *night* and *though* (Peter, 2000, pp. 10, 35, 48, 69).

English syllable structure contrasts with that of Farsi/Dari. English syllables may begin with vowel sounds (e.g., V, VC, VCC), or with one or more consonants (e.g., CV, CVC, CCV, CVCC, CCVCC, CCVCCC). By contrast, Farsi/Dari syllables do not begin with vowel sounds, as shown in the following table:

V	I /i/	VC	am /æm/
VCC	Ant /ænt/	CV	key /ki:/
CVC	Car /ka:r/	CVCC	talk /ta:lk/
CCV	tree /tri:/	CCVC	trap /træp/
CCVCC	stamp /stæmp/	CCVCCC	spends /spends/

Table 3: English Syllable Structure

Hall (2007) highlights that the variation in syllable patterns between English and Farsi/Dari can lead to pronunciation difficulties for Farsi/Dari speakers learning English. Specifically, these speakers often struggle to produce consonant clusters in English words, a challenge stemming from the fact that Farsi/Dari phonology does not permit words to begin with two consonants (p. 28).

Similarly, Shademan (2002) explains that when a consonant's phonetic features are compatible with the vowel's features in a spreading process, the inserted vowel is a replica of the following vowel, meaning that both vowels share similar features. However, if the consonant's features are incompatible with this process, the default vowel /e/ is inserted. Notably, all SC (S + Consonant) clusters in Farsi/Dari involve the insertion of the epenthetic vowel /e/ (pp. 28-29).

METHODOLOGY

Here the researcher presents the methods to follow up the research procedures step by step. The subtitles of the research methodology are participants, instrument, instruments for Farsi/Dari speaker of English, data collection procedure *and* limitations of the research.

Participants

This study involved six Afghan students who pursued their M.A. degrees in the English Department at Selçuk University in Konya, Turkey, through English as the medium of instruction. The participants included two Afghan female educators and four male students, all of whom possessed a comparable level of English proficiency. It was important to note that the

participants were recruited via the researcher's professional contacts at the university and through acquaintances of other students. The age range of the participants was 22 to 31, and they were from various provinces of Afghanistan.

Of the six participants, one female and three males were academic staff members at universities in Afghanistan. They enrolled in their M.A. studies under a contract between Selçuk University and Kansas State University, funded by the World Bank Project. This initiative sought to support the Afghan Ministry of Higher Education in enhancing the academic qualifications of Afghan university teachers, enabling them to advance from a B.A. to M.A. and Ph.D. level. Four participants were beneficiaries of this project, while the remaining two, one male and one female, received scholarships from the Government of Turkey.

Five of the participants held degrees from English departments, with the exception of one female student who had completed four semesters in an English department in Afghanistan before receiving a Turkish government scholarship to continue her education at Selçuk University. She was currently in her fourth year at the Faculty of Economics and Administrative Sciences at Selçuk University.

Instruments

To address the errors, the researcher conducted a two-month experimental class designed to teach the correct pronunciation of phonemes /s/ and /h/. A custom textbook, which incorporated texts featuring words with /s/ and /h/, was used as the primary instructional material. The class was designed to improve pronunciation accuracy through targeted practice. Throughout the study, the author utilized seven instructional tools to achieve positive results and to develop recommendations for both learners and teachers of English as a foreign language (EFL) facing similar challenges. These tools included a computer, internet resources, specific websites, pronunciation software CDs, a compiled textbook, a tape recorder, and phonetic transcriptions of target words from the Longman Dictionary. These materials were employed during lessons to demonstrate and facilitate the correct articulation of the phonemes /s/ and /h/. Additionally, the researcher concentrated on teaching the correct pronunciation of the phonemes /s/ and /h/ using authentic listening passages read by native English speakers, with the aim of improving the participants' articulation of these sounds.

Data Collection Procedure

The data collection process was conducted in three stages. In each stage, the researcher recorded the articulation of the phonemes /s/ and /h/ as pronounced by the participants. After more than twenty days of instruction, which constituted the first stage of the study, a list of target words containing the phonemes /s/ and /h/ was compiled from the conversation lessons. The participants were recorded reading these words, and the recordings were subsequently analyzed to assess their progress and determine how effectively they had learned the correct pronunciation of these phonemes. Following this analysis, the researcher provided direct feedback to the participants and conducted a meeting to discuss their pronunciation errors. Special attention was given to comparing problematic areas between their native language and English, with a particular focus on the phonemes /s/ and /h/. In the second stage, the participants' voices were again recorded as they read aloud the provided texts and word lists containing the target phonemes. After analyzing the recordings, the researcher engaged the participants in discussions about the problematic areas identified. The third stage involved an oral discussion with the participants about the persistent misarticulation of /s/ and /h/ by Afghan students, during which the participants were asked to read aloud words containing these phonemes.

In addition to using the participants' recorded voices for analysis, the researcher also facilitated discussions to gain insights into the causes of the mispronunciations. This exchange of views not only enabled a detailed analysis of the mispronunciation of /s/ and /h/ but also helped to

identify underlying reasons for these errors, leading to the proposal of practical solutions for Afghan English learners.

Limitations of the Research

The researcher encountered several limitations that impeded the research process. One of the primary constraints was the limited access to academic resources in Afghanistan. Although some literature on Farsi/Dari phonetics and phonology exists in Afghanistan, locating relevant works authored by Afghan scholars proved to be both time-consuming and, in many cases, unfeasible in Turkey. The internet, along with email correspondence from Afghanistan, and borrowing books from Afghan students in Turkey, became the only reliable sources of information for this study. Another significant limitation was the lack of direct access to a broader sample of Afghan English learners within Afghanistan. This restriction necessitated the involvement of Afghan students currently residing in Turkey, which may not fully represent the linguistic diversity of Afghan English learners. Additionally, the small sample size, consisting of six participants (two female students and four male students), further constrained the generalizability of the findings. Despite these challenges, the study offers valuable insights, though the limitations in resources and sample size should be considered when interpreting the results.

FINDINGS

The findings of this study categorized in three distinct sections to answer the research questions in a better way. The first section explains the occurrence of the phoneme /s/ preceding vowel sounds in both monosyllabic and polysyllabic words. The second section focuses on the phoneme /s/ when it precedes other consonants within either one or multi-syllable words. The final section addresses the phoneme /h/ preceding vowel sounds in words of one or more syllables.

Findings of the Phoneme /s/ in One or Multi Syllable Words Preceding Vowel Sounds

Afghan students exhibited fewer difficulties in articulating the phoneme /s/ when it preceded vowel sounds in both monosyllabic and polysyllabic words. However, challenges were noted in their articulation of the phonemes /s/ and /h/ when preceding both consonant and vowel sounds. Upon analyzing the articulation of the phoneme /s/ preceding vowel sounds, the researcher identified the reasons for the accurate pronunciation by Afghan students. To investigate this further, the researcher developed texts and lists of target words featuring the phoneme /s/ in this context and instructed participants to read them aloud. During the reading process, the participants' voices were recorded to assess their articulation. The findings revealed that all participants accurately articulated the phoneme/s/ preceding vowel sounds in monosyllabic words.

The findings from the primary analysis indicated that when the phoneme /s/ preceded vowel sounds in monosyllabic words, there were no impediments or constraints in the prolongation of the phoneme /s/, which consequently led to the absence of mispronunciation. For example, Afghan students pronounced the English word "some" as /sæm/, demonstrating that in both English and Farsi/Dari, the phoneme /s/ was followed by a vowel sound—/ʌ/ in English and /æ/ in Farsi/Dari. Given the lack of restrictions in prolonging the phoneme /s/ in both languages, combined with the similarity in its place and manner of articulation, no misarticulation occurred. Additionally, it is important to note that Farsi/Dari and English share both similarities and differences in their phonological systems. Therefore, when the place and manner of articulation of a phoneme are consistent between the two languages, speakers of Farsi/Dari and English encounter no difficulties in articulating that phoneme, particularly when it precedes vowel sounds. Specifically, the phoneme /s/ is an alveolar fricative sound in both languages, characterized by its voiceless nature and distinctive hissing sound.

After three weeks teaching the phoneme /s/ preceding vowel sounds, the researcher recorded the participants' voices once more. The results showed that Afghan students did not misarticulate this phoneme. The fact is that in both Farsi/Dari and English, the phoneme /s/ is articulated from the same place in the mouth and shares the same manner of articulation. After two months of teaching the pronunciation class with a particular emphasis on the phoneme /s/, the findings demonstrated that when the syllable structure, place, and manner of articulation of the phoneme were identical in both languages, mispronunciation did not occur. Additionally, the English phoneme /s/ preceding vowel sounds in monosyllabic words exhibited the same sound and syllable structure as in Farsi/Dari. For instance, Afghan students pronounced the word "sir" as /sær/, reflecting that in both languages, the phoneme /s/ was followed by a vowel sound. These phonological and syllabic similarities explain why Afghan students did not misarticulate the phoneme /s/ when it preceded vowel sounds in monosyllabic words.

Later, the researcher developed texts and lists of target words containing the phoneme /s/ in polysyllabic words to assess how Afghan students articulated this sound in such contexts. The results revealed that nearly all participants accurately pronounced the phoneme /s/ preceding vowel sounds in polysyllabic words, with the exception of two participants. While the researcher was providing feedback and reanalyzing their pronunciations, he understood that these instances were mistakes rather than indicative of a systematic pronunciation error. The absence of misarticulation of the phoneme /s/ in both monosyllabic and polysyllabic words can be attributed to the similarities of the syllable structure, sound system, and place and manner of articulation in both English and Farsi/Dari languages. Afghan students did not mispronounce the phoneme /s/ preceding vowel sounds in multi-syllable words because there was no obstacle or limitation in front of it, and speakers could prolong this phoneme as much as they wanted. Furthermore, the analysis revealed that /s/ in multi-syllable words has the same phonological similarities as in one-syllable words preceding the phoneme /s/, which is why Farsi/Dari speakers have no difficulty pronounced it.

The third recording of the phoneme /s/ preceding vowel sounds in polysyllabic words showed the same results consistent with previous findings. Additionally, when the phoneme /s/ preceded semivowel sounds in both monosyllabic and polysyllabic words, Afghan students did not misarticulate the phoneme /s/. This was because, in some cases, the semi-vowel functions as a vowel, as observed in the word "system" (/sistəm/). Even when the semi-vowel was represented in the phonetic transcription, as in the word "sweet" (/swi:t/), Afghan students accurately pronounced the phoneme /s/. The absence of obstacles in prolonging the phoneme /s/ prevented any misarticulation in these contexts.

Findings of the Phoneme /s/ in One or Multi Syllable Words Preceding Consonants

The study's findings indicated that there was no evidence of misarticulation of the phoneme /s/ when preceding vowel sounds were present in both monosyllabic and multisyllabic words. However, it was observed that Afghan students commonly misarticulated the /s/ phoneme when it was followed by consonants in both one- and multi-syllable words. The first recordings revealed that five out of six Afghan students demonstrated misarticulation of the /s/ phoneme in monosyllabic words, with varying degrees of frequency among the five students. While some showed a lower rate of misarticulation, others had a higher rate. Furthermore, the study recognized that second-language learners who had exposure to English through native speakers, regularly engaged with authentic English media, received direct instruction from native English teachers, or studied in an immersive English environment demonstrated a higher accuracy in pronouncing the /s/ phoneme compared to those without such experiences.

After recording the participants' voices as they read aloud texts and lists of target words containing the phoneme /s/, the researcher conducted a three-week pronunciation course designed to teach proper articulation of the /s/ phoneme when preceding other consonants in monosyllabic words. In addition to using texts and dialogues sourced from highly credible

academic materials, the researcher incorporated authentic pronunciation lessons and programs from various reputable websites. During the course, the researcher exposed the participants to native English speakers' pronunciation, with particular emphasis on the phoneme /s/. It was observed that regular exposure to native English pronunciation had a positive impact on the participants' own articulation, gradually improving their accuracy. Throughout the three weeks of instruction, the researcher noted a significant challenge in helping students sustain the /s/ phoneme when it preceded other consonants. A major contributing factor to this difficulty was the influence of the Farsi/Dari sound system, which included an additional phoneme before the /s/ in such contexts. For instance, Afghan students tended to pronounce words like "stick," "school," and "scream" as /əstik/, /əskul/, and /əskri:m/, respectively. This mispronunciation was largely attributed to the phonological structure of their native language. In Farsi/Dari, syllables typically follow a consonant-vowel (CV) structure for instance, "mar" /ma:r/, meaning "snake", whereas English often employs more complex syllable structures, such as consonant-consonant-vowel (CCV), as seen in words like "student" /stu:dənt/. The study highlighted that the primary reason for Afghan students' mispronunciation of the /s/ phoneme before other consonants was interference from the phonological system of their native language. This linguistic transfer impeded their ability to produce English syllable structures accurately, resulting in persistent errors in pronunciation.

Among the six participants in the pronunciation class, four successfully articulated the phoneme /s/ without inserting a schwa /ə/ sound before it. However, two participants faced some difficulty with the pronunciation of /s/. Over the course of the three-week class, the researcher observed that Afghan students encountered fewer issues articulating the /s/ phoneme preceding other consonants in monosyllabic words, such as "speak," "sky," "street," and "state." In contrast, when attempting to pronounce polysyllabic words, the students commonly misarticulated the /s/ phoneme preceding other consonants. For instance, "student" as "əstu:dənt," and "stationary" as "əstationary". The frequent misarticulation of the phonemes /s/ and /t/ in polysyllabic words can be attributed to the differing places of articulation of these sounds. In the context of monosyllabic words, this articulation distance did not appear to cause significant pronunciation difficulties. However, in polysyllabic words, the phonetic complexity likely contributed to the higher frequency of errors among the Afghan students. This suggests that the interaction between syllabic structure and articulatory placement played a critical role in the students' mispronunciation of these sounds in more complex lexical items.

The second key focus of the study was to investigate the underlying reasons for the misarticulation of the phoneme /s/ in multisyllabic words when it precedes other consonants. The analysis revealed that two participants were able to pronounce the phoneme /s/ accurately, without inserting a schwa /ə/ sound before it. These participants had primarily learned English from native speakers and had access to authentic online pronunciation resources, which contributed to their more accurate articulation. The findings suggest that pronunciation issues often arose when second-language teachers' native language sound systems influence their teaching. In this case, the sound system of the second language instructor's native language can unintentionally shape the way pronunciation is taught, leading to persistent misarticulations in students. This highlighted the importance of exposure to native pronunciation models and the use of authentic linguistic resources in improving phonetic accuracy among second language learners.

After teaching the articulation of the phoneme /s/ preceding other consonants for three weeks, the researcher observed that Farsi/Dari speakers consistently misarticulated the /s/ phoneme due to the presence of an additional phoneme /ə/ in their native language when /s/ precedes consonants. Additionally, misarticulation occurred when the phoneme /s/ appeared before other consonants in words where the stress was on the first syllable or when the place of articulation of /s/ was far from the following consonant. For example, in the word "student," the phonemes

/s/ and /t/ have distant places of articulation, and the stress falls on the /st/ cluster, leading to frequent errors in pronunciation. Another significant finding was that misarticulation was more prevalent when voiced consonants followed the phoneme /s/ than when voiceless consonants followed it. For instance, in the words "speech" and "structure," the phoneme /p/ is voiceless, whereas /t/ is voiced, and this difference in voicing contributed to variation in pronunciation errors. After three weeks of instruction, recordings and analysis of the participants' pronunciation showed considerable improvement, particularly in their articulation of the phoneme /s/. This progress was largely attributed to the use of authentic pronunciation lessons from free online sources and pronunciation CDs, which provided students with accurate models of English pronunciation. The study also revealed that multisyllabic words with primary stress on the first syllable, such as "stalemate," were more prone to misarticulation than monosyllabic words like "spark," despite both starting with the same /s/ sound. Afghan students were more likely to mispronounce the /s/ phoneme when it was not followed by /t/, further underscoring the influence of native language phonological patterns on their English pronunciation.

The final analysis of the study on the articulation of the phoneme /s/ preceding other consonants in multisyllabic words revealed that consistent practice through listening to native speakers and imitating their pronunciation can effectively resolve misarticulation issues. Over the course of two months, during which a specialized class focused on the correct articulation of the /s/ phoneme for Afghan students, the researcher observed steady improvements in the participants' pronunciation. Despite the presence of multiple counterparts to the English /s/ phoneme in Farsi/Dari, each with different places of articulation—some of which do not exist in English—the analysis demonstrated that, while correcting the articulation of absent phonemes from a learner's native language is a gradual process, it is ultimately achievable. This study emphasized the importance of prolonged and focused practice in overcoming phonetic challenges, even when the phonemes in question were not part of the learner's native language sound system.

Findings of the Phoneme /h/ Preceding Vowel Sounds in One or Multi Syllable Words

Afghan students also faced challenges with the articulation of the phoneme /h/. The third key focus of this study was to investigate the reasons behind the mispronunciation of /h/ when it precedes vowel sounds. Afghan students frequently replaced the /h/ sound with a prolonged /ee/ or /a/ sound, resulting in words like "happy" being pronounced as "appy" or "him" as "eem."

The pre-study and literature review revealed that Farsi/Dari contains two distinct phonemes, /ح/ and /ه/, which correspond to a single phoneme /h/ in English. These Farsi/Dari phonemes differ in both place and manner of articulation, which contributes to the mispronunciation of the English /h/ sound. For example, Afghan students often pronounced "happens" as "appens" and "hospital" as "aspital." This discrepancy is largely due to the fact that the two Farsi/Dari phonemes are articulated differently from their English counterpart, leading to confusion when Afghan students attempt to pronounce the English /h/.

Among the six participants in the pronunciation class, only one of them was able to pronounce the phoneme /h/ correctly before the lessons began, while the other participants had an accuracy rate of over 75%. In discussions with the students about their misarticulations, they pointed to the mismatch between the place and manner of articulation of the phonemes in Farsi/Dari and English as a key source of difficulty. Unlike in English, where the /h/ phoneme is pronounced from the glottal region in a limited range of contexts, its Farsi/Dari counterparts are pronounced more softly and without such constraints. For example, in words like "handle" and "help," the English /h/ requires a stronger articulation from the glottis, whereas its Farsi/Dari equivalents are produced more gently. This difference contributed to the articulation challenges faced by Afghan students in mastering the English /h/ phoneme.

After three weeks of teaching the phoneme /h/ in the pronunciation class for Afghan students, the researcher recorded the participants' voices as they read lists of target words containing the /h/ sound. The researcher provided reading texts, websites and authentic books. These authentic

resources resulted in significant improvements, with noticeable changes in the students' pronunciation of the /h/ phoneme. The findings revealed that five out of six participants pronounced the phoneme /h/ accurately, without any influence from their native language. Only one participant, on the other hand, mispronounced one word but still achieved 97.5% accuracy in the pronunciation of /h/. Throughout the two months of instruction, the researcher observed that while Farsi/Dari and English share certain phonetic similarities, their differences in sound systems, particularly in the articulation of the /h/ phoneme, led to misarticulations and misunderstandings. The study recommended that to correct misarticulations of the /h/ phoneme, students should use free, authentic, native English pronunciation lessons available online, practice listening to native speakers, and engage in repetitive exercises.

At the end of the pronunciation class, the researcher recorded the participants' voices once more for a final analysis. The findings showed that all participants who had previously misarticulated the phoneme /h/ were now able to pronounce it correctly after two months of targeted instruction. This analysis underscored the notion that correcting pronunciation difficulties in second language learners was not impossible but required consistent practice, listening, and imitation, particularly through online pronunciation lessons when access to native English-speaking teachers was limited. The study also highlighted that when words in Farsi/Dari containing the phonemes /ح/ and /ه/ were transliterated into Latin script, they often begin with the English phoneme /h/, which caused confusion and misarticulation for Afghan students. For example, the Farsi/Dari word "حياته" is transliterated as "hayata," meaning "yard," and "هديه" is written as "hadeya," meaning "gift." This overlap between Farsi/Dari and English phonemes contributed to the challenges Afghan learners faced in accurately pronouncing the English /h/ sound.

DISCUSSION

The findings support the notion that the phonological characteristics of Farsi/Dari speakers of English influence their intelligibility when interacting with native English speakers. This study specifically highlighted the extent to which these phonological characteristics affected their articulation, particularly when conversing or reading aloud.

The first key finding concerned the articulation of the phoneme /s/ preceding vowel sounds in both one- and multisyllable words. Afghan students generally did not misarticulate this phoneme, as the syllable structure and sound systems of Farsi/Dari and English were somewhat aligned in this context. When /s/ precedes a vowel sound, it can be prolonged without difficulty, as there are no structural constraints in either language. This finding emphasized the positive impact of using online lessons, listening to native speakers, and imitating authentic pronunciation. Over the two-month study period, the researcher observed that participants who had access to native English speakers or authentic English resources performed significantly better in pronunciation. The finding aligned with the contrastive analysis hypothesis, which suggests that misarticulation may arise when patterns in two languages are minimally distinct (Brown, 2000, p. 10).

The second major finding addressed the misarticulation of the phoneme /s/ preceding consonants. Afghan students encountered difficulties with this phoneme due to differences in the syllable structures of Farsi/Dari and English. In English, syllables often begin with two consonants, while in Farsi/Dari, only one consonant typically precedes a vowel. This structural difference led Afghan students to insert a schwa /ə/ sound before the /s/ when it was followed by a consonant, as in "əsnooker" for "snooker." This finding was consistent with Mahnaz Hall's (2007) research, which noted that the difference in syllable patterns can cause pronunciation problems for Farsi/Dari speakers of English. Additionally, Farsi/Dari has three distinct /s/ phonemes such as ص، پ، س. Each has different articulatory features, whereas English has only one /s/. This further complicated the correct articulation of /s/ preceding consonants. The study also revealed that Afghan students had greater difficulty when the /s/ preceded voiced

consonants; for instance, “t” in “still” compared to voiceless consonants such as /p/ in "speech". The influence of the native language's syllable structure was evident, as Farsi/Dari often inserts an additional sound before /s/ + consonant clusters, making it more challenging for Afghan students to articulate such sounds in English.

The third key finding related to the misarticulation of the phoneme /h/ preceding vowel sounds in one- and multisyllable words. Farsi/Dari has two phonemes, /ح/ and /ه/, which differ in their places of articulation but correspond to a single phoneme /h/ in English. This discrepancy led Afghan students to mispronounce the English /h/, often replacing it with a long /ee/ or /a/ sound. A research was conducted by Negari (2005) and Bashiri (1991) supports this observation, noting that when the glottal stop /ʔ/ and the phoneme /h/ are dropped in Farsi/Dari, the preceding vowel is lengthened. As a result, words such as "shahar" may be pronounced as /ʃa:r/, with the vowel sound /e/ elongated. This tendency is compounded by the fact that Afghan students are accustomed to producing the /h/ sound from the middle of the mouth rather than from the glottal region, as required in English.

The findings suggested that second language learners, particularly Afghan students, must engage in extensive practice, actively listen to native pronunciation, and immerse themselves in an English-speaking environment to overcome these challenges. While these recommendations may seem demanding and time-consuming, the two-month instructional program demonstrated that authentic English lessons, supported by cassettes, CDs, and other resources, can lead to significant improvements in pronunciation.

In conclusion, this study demonstrated that the phonological interference of Farsi/Dari on the articulation of English phonemes /s/ and /h/ was a critical factor affecting Afghan students' comprehensibility in English. However, with sustained practice and exposure to authentic pronunciation resources, these learners can improve their articulation, suggesting that phonological differences are not insurmountable barriers but can be effectively addressed through targeted instruction and practice

CONCLUSION

The aim of this error analysis study was to examine the misarticulation of the phonemes /s/ and /h/ by Afghan students when speaking English. Specifically, the study focused on the mispronunciation of /s/ preceding vowel sounds in one- or multisyllable words, /s/ preceding other consonants in both one- and multisyllable words, and /h/ preceding vowel sounds. Consequently, the findings were categorized into three main sections: first, the phoneme /s/ preceding vowel sounds, second, the phoneme /s/ preceding consonants, and third the phoneme /h/ preceding vowel sounds.

The findings revealed that Afghan learners of English, whose native language is Farsi/Dari, struggled primarily with the pronunciation of the phoneme /s/ when it preceded consonants in both one- and multisyllable words. In contrast, the phoneme /s/ preceding vowel sounds in these contexts did not pose a significant problem for Farsi/Dari speakers. Additionally, the phoneme /h/ preceding vowel sounds was frequently misarticulated, which the study attributed to differences in the place and manner of articulation between Farsi/Dari and English. However, two participants who had learned English from native speakers, did not exhibit these pronunciation difficulties.

The findings further indicated that the targeted instruction of these phonemes—incorporating activities from free online English lessons, pronunciation CDs, and lessons from native English speakers—greatly contributed to correcting the misarticulations. The results demonstrated that second language learners who had access to native pronunciation models and structured, authentic pronunciation practice could improve their articulation of problematic phonemes. This highlighted the effectiveness of learning from native speakers, not only for pronunciation but also for acquiring other essential linguistic skills such as sentence structure and general fluency.

As a conclusion, the two months of focused instruction on the phonemes /s/ and /h/ reinforced the researcher's belief that the misarticulation of certain phonemes by second language learners can be corrected. The key lies in providing learners with consistent practice, exposure to native speakers, and opportunities to apply these phonemes in real-world contexts. This study revealed the importance of practical, authentic pronunciation classes in helping Afghan students overcome pronunciation challenges and develop more accurate English pronunciation.

REFERENCES

- Andrew, R. et al. (1999). *Linguistics: An introduction*. Cambridge: Cambridge University Press.
- Anwari, A., & Giwee, A. (1996). *Farsi language grammar* (2nd ed.). Iran: Tehran Qom Setarah Publication.
- Aitken, W. (2006). *Guide to Arabic pronunciation*. Retrieved December 2009, from [eltnotebook.blogspot.com /2007/07 English Consonant Sounds](http://eltnotebook.blogspot.com/2007/07/English-Consonant-Sounds).
- Aitchison, J. (1999). *Linguistics*. (5th ed.). England: Euston Road London.
- Avery, P. & Ehrlich, S. (1992). *Teaching American English pronunciation*. Oxford: Oxford University Press.
- Azim, A. (1996). *Prosody*. Afghanistan: Kabul Maiwand Publication.
- Bashiri, I. (1991). *Persian for beginners: Tape manual*. (4th ed.). Iran: Teharn Ebteda Publication.
- Brown, H.D. (2000). *Principles of language learning and teaching*. New York: Longman Publication.
- Bloomfield, M.W., & Newmark, L. (1979). *A linguistic introduction to the history of English*. American: Greenwood press.
- Demirezen, M. (1987). *Articulatory phonetics and the principles of sound production*. Ankara: Ankara Feryal Press.
- Dehghani, Y. (2006). *Persian-English English Persian learner's dictionary*. Bethesda: Ibex Publishers.
- Farkhari, A. Y. (2004). *Inadequacy and difficulties of alphabets*. Afghanistan: Kabul, Maiwand Publication.
- Hall, M. (2007). *Phonological characteristics of Farsi speakers of English and L1 Australian English speakers' perceptions of proficiency phonological characteristics of Farsi speakers of English and L1 Australian English speakers' perceptions of proficiency*. [Master of Art M.A. Thesis, Curtin University]. Human Research Ethics Committee. Retrieved December 01, 2009, from <http://www.asianjournal.com>
- Khanlari, P. N. (2006). *Historical grammar of Farsi language*. Afghanistan: Secretariat Administration Press.
- Museen, A. (1995). *History of Farsi language*. Iran: Tehran Publication of Samt Organization.
- Mahjani, B. (2003). *An instrumental study of prosodic features and intonation in modern Farsi (Persian)*. [Master of Art Dissertation, University of Edinburgh]. Retrieved December 10, 2009, from <http://www.asianjournal.com>
- Negari, L. (2005). *Farsi language and its disorderliness of pronunciation*. Iran: Tehran.
- Peter, R. (2000). *English phonetics and phonology: A practical course* (2nd ed.). Cambridge: Cambridge University Press.
- Radford, A. et al. (1999). *Linguistics: An introduction*. Cambridge: Cambridge University Press.
- Shademan, Sh. (2002). *Epenthetic vowels harmony in Farsi*. [Master of Art Dissertation, University of California, Los Angeles]. Retrieved December 05, 2009, from [http://www.linguistics.ucla.edu/people/grads/shademan/shademanThesis .pdf](http://www.linguistics.ucla.edu/people/grads/shademan/shademanThesis.pdf)
- Sousa, A.D. (2005). *How the brain learns to read?* California: Crowin Press.

Swam, M. & Smith, B. (1987). *Learn English: A teacher's guide to interference and other problem*. Cambridge: Cambridge University Press

Yamin, M. U. (2005). *Modern grammar of Farsi / Dari language*. Afghanistan: Kabul, Maiwand Publication.

SİLİNDİRİK PİL HÜCRELERİNİN YANAL YÜZEYLERİNE ENTEGRE EDİLEN FARKLI KANAT PROFİLLERİNİN TERMAL ETKİLERİNİN SAYISAL VE DENEYSEL OLARAK İNCELENMESİ

NUMERICAL AND EXPERIMENTAL INVESTIGATION OF THE THERMAL EFFECT OF DIFFERENT FIN PROFILES INTEGRATED ON THE LATERAL SURFACES OF CYLINDRICAL BATTERY CELLS

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Özet

Bu çalışmada, silindirik Li-ion piller için daha iyi bir soğutma performansı elde etmek üzere farklı tipte kanatçıklar kullanılmıştır. Li-ion piller için termal koşullar önemli olup, daha iyi bir performans ve pil ömrü için hücre sıcaklığının 15 °C ile 35 °C arasında olması tercih edilir. Öte yandan, ikinci bir koşul olarak, tüm modül hacminde 5 °C üzerinde bir sıcaklık farkı oluşmayacak şekilde homojen sıcaklık dağılımı istenir. Bu kısıtlamalar nedeniyle, elektrikli araçların Batarya Termal Yönetim Sistemlerinde (BTMS) pek çok farklı türde soğutma yöntemi kullanılmaktadır. Hava soğutmalı sistemler, basit yapıları ve düşük maliyetleri nedeniyle genellikle düşük güçteki araçlar için tercih edilmektedir. Pasif elemanlara sahip benzer hava soğutma tabanlı tasarımlar, elektrikli bisikletlerde, scooterlarda ve diğer bazı ev aletlerinde de kullanılmaktadır. Ancak, Li-ion pil paketlerinin hava soğutma işlemi için karşılaşılan ana problemlerden biri, paketin iç kısımlarında bulunan hücrelerin yeterince soğutulamamasıdır. Bu çalışmada, bu soruna bir çözüm önerisi oluşturmak amacıyla, piyasada 18650 koduyla bilinen silindirik pil hücrelerinin yanall yüzeyine doğrudan kanatçıklar entegre edilmiştir. 4S3P modül konfigürasyonunun farklı deşarj hızları için, kanatçık taşımayan hücreler ve halka, kare, trapezoid ve pim tipi kanatçık profillerine sahip hücreler FLOEFD paket programı kullanılarak sayısal olarak analiz edilmiştir. Sonuçlar, kanatçıkların doğal konveksiyon ortamında 3 °C kadar pozitif bir etki sağladığını göstermiştir. Benzer şekilde, zorlanmış konveksiyon ortamında bu fayda 5 °C'i aşmaktadır. Ancak, bazı tasarımlarda, zorlanmış konveksiyon, Li-ion piller için istenmeyen bir durum olan 5 °C üzerinde paket içi sıcaklık farklarına neden olmaktadır. Pillerin dış yüzeylerinde genellikle paslanmaz çelik kullanıldığından, alüminyum ve paslanmaz çelik kanatçıklar da karşılaştırılmıştır. Trapezoid kanatçık eklenmiş piller için deşarj deneyleri gerçekleştirilmiş ve benzer şekilde, kanatçıklı hücrelerin kanatçiksiz olanlara kıyasla daha düşük sıcaklıklara eriştiği görülmüştür.

Anahtar kelimeler: Li-ion Bataryalar, Batarya Termal Yönetim Sistemleri, Elektrikli Araçlar, Kanatçık

Abstract

In this study, different kinds of fins are utilized for cylindrical Li-ion batteries for a better cooling performance. Thermal conditions are important for Li-ion batteries so that temperature for batteries is preferred to be between 15 °C and 35 °C for better performance and product life. On the other hand, as a second condition it is desired to sustain temperature uniformity for 5 °C temperature difference in entire module volume. Because of these constraints, many kinds of cooling methods are used in electric vehicles' battery thermal management systems (BTMS). Air cooled systems, due to its basic construction and low cost are usually preferred for small power vehicles. Similar air cooling based designs with passive elements are used in e-bikes, scooters and other some household appliances. However, one of the main problems encountered for the air cooling process of Li-ion batteries is that the cells located inner side of the pack cannot be cooled sufficiently. In the study, in order to propose a solution for this problem, fins were integrated directly to the lateral surface of the 18650 cylindrical battery cells. For different discharge rates of the 4S3P module configuration, cells without fins and cells

with annular, square, trapezoidal and pin type fin profiles were numerically analyzed by using the FLOEFD package program. Results showed that fins have a positive effect up to 3 °C in natural convection environment. Similarly, for forced convection case this benefit exceeds 5 °C. However, for some designs, forced convection causes temperature differences higher than 5 °C within the pack which is not desired for Li-ion batteries. As usually, stainless steel is used for cover of the batteries, aluminum and stainless steel fins were also compared. Experimentally, discharging process was also carried out for trapezoidal fins added batteries and it is shown that finned cells have lower temperatures compared to no-fin ones, similarly.

Keywords: Li-ion Batteries, Battery Thermal Management Systems (BTMS), Electric Vehicles, Fin

GİRİŞ

Elektrikli araçlar yüz yılı aşkın bir süredir bilinmesine rağmen çevresel kaygıların artması, petrol fiyatlarının yükselmesi ve sonuç olarak fosil yakıtlara olan bağımlılığın azaltılması gerekliliği ile birlikte son yıllarda rağbet görmeye başlamıştır. Ağır ve hacimli bataryaların, yüksek maliyetleri, kısa menzilleri ve güvenlik sorunları nedeniyle içten yanmalı motorlu araçlar karşısında uzun yıllar ticarileşemeyen bu teknoloji günümüzde kullanılabilir duruma gelmiş, bununla birlikte elektrikli bisiklet, scooter, cıncır gibi bireysel taşıtlar da günlük hayatımızda yer edinmiştir. Benzer şekilde mobil, elektrikli aletler de her geçen gün hayatımızdaki yerini genişletmektedir. Bütün bu mobil cihazlar için günümüzde en uygun enerji kaynağı, elektrokimyasal enerji depolama sistemleri olan bataryalardır.

Batarya teknolojilerinin önemli problem alanlarından birisi de ısı yönetim sistemleridir. Günümüzde elektrikli araçlar ve diğer tüm şarjlı ekipmanlar için en uygun batarya teknolojilerinden birisi olarak görülen Li-ion bataryalar şarj ve deşarj esnasında ısı enerjisi yaymakta, yükselen sıcaklıklar bataryalarda verimsizliğe, yüksek maliyetli bataryaların ömrü noktasında kısalmaya ve termal kaçışıyla birlikte bataryanın iflasına ve yangın tehlikelerine sebebiyet verebilmektedir.

Batarya termal yönetim sistemleri için ortam sıcaklıkları da dikkate alınarak hava soğutmalı sistemler, sıvı soğutmalı sistemler, soğutma akışkanlı sistemler ve faz değiştiren malzeme esaslı sistemler yoğun şekilde tercih edilmektedir. Bunların haricinde termoelektrik soğutma, ısı borusu ile soğutma gibi yenilikçi sistemler de söz konusu olup, manyetik soğutma, piezo elektrik soğutma gibi geleneksel olmayan soğutma teknikleri ise araştırma aşamasındadır.

Batarya Yönetim Sistemi (BMS, Battery Management System) elektrikli ve hibrit elektrikli araçların kritik bir bileşenidir. Batarya yönetim sisteminin amacı bataryanın güvenli ve güvenilir çalışmasını garanti etmektir. Pilin güvenliğini ve güvenilirliğini korumak için durum izleme ve değerlendirme, şarj kontrolü ve hücre dengeleme, yönetim sistemlerince uygulanan işlevlerdir. Elektrokimyasal bir ürün olarak pil, farklı çalışma ve çevre koşulları altında farklı davranır. Bir pilin performansının belirsizliği, bu işlevlerin yerine getirilmesi için çok çeşitli zorluklar oluşturmaktadır. Batarya yönetim sistemleri için en kritik görevler batarya durumunu tespit etmeye yönelik olarak, bataryaların şarj durumu (state of charge, SoC), sağlık durumu (State of Health, SoH) ve ömür durumu (State of Life, SoL) bileşenlerinin değerlendirilmesidir. Çeşitli donanım ve yazılım unsurları barındıran batarya yönetim sistemleri için en önemli konulardan birisi de ısı (termal) yönetimidir (Xing, Ma, Tsui, & Pecht, 2011). Bu amaca ulaşmak için, halihazırda EV ve HEV'lerde çeşitli türlerde termal yönetim sistemleri (TMS) kullanılmaktadır.

Elektrikli araçlarda kullanılan batarya termal yönetim sistemleri temelde soğutma, ısıtma, havalandırma ve yalıtım olmak üzere dört işlev üstlenmektedir. (Pesaran A. A., 2001).

Tümüyle elektrikli ve hibrit elektrikli araç termal yönetim sistemleri, iç ve dış sıcaklık değişimlerinden etkilenmeksizin, ilgili bileşenleri güvenli ve verimli bir şekilde çalıştırmak ve sistemi ilgili ılıman aralıklarda tutmak için dört farklı döngüden oluşur. Radyatör devresi, güç elektroniği devresi, sürücü ünite devresi ve hava şartlandırma (A/C) devresi şeklindeki bu döngüler araçtan araca yapıları ve çalışma prensipleri itibarıyla farklılıklar gösterebilir (Dinçer, Hamut, & Javani, 2017).

Bu çalışmada, elektrikli araçlarda termal yünden temel kaynağı ve problemi oluşturan bataryanın termal yönetimi üzerinde durulacak olup, bu süreç genellikle araç kabin klima devresi (A/C) ile birlikte ele alınmaktadır. Lityum iyon bataryalar – 20 °C ve 60 °C sıcaklık aralığında çalışmaktadır (Vayrynen & Salminen, 2012). Ortam sıcaklığı da dikkate alınırsa dünya coğrafyasının pek çok bölgesini içine alan bu sıcaklık değerleri bu tür bataryaların elektrikli araçlarda kullanımı noktasında cesaret verici olmuştur. Öte yandan optimum çalışma sıcaklığı ise 15 °C – 35 °C aralığıdır (Pesaran & Santhanagopalan, 2013), (Electropaedia, 2014.), (Matthe, Turner, & Mettlach, 2011). 30 °C – 40 °C aralığında olmak üzere, batarya çalışma sıcaklığındaki her 1 °C derecelik artış batarya ömrünü ortalama 2 ay kısaltmaktadır

(Motloch, ve diğerleri, 2002). Ayrıca bataryayı oluşturan çok sayıdaki pil ve modüller arasındaki sıcaklık farkları da önemlidir. Verimli ve güvenli bir elektrikli araç için tüm batarya hacmi içinde, modüller arasındaki sıcaklık farkının 5 °C derecesini geçmemesi arzu edilmektedir (Pesaran A. A., 2001), (Pesaran A. A., 2002). Dolayısıyla esasen termal yönetim sistemleri tek başına bir soğutma ya da ısıtma işlemi değil, sıcaklığı yukarıda anılan değerler arasında tutma amacı taşımaktadır. Ancak özellikle ticari uygulamalarda, otomotiv teknolojilerindeki karmaşıklık düzeyi ile ilgili parametreler de dikkate alındığında sadece soğutma yapan sistemler de mevcuttur.

Sıcaklık dağılımları ve batarya hücresinin sıcaklığının homojen olmaması, farklı uygulamalar için temel problemler ve dezavantajlardır. Lityum iyon hücrelerinin termodinamiği, tek fazlı ve çok fazlı katıların yanı sıra sıvı elektrolit karışımlarının varlığı ile karmaşıklaşır. Isı üretimi, ana elektrokimyasal reaksiyonların yanı sıra karıştırma ve faz değişiminden de kaynaklanabilir (Xiao, Shaohua, & Stanton, 2010), (Duan & Naterer, 2010), (Williford, Viswanathan, & Zhang, 2009), (Viswanathan, ve diğerleri, 2010), (Lin, Chen, Sun, Tang, & Zhao, 2009), (Kumaresan, Sikha, & White, 2008) .

Doğal ve zorlanmış hava ile soğutma tekniklerinin, doğrudan ve dolaylı sıvı soğutma yöntemlerinin ve ısı borularıyla soğutma dahil olmak üzere farklı teknolojilerinin ayrıntılı bir mukayesesinin yapıldığı bir çalışmada, hava soğutmalı BTMS'nin güvenli, tutarlı ve basit tasarım gibi avantajlı özelliklere sahip olduğu tespit edilmiştir. Ancak havanın bir soğutma ortamı olarak daha düşük ısı kapasitesine sahip olması ve termal verimliliğinin sınırlı olduğu görülmüştür. Bu durum, optimum bir soğutma sağlamak için havanın batarya paketlerinin içindeki kanallardan aktığı yüksek şarj/deşarj oranlarında zorlanmış hava soğutmalı BTMS'lerin kullanılmasına gerekli kılmaktadır (Thakur, ve diğerleri, 2020) (Rahmani, Dibaj, & Akrami, 2024).

BTMS'lerde hava soğutmasının incelendiği bir diğer çalışmada ise verimli BTMS'leri tasarlamada doğru sayısal modelleme ve batarya davranışının simülasyonunun önemi ortaya konulmuştur. İncelenen üç optimizasyon tekniğinden; hava akış kanalı optimizasyonunun en çok tercih edilen strateji olduğu görülmektedir. Her ne kadar birçok araştırmacı araştırdıkları modeller için çeşitli sayısal simülasyonlar gerçekleştirme yöntemlerini tanımlamış olsa da, BTMS ile ilgili olarak çeşitli amaç fonksiyonları için tasarım değişkenlerinin seçilmesinde ve tasarım alanlarının tanımlanmasında DoE (Deney Tasarımı) uygulamasının eksikliği açıkça fark edilmiştir (Akinlabi & Solyali, 2020).

Termal yönetim sisteminde havanın kullanılması daha az etkili fakat daha az karmaşık olmasına karşın sıvı soğutmalı ve ısıtma sisteminin daha etkili olduğu sonucuna varılmıştır. Genel olarak, paralel hibrit elektrikli araçlarda hava kullanımının termal yönetim sistemi için yeterli olduğu fakat elektrikli araçlar ve seri hibrit elektrikli araçlarda optimum termal performans için sıvı bazlı sistemlerin gerekli olduğu değerlendirilmektedir. Batarya paketinin araç içindeki konumunun da batarya termal yönetim sistemi üzerinde güçlü bir etkiye sahip olacağı belirtilmektedir (Pesaran A. A., 2001).

Yapılan bir başka çalışmada, hava soğutma, direk sıvı soğutma, indirek sıvı soğutma ve kanatçık yapılı soğutma yöntemleri aynı hacimli lityum iyon batarya paketi için sayısal olarak incelenmiştir. Buna göre hava soğutma sisteminin, aynı ortalama sıcaklığı korumak için diğer yöntemlerden 2 ila 3 kat daha fazla enerjiye ihtiyaç duyduğu; indirek sıvı soğutma sisteminin en düşük maksimum sıcaklık artışını sağladığı; kanatçıklı soğutma sisteminin, aynı hacimli batarya paketi için ağırlığı yaklaşık % 40 artırdığı sonuçlarına ulaşılmıştır. İndirek sıvı soğutma sistemi, daha düşük soğutma performansına sahip olmakla birlikte, doğrudan sıvı soğutma sistemine kıyasla daha pratiktir (Chen, Jiang, Kim, Yang, & Pesaran, 2016).

Bir başka çalışmada ise yan yana dizilmiş lityum iyon hücrelerinden oluşan batarya paketinde her 20 hücre arasına konulan hava kanallarının doğal ve zorlanmış taşınım etkileri incelenmiştir. Akışkan olarak hava kullanıldığında zorlanmış taşınımın daha etkili olduğu, akışkan olarak sıvı kullanıldığında doğrudan bataryaya temas eden sıvıların soğutma performansının doğrudan temasın olmadığı sistemlere göre daha fazla olduğu sayısal olarak analiz ve rapor edilmiştir (Karimi & Li, 2013) .

Başka bir çalışmada ise 3 boyutlu modellenen bataryaların paralel düzende, havayla soğutulması problemi optimize edilmiş, sabit giriş debisine göre yapılan optimizasyonda sıcaklık farkının %45 dolayında iyileştirildiği, sabit güç tüketimine göre yapılan optimizasyonda ise %41 iyileşme sağlandığı tespit edilmiştir (Chen, Wang, Mengxuan, & Chen, 2017).

Bataryalar hacim ve ağırlıkları itibarıyla elektrikli araçlara önemli kısıtlar getirmektedir. Bu durumu minimize etmek ve daha etkin bir termal yönetim sistemi kurmak açısından son dönemde batarya hücre, modül ve paketlerinin geometrisine yönelik çalışmalar yaygınlaşmıştır. Silindirik hücrelerin dış gövdelerini oluşturan ince metal sacların içine mini kanallar açılarak bu kanallarda sıvı dolaştırılması

hücre geometrisi açısından önemli bir müdahaledir (Zhao, Rao, & Li, 2015). Benzer durum prizmatik batarya paketleri için daha geniş kanallar biçiminde uygulanmıştır (Rao, Wen, & Zhao, 2019). Öte yandan hücre etrafında dolaştırılan helezonik boruların içinde soğutma sıvısı dolaştırılması ve modüllerin silindirik kutular biçiminde tasarımı da sayısal olarak yapılan incelemelerde önemli faydalar öngörmüştür (Adair, Ismailov, & Baken, 2014).

Batarya hücrelerinin farklı aralıklarla düz dizilimine ilişkin analizler ile minimum hacim oluşturacak şekilde silindirik pillerin açılı diziliminin analizine yönelik literatürde çeşitli çalışmalar mevcuttur. Alt ve üst yüzeylerden plakalı soğutma, yanal yüzeyler arasından geçen soğutucu kanallar ve bu kanalların optimum konfigürasyonları sıvı, gaz ve nano-akışkan ortamlar için analiz edilmiştir (Jarrett & Kim, 2011), (Cao, Luo, Fang, Ling, & Zhang, 2020), (Al-Zareer, Dinçer, & Rosen, 2019), (Lazrak, Fourmigue, & Robin, 2018), (Zhao, Sousa, & Jiang, 2019), (Wiriyasart, Hommalee, Sirikasemsuk, Prupark, & Naphon, 2020). Ayrıca lityum iyon pillerin farklı adetlerinin prizma, üçgen, beşgen, altıgen prizma ve silindirik yapılar biçiminde oluşturduğu modüllerin nano-akışkan ile soğutulmasına yönelik mukayeseli analizler de yapılmıştır (Sefidan, Sojoudi, & Saha, 2017).

Batarya termal yönetim sistemlerinde havanın soğutma performansını artırmak için Yang ve diğerleri tarafından biyotik yüzey yapısına sahip bir radyatör önerilmiştir. Çalışmada, üç farklı kanatçık kesiti (dikdörtgen, yamuk ve elips) ve farklı kalınlık, yükseklik ve uzunluk değerleri için maksimum sıcaklık ve sıcaklık farkı hesaplanmıştır. Optimum parametreler, sırasıyla 313 K ve 5 K içinde maksimum sıcaklığı ve sıcaklık farkını koruyabilmek olarak belirlenmiştir (Yang, Zhou, Zhou, & Liu, 2020). Chen ve arkadaşları tarafından yapılan bir başka çalışmada ise, pil paketleri için hava soğutma konseptinin ayrıntılı hücre düzeyinde termal ve basınç düşüşü performansı için 3 boyutlu CFD modelleri oluşturulmuştur. Ancak pim kanatçıkların kanal içinde ve kanal dışında olduğu her iki konfigürasyon da termal gereksinimleri karşılamamıştır (Chen, Han, Khalighi, & Kalus, 2017).

Bir diğer sayısal çalışmada, karşılıklı yön değiştiren hava akışı analiz edilmiş ve karşılıklı akışın pil sisteminin hücre düzeyinde sıcaklık farkını yaklaşık 4 °C (%72) ve maksimum hücre sıcaklığını tek yönlü akışa kıyasla 1,5 °C azaltabileceğini göstermiştir (Mahamud & Park, 2011). Li ve diğerleri ise, optimize edilmiş bir tasarımı belirlemek için 18 farklı hava akışı konfigürasyonunun çalıştırıldığı bir U tipi BTMS'yi sayısal olarak analiz etmiş, giriş sıcaklığının soğutma kanallarındaki maksimum sıcaklığı doğrudan etkilediğini ancak kanallar arasındaki sıcaklık farkı üzerinde daha az etkisi olduğunu göstermiştir (Li, Zhao, Yuan, Duan, & Liang, 2021). Fan ve diğerleri, hava soğutmalı bir Li-ion pil modülünün termal yönetimi üzerine parametrik bir çalışma gerçekleştirmiştir. Sıcaklık artışının komşu hücreler arasındaki boşluk aralığının azaltılmasıyla düşürülebileceği gösterilmiştir. Sıcaklığın homojen dağılımı yüksek akış hızlarında ve hücreler arasında küçük boşluklar ile sağlanabilmiştir (Fan, Khodadadi, & Pesaran, 2013). Benzer şekilde, Hoş ve Türkakar, hava soğutmalı 6S6P pil paketi için (toplamda 36 Lityum-iyon 26650, LiFePO4 pil) sistemi için iki boyutlu bir hidrodinamik ve termal analiz gerçekleştirmiştir (Hoş & Türkakar, 2021).

Wang ve diğerleri tarafından kübik, dikdörtgen, silindirik ve altıgen formlardaki modüller cebri hava soğutması için araştırılmıştır. Hizalanmış ve kademeli hücre yapılandırmaları Yang ve diğerleri tarafından hava soğutma sistemi için karşılaştırılmış ve geometrik olarak optimize edilmiştir. Bu çalışmalarda tasarım gereksinimlerini (maksimum sıcaklık artışı, sıcaklık düzgünlüğü, güç gereksinimi ve soğutma indeksi) dengeleyerek, hizalanmış düzenleme için uzunlamasına aralık, enine aralık ve hava giriş genişliğinin optimum kombinasyonu açısından uygun bir çözüm elde edilmiştir (Wang, Tseng, Zhao, & Wei, 2014) (Yang, Zhang, Li, & Hua, 2015).

Batarya termal yönetim sistemlerinde kanat uygulamaları genellikle faz değiştiren malzemelerin düşük ısı iletkenliklerinin sebep olduğu olumsuz etkileri azaltmak için önerilmektedir. Faz değiştiren malzemeler ile kanat uygulamalarının birlikte kullanımı çeşitli çalışmalarda incelenmiştir (Moaveni, Siavashi, & Mousavi, 2024; Aslan, Aydın, & Yaşa, 2022).

Kanat uygulamalarında sayısal ve deneysel çalışmalarda, halka biçiminde, silindirik pili radyal olarak saran kanat dizilerinin pil sıcaklığı üzerindeki etkilerinin %39,23 düzeyinde iyileştirdiği saptanmıştır (Chaudhari, Singh, Rathod, & Muhammad Ali, 2024). Benzer şekilde silindirik pillerin yanal yüzeylerini çevreleyen ince kanatların soğutma performansı üzerindeki etkileri %18,71 olarak saptanmıştır (Padalkar, ve diğerleri, 2024).

Bu çalışmada ise, elektrikli araçlar ve diğer mobil cihazlar için termal yönetim sistemleri incelenmiş, Li-ion bataryaların şarj ve deşarj süreçleri esnasında yaymış olduğu yüksek ısılardan yarattığı olumsuzlukları gidermek için hava soğutmalı sistemlere yenilikçi bir yaklaşım önerilmiştir. Çalışmada

piyasada 18650 koduyla bilinen 18 mm çapa ve 65 mm yüksekliğe sahip silindir formundaki Li-ion piller hedeflenmiş, bu pillerin yanal gövdelerine eklenen halka, kare, trapezoid ve pim tipi kanatçıkların, modül içinde oluşan maksimum sıcaklık ve maksimum sıcaklık farklılıklarına etkisi irdelenmiştir.

MATERYAL VE YÖNTEM

Bu çalışmada, piyasada 18650 koduyla bilinen, silindirik pil modeli seçilerek, bu pil hücrelerinin yanal yüzeyine doğrudan eklemenecek farklı tür ve ebatlardaki kanatçıkların termal etkileri sayısal ve deneysel olarak analiz edilmiştir.

Sayısal çalışmada, NCA 18650 kodlu li-ion piller seçilmiş olup, FLOEFD termal analiz ve akış programı kullanılarak, eşdeğer devre modellemesi (ECM) yaklaşımı ile batarya modellemesi ve kanat tasarımı yapılmış, 4S3P bağlantı modeline sahip batarya paketi için farklı koşullar altında elektrokimyasal ve termal analizler gerçekleştirilmiştir. Kare kesitli, pim şeklinde, halka şeklinde ve trapezoid kesitli kanatlara sahip batarya paketleri ile kanat taşımayan hücrelerin oluşturduğu batarya paketleri ayrı ayrı şarj ve deşarj döngülerine tabi tutulmuş, voltaj ve yüzey sıcaklık değerleri ile ortama yaydıkları ısı akıları analiz edilmiştir.

4S3P biçiminde batarya paketleri, düz hücre dizilimleri için oluşturularak 2C deşarj hızı ile yürütülen sayısal denemeler doğal taşınım koşullarının yanı sıra, çapraz hava akımı altında da gerçekleştirilmiştir. Çalışmada ortam ve materyal başlangıç sıcaklıklarının 20 °C ve 30 °C olduğu durumlar analiz edilmiştir. Sayısal çalışmada kullanılan değişkenler ve değerleri/türleri Çizelge 1'de listelenmiştir.

Çizelge 1 Çalışmada kullanılan değişkenler ve değerleri

<i>Değişkenler</i>	<i>Değişkenlere ait değerler</i>
Batarya Modeli	2S (2 Seri pil bağlantısı) 4S3P (4 seri, 3 paralel pil bağlantısı)
Hücre Dizilim Türü	Düz Dizilim (25mmx25mm kare)
Isı Taşınım Türü ve Koşulları	Doğal Taşınım (Ortam sıcaklığı ve tüm materyaller için başlangıç sıcaklığı: 20 °C) Zorlanmış Taşınım (Hava Giriş Hızı: 2 m/s, Ortam sıcaklığı ve tüm materyaller için başlangıç sıcaklığı:20 °C) Zorlanmış Taşınım (Hava Giriş Hızı: 4 m/s, Ortam sıcaklığı ve tüm materyaller için başlangıç sıcaklığı: 30 °C)
Kanatçık Geometrisi	Kare kesitli Kesik Konik Pim şeklinde Halka şeklinde Trapezoid kesitli
Deşarj Hızı	2C
Batarya Hücresi	NCA 18650 Kapasite:10.908 Asn Pil Tipi: Eşdeğer Devre Modeli (ECM)
Kanatçık Malzemesi	Alüminyum Paslanmaz Çelik
Bağlantı Elemanları Malzemesi	Nikel
Hücre Doluluk Oranı	% 100

Li-ion batarya hücrelerinin hava kullanılarak termal yönetimleri noktasında en önemli koşullardan birisi ortam sıcaklığıdır. Elektrikli araçlar, dünyanın pek çok coğrafyasında kullanılmaya aday olmakla birlikte ortam sıcaklığı, nem, aşırı yağış ve sellerden korunma hali, kuraklık ve tozlanma gibi sebeplerden dolayı araç modellerinde farklı tasarımlara gidilmektedir. Bu çalışmada, ortam sıcaklığı olarak 20 °C ve 30 °C koşulları benimsenmiş, sıcaklığın 30°C dereceye çıkacağı durumlarda doğal taşınımın yeterli olmayacağı öngörüsüyle denemeler zorlanmış taşınım altında gerçekleştirilmiştir. Sayısal deneme sayısını artırmamak adına zorlanmış taşınım denemeleri 2 m/s hava giriş hızı ve 20°C sıcaklık koşullarında, 4 m/s hava giriş hızı ve 30°C sıcaklık koşullarında yapılmıştır.

Batarya hücresi düzeyinde termal kanat kullanımının en önemli handikaplarından birisi batarya paketinin alanı, hacmi ve ağırlığındaki artış olacaktır. Termal kazanımlar nispetinde tolere edilebilecek olan bu durumun minimum seviyede kalması için fiziksel model oluşturulurken yan yana pillerin kanatları arasında 1 mm boşluk kalması durumu gözetilmiş olup, buna göre düz dizilim konfigürasyonu için batarya merkezleri arasındaki mesafe 25 mm olarak belirlenmiştir. Oluşturulan fiziksel modelde kare tipi kanatlar sabit kesitli, halka, trapezoid ve pim tipi kanatlar ise değişken kesitli kanatlar olarak seçilmiş olup, pil üzerinde yer alan kanat sayısının fazla olmasından dolayı bütüncül bir kanat verimliliği hesaplaması söz konusu olacaktır.

Kanat üzerinde seçilen diferansiyel bir eleman üzerinde enerjinin korunumu eşitliği kurulacak olursa elemana iletilen ısının, elemandan dışarıya iletilen ve taşınımıyla havaya atılan ısıya eşit olacağı görülecektir. Buna göre ısı iletkenliğinin ve taşınımıyla ısı transferi katsayısının sabit kabul edildiği, radyasyonun ihmal edildiği durum için kanat genel denklemi;

$$\frac{d^2T}{dx^2} + \left(\frac{1}{A_c} \cdot \frac{dA_c}{dx}\right) \frac{dT}{dx} - \left(\frac{1}{A_c} \cdot \frac{h}{k} \cdot \frac{dA_s}{dx}\right) \cdot (T - T_\infty) = 0 \quad (1)$$

şeklindedir. Bu genel denklem;

a) Sabit kesitli kanatlar için;

$$\frac{d^2T}{dx^2} - \left(\frac{hP}{kA_c}\right) \cdot (T - T_\infty) = 0 \quad (2)$$

şeklinde özelleştirilebilir. Eşitlik 2, $\theta(x) \equiv T(x) - T_\infty$ ve $m^2 = \frac{hP}{kA_c}$ şeklinde dönüşümler yapılarak doğrusal, homojen, ikinci dereceden sabit katsayılı bir diferansiyel denkleme dönüştürülerek;

$$\theta(x) = C_1 \cdot e^{mx} + C_2 \cdot e^{-mx} \quad (3)$$

genel çözümüne ulaşılabilir.

b) Değişken kesitli kanatlar için; genel denklemin çözümü çok daha karmaşık olup fiziksel modelde kanat kesit alanı yarıçapa bağlı olarak değiştiğinden Eşitlik 1’de x yerine r yazılarak ve örneğin halka tipi kanat için kanat yüzeyi $2 \cdot \pi \cdot (r^2 - r_1^2)$ yerine konulmak suretiyle;

$\frac{d^2T}{dr^2} + \left(\frac{1}{r}\right) \frac{dT}{dr} - \left(\frac{2h}{kt}\right) \cdot (T - T_\infty) = 0$ ve $m^2 = 2h/kt$ dönüşümü yapılarak modifiye edilmiş sıfırıncı dereceden bir Bessel denklemi elde edilebilir ve genel çözüm olarak;

$$\theta(r) = C_1 \cdot I_0(mr) + C_2 \cdot K_0(mr) \quad (4)$$

elde edilebilir. Burada I_0 ve K_0 sırasıyla modifiye, birinci ve ikinci tür Bessel fonksiyonlarıdır (Incropera & DeWitt, 1996).

Çalışmada uygulanan fiziksel modelin analitik olarak çözümü oldukça karmaşık olduğundan sayısal yöntemlerle çözüm yoluna gidilmiştir.

BULGULAR

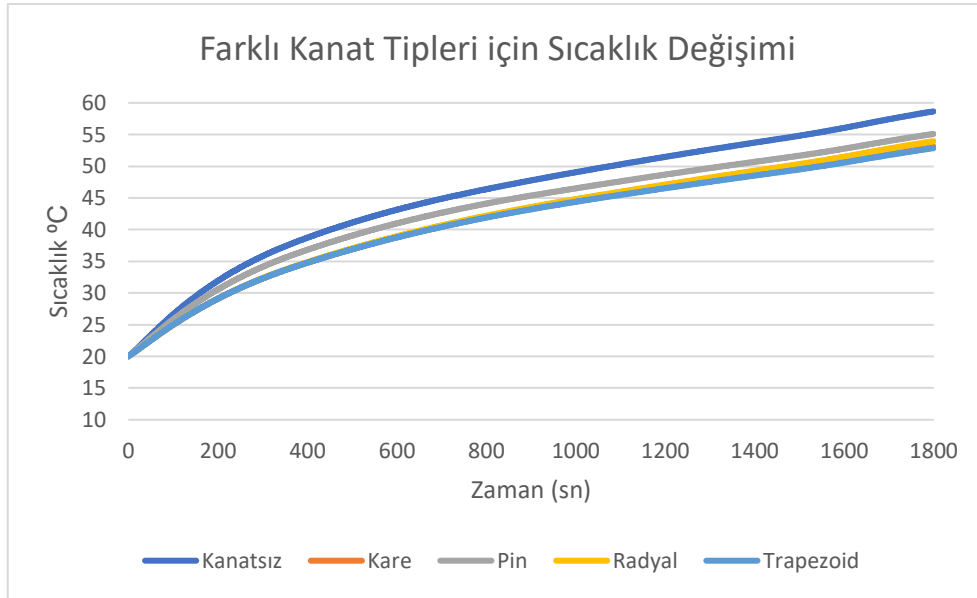
Seri bağlı 2 pilin analizi

İki silindirik pilin seri olarak bağlandığı durum için doğal taşınım koşulları sayısal olarak analiz edilmiştir. Sayısal çalışma sonucunda elde edilen en yüksek pil sıcaklıkları Çizelge 2’de verilmiştir. Kanatlı hücrelerin, kanatsız hücrelere göre 6 °C’ye yaklaşan düzeylerde avantaj sağladığı gözlenmiştir.

Çizelge 2 2S Bağlantı Durumunda Farklı Kanat Tipleri için Maksimum Pil Sıcaklıkları (°C)

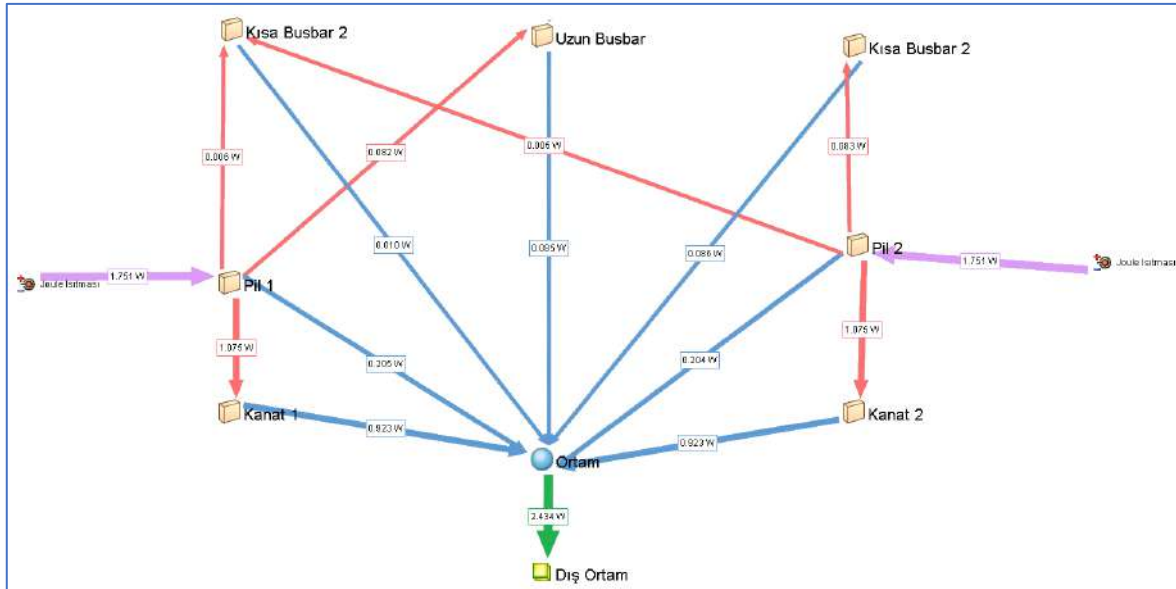
Kanat Tipi	Kanatsız	Kare	Pim	Halka	Trapezoid
Pil No					
Pil 1	58,65	53,11	55,09	53,95	52,86
Pil 2	58,65	53,12	55,10	53,95	52,86

İki pilin seri şekilde bağlanması durumundaki paketin 2C deşarj hızı ile boşaltılması halinde sayısal olarak gözlemlenen zamana göre maksimum sıcaklık dağılımı Pil-1 için Şekil 1’de verilmiştir. 30 dakika boyunca sürdürülen deşarj işlemi esnasında kanatsız pil hücrelerinin sıcaklıklarının kanatlı pillere göre daha yüksek seviyelerde seyrettiği, en düşük pil sıcaklığının trapezoid kesitli pillerde gözlemlendiği tespit edilmiştir.



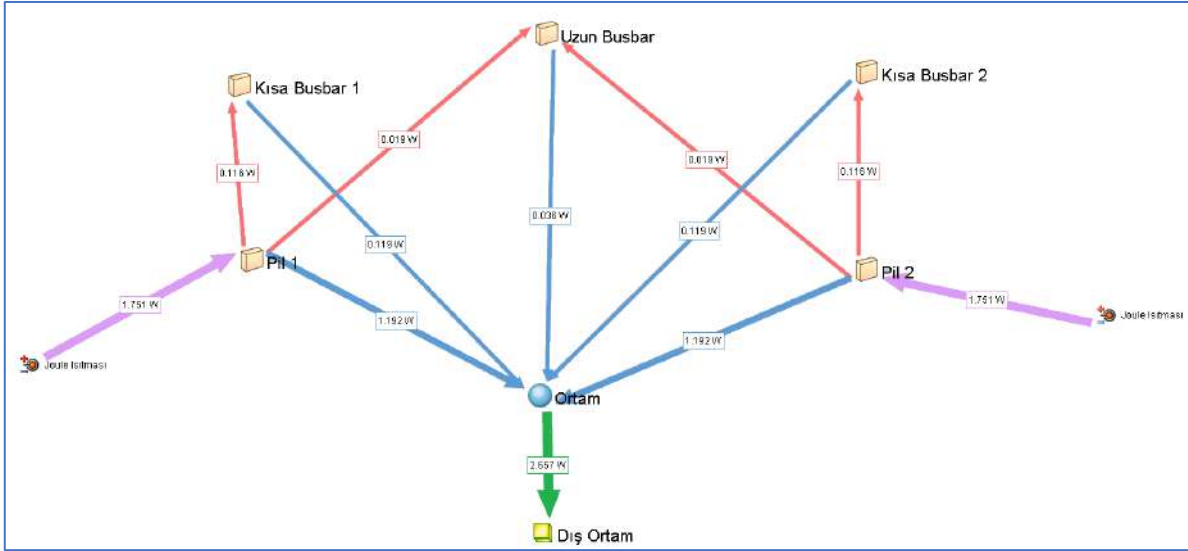
Şekil 1 2S Bağlantı Durumunda Farklı Kanat Tipleri için Sıcaklık Değişimi

Ayrıca sistemin ısı akı grafiği de Şekil 2 ve Şekil 3’de kanatsız piller ve trapezoid kesitli kanada sahip piller için karşılaştırmalı olarak verilmiştir. Akı grafiklerinde kanatların pillerde oluşan joule ısısının dışarı atılmasında etkisinin olduğu görülmektedir. Analiz süresi sonu olan 1800. saniye itibariyle, her bir pilde üretilen ısı 1,751 W olup, bunun 1,192 W olan kısmı havaya, 0,135 W olan kısmı devreyi oluşturan nikel busbar çubuklarına iletilmektedir. Üretilen ısının tamamı dış ortama atılmadığından sıcaklık yükselmektedir.



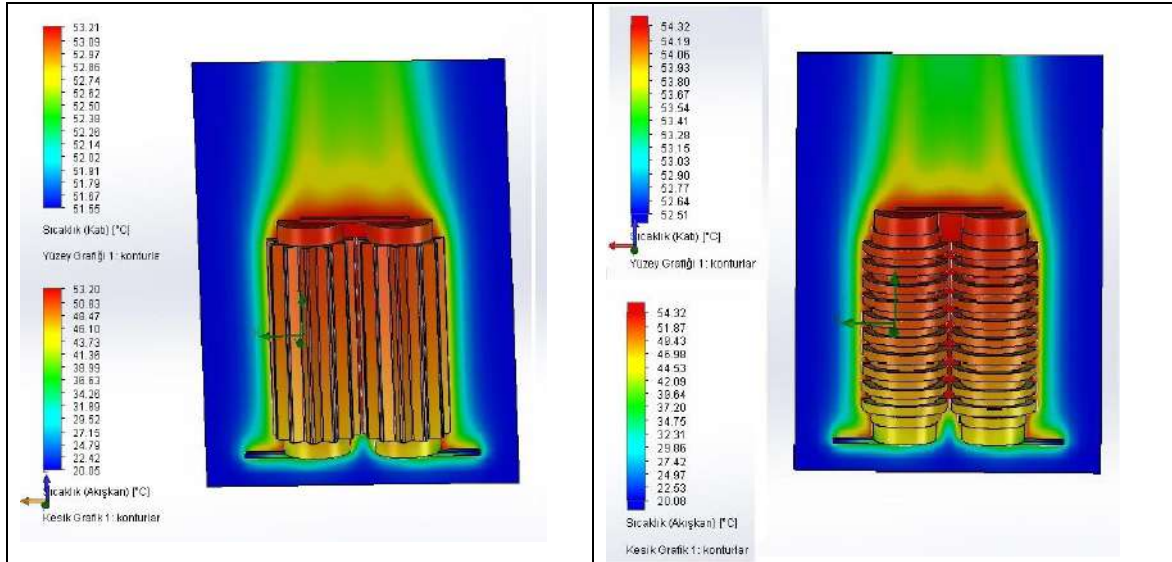
Şekil 2 2S Bağlantı Durumunda Trapezoid Kanatlı Piller için Isı Akı Grafiği

En düşük pil sıcaklığını sergileyen trapezoid kesitli kanada sahip pil paketi incelendiğinde ise, benzer şekilde pilde son saniyede üretilen 1,751 W ısı enerjisinin 1,075 W kadarlık kısmının kanada, 0,088 W kadarlık kısmının busbar çubuklarına iletiildiği, 0,205 W kadar kısmı doğrudan pil üzerinden havaya verilirken, 0,923 W kadar kısmı ise kanat üzerinden taşınım ile atılmaktadır. Bu durum, zamana yaygın şekilde incelendiğinde pilin üzerinde biriken ısının kanatsız durumda daha az olduğu, dolayısıyla pilin daha düşük sıcaklıklara eriştiği gözlenmiştir. Öte yandan, doğal taşınım şartlarında bu etkinin görece küçük olduğu, kanatların pilleri yalıtın ve ısıyı depolayan bir özellik de gösterdiği ve bu durumun işlem süresi sonunda pillerin soğumasını geciktirici bir etki yapacağı da söylenebilir.



Şekil 3 2S Bağlantı Durumunda Kanatsız Pil Paketine ait Isı Akı Grafiği

Şekil 4'te trapezoid kanatlı piller ile halka kanatlı pillerin katı gövdelerindeki (pil ve kanat) sıcaklık dağılımı ile merkezindeki hava sıcaklık dağılımı bir arada verilmiştir. Halka kanatların hava akış yönüne dik, trapezoid kanatların hava akış yönünde olmasının sonuçları küçük de olsa gözlenebilmektedir.



Şekil 4 Trapezoid ve Halka Tipi Kanada Sahip 2S Pil Paketinde, pil, kanat ve hava için sıcaklık dağılımı

Düz Dizilmiş 4S3P Pil Paketinin İncelenmesi

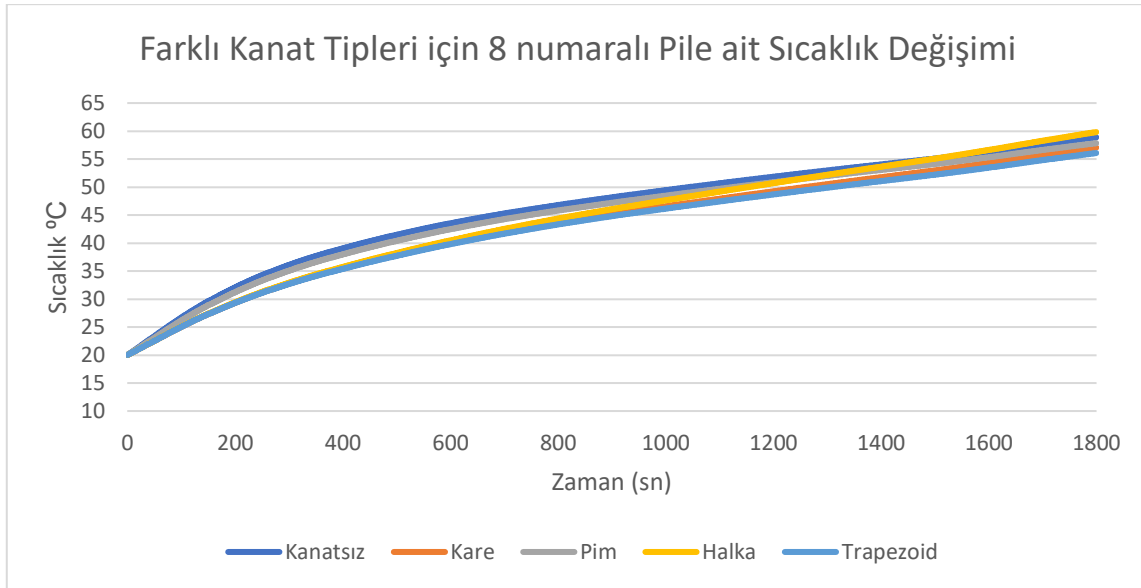
Doğal taşınım koşulları

4 seri 3 paralel olmak üzere birbirine bağlanarak paket oluşturan 12 silindirik pilin 2C deşarj hızı ile boşaltılması halinde termal davranışları incelenmiştir. 20 °C ortam sıcaklığında, doğal taşınım koşullarında pillerde oluşan en yüksek sıcaklıkların kanat tipine göre dağılımı Çizelge 3'te verilmiştir. Kanatsız piller ile kanatlı piller arasındaki sıcaklık farkının 4 °C seviyesine kadar çıktığı, en düşük sıcaklık değerleri trapezoid kesitli kanada sahip pillerde gözlenirken halka tipi kanada sahip pillerin sıcaklığının bazı piller için kanatsız pil sıcaklıklarının üzerine çıktığı görülmüştür.

Çizelge 3 4S3P Bağlantı Konfigürasyonu için Farklı Kanat Tiplerinde Pillerin Eriştiği Maksimum Sıcaklıklar (°C)

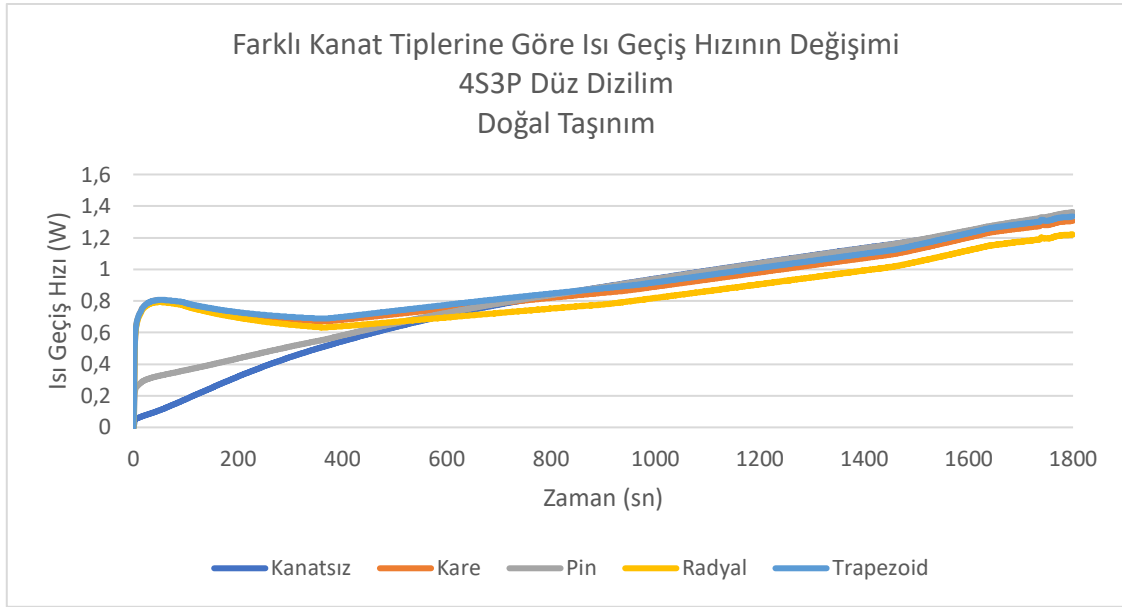
Kanat Tipi	Kanatsız	Kare	Pim	Halka	Trapezoid
Pil No					
Pil 1	58,72	55,35	56,61	57,14	54,59
Pil 2	58,44	55,44	56,73	57,15	54,80
Pil 3	58,29	55,62	56,85	57,50	54,22
Pil 4	58,29	54,89	56,18	56,74	55,52
Pil 5	58,88	55,59	56,74	57,50	56,09
Pil 6	58,19	54,82	56,25	56,74	55,51
Pil 7	58,29	56,40	57,18	58,70	55,43
Pil 8	58,88	57,11	58,00	59,83	56,08
Pil 9	58,19	56,26	57,13	58,57	55,42
Pil 10	58,73	56,31	57,13	58,68	54,58
Pil 11	58,45	57,05	57,83	59,82	54,76
Pil 12	58,29	56,24	56,94	58,56	54,37
Ortalama Sıcaklık	58,47	55,92	56,96	58,08	55,11

Pil paketinin iç kısmında yer aldığı için en yüksek sıcaklıklara ulaşan 8 numaralı pile ait sıcaklık değerlerinin zamanla değişimi Şekil 5'te verilmiştir. Gözleendiği üzere oldukça düşük sıcaklık farkları ile değişim gösteren kanat tipleri içinde halka tipi kanatlı pil en yüksek, trapezoid tipi kanatlı pil en düşük seviyelerde seyretmektedir.



Şekil 5 Farklı Kanat Tipleri için 8 numaralı Pile ait Sıcaklık Değişimi

Farklı kanat tipleri için paketin iç kısımlarında kalan ve en yüksek sıcaklıklara erişen 8 numaralı pilin ısı transfer davranışı Şekil 6'da verilmiştir. Doğal taşınım koşullarında, kanatsız pillerin ve pim tipi kanatlı pillerin ilk ısınma anlarında daha yüksek hızlarda ısı transferi gerçekleştirdiği, ısınan havanın yükselmeye başlaması ile birlikte ısı transfer hızlarının birbirine yaklaştığı ve zaman içinde halka tipi kanatların yatay olması nedeniyle dikey kanatlara göre daha düşük hızlarda ısı geçişi sağladığı gözlenmiştir.



Şekil 6 Pil 8 için Isı Transfer Hızı Değişimi

Zorlanmış taşınım koşulları

4S3P konfigürasyonu ile bağlantıları sağlanan hücrelerin 2C hızı ile deşarjı halinde, zorlanmış taşınım koşullarında oluşan maksimum pil sıcaklıkları, tüm piller için Çizelge 4'te verilmiştir. Zorlanmış taşınım koşulları batarya paketinin kısa kenarına yerleştirilen bir fan yardımıyla 2 m/s hızda hava akımı oluşturularak tesis edilmiş olup ortam sıcaklığı 20 °C olarak verilmiştir.

Fanla soğutma işlemi 1-3 numaralı pillere en yakın konumda 10-12 numaralı pillere ise en uzak konumda bulunduğundan bu piller arasında önemli bir sıcaklık farkı meydana gelmektedir. Sıcaklığın en yüksek değerlerde seyrettiği 10-12 numaralı pillerin sıcaklıkları kanat kullanıp kullanılmaması durumuna göre 3°C ile 4°C arasında değişiklik gösterebilmektedir. Bu fark fana yakın pillerde 7°C-8°C dolayına çıkabilmektedir.

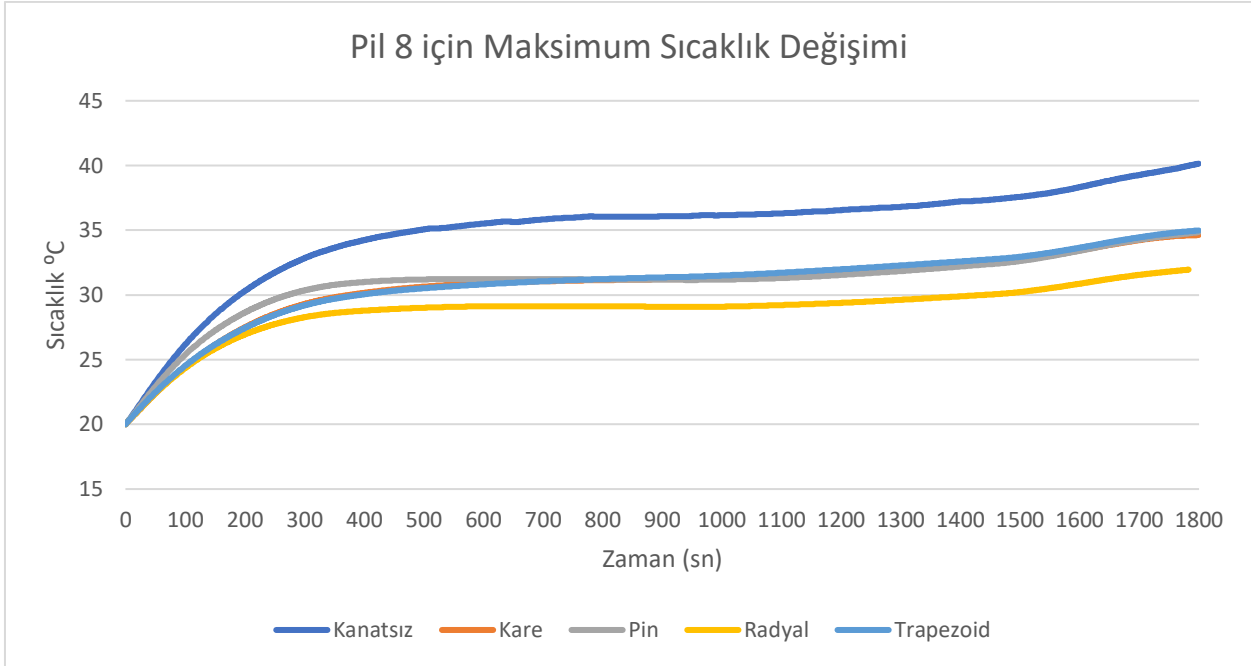
En düşük pil sıcaklıkları halka tipi kanatlara sahip pillerde gözlenirken geometrik benzerliklerinden dolayı kare ve trapezoid kesite sahip pil sıcaklıklarının büyük ölçüde yakın değerlerde seyrettiği söylenebilir.

Çizelge 4 4S3P Konfigürasyonunda Zorlanmış Taşınım Koşulları için Pillerin Maksimum Sıcaklıkları (°C)

Kanat Durumu/Türü	Kanatsız	Kare	Pim	Halka	Trapezoid
Pil No					
Pil 1	38,00	30,01	31,57	29,33	30,16
Pil 2	36,78	29,40	30,58	28,68	29,54
Pil 3	38,26	29,88	31,74	29,34	30,24
Pil 4	40,43	36,27	36,94	34,30	37,13
Pil 5	40,29	38,02	36,94	34,51	38,05
Pil 6	40,44	36,12	36,70	34,45	36,73
Pil 7	40,47	33,83	34,66	31,95	34,70
Pil 8	40,14	34,63	34,86	31,95	34,98
Pil 9	40,57	33,73	34,86	31,99	34,35
Pil 10	40,43	37,59	37,85	36,09	38,05
Pil 11	40,66	38,77	37,95	35,36	38,60
Pil 12	40,61	37,59	37,90	36,08	37,45
Ortalama Sıcaklık	39,76	34,65	35,21	32,84	35,00

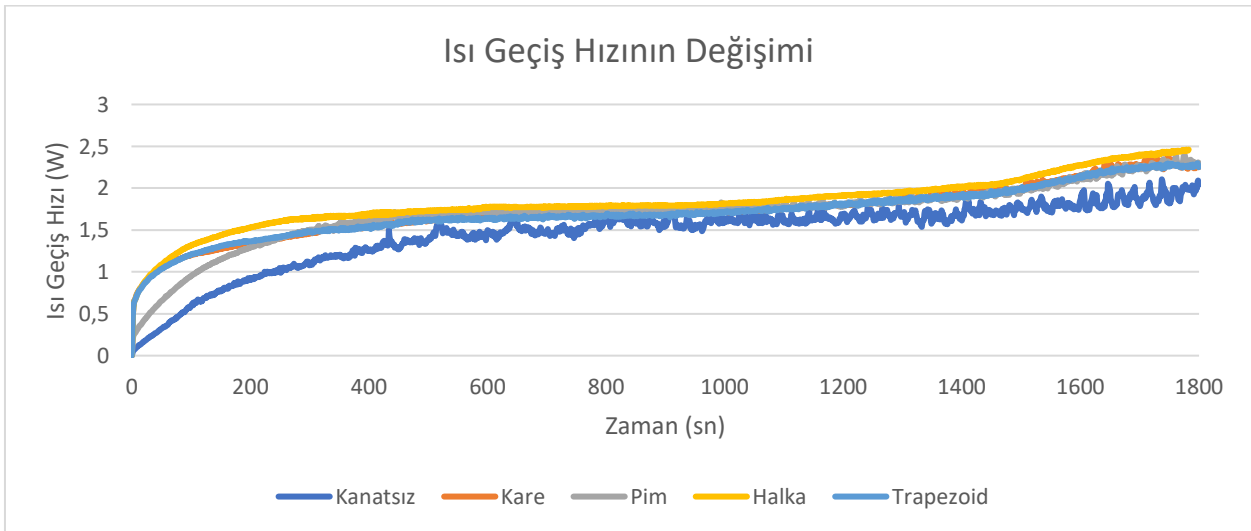
Şekil 7'de verilen pil sıcaklıklarının 30 dakika olan deşarj süresi boyunca değişimi incelendiğinde kanatsız hücrelerin sıcaklığının özellikle ilk 4-5 dakika sonrasında belirgin bir şekilde arttığı

gözlenmektedir. Fanın tek bir noktaya konumlandırılması nedeniyle farklı konumdaki piller ve kanat türleri arasında sıcaklık iniş/çıkışları yaşanmasına rağmen kanatsız pillerin belirgin bir şekilde daha yüksek sıcaklık değerlerine sahip olduğu görülmüştür.



Şekil 7 Zorlanmış Taşınım Koşullarında Pil 8 için maksimum sıcaklıkların değişimi

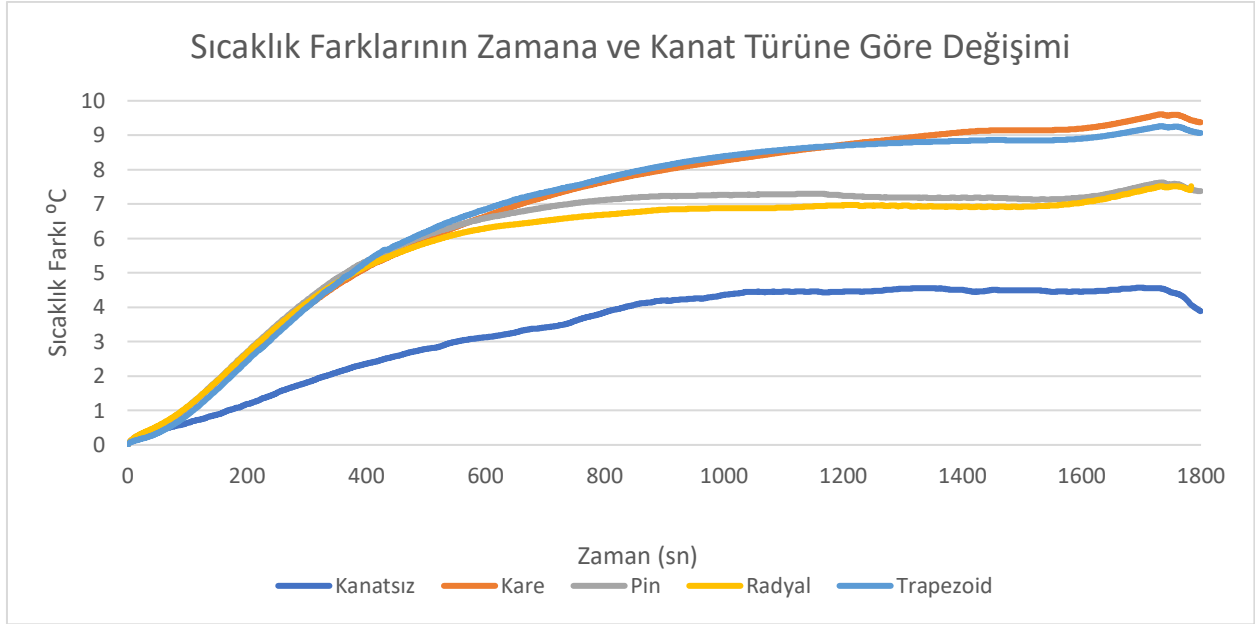
Kanatların ısı transferine olan olumlu etkisi ısı geçiş hızı ile gözlenmiştir. Şekil 8'de verilen grafikte farklı kanat tipleri için ısı geçiş hızının zamana göre değişimi verilmiştir. Halka biçimindeki kanatların monte edildiği piller en yüksek ısı geçiş hızına sahipken kanatsız pillerin ısı geçiş hızı belirgin şekilde düşüktür. Öte yandan kanatsız durumda ısı geçiş hızının çok daha değişken olduğu, kanatlı pillerde ise ısı geçiş hızının kararlı bir şekilde seyrettiği görülmektedir. Kanatların ısı geçiş hızını düzenleyici etkisi göze çarpmaktadır.



Şekil 8 Zorlanmış Taşınım koşullarında farklı kanat tipleri için ısı geçiş hızı

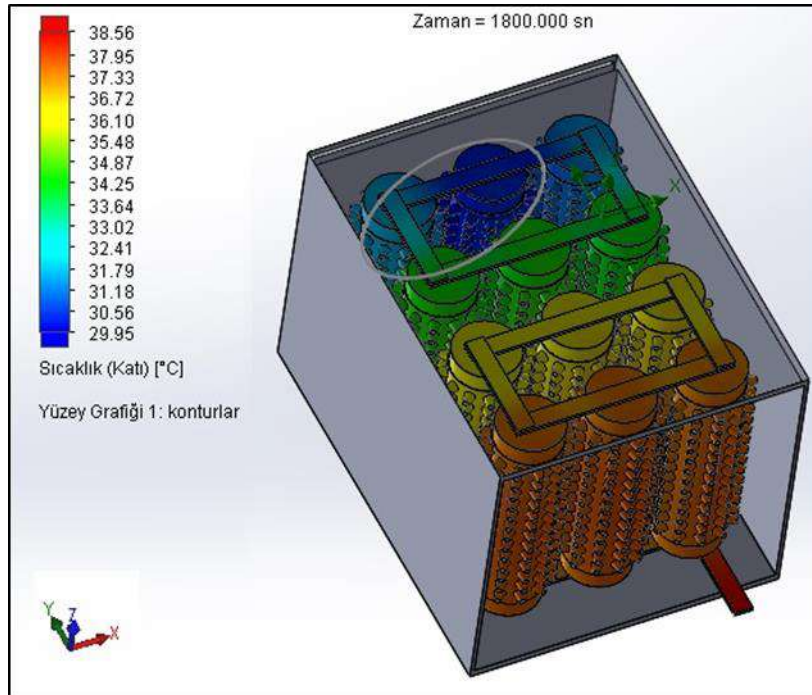
Li-ion bataryaların performansını ve ömrünü artıran hususlardan birisi de sıcaklığın aynı paket içinde homojen şekilde dağılması gerekliliğidir. Literatürde sıcaklık dağılımının sınırlarının belirlenmesi noktasında 5°C sıcaklık farkının aşılması gerekliliği vurgulanmaktadır. Zorlanmış taşınımın önemli dezavantajlarından birisi paket içindeki sıcaklık dağılımını bozması yönündedir.

Şekil 9’da zorlanmış taşınım koşulları için aynı paket içinde yer alan 12 pilin sıcaklık farkları zamana göre verilmiştir. Kanatsız pillerde daha homojen bir sıcaklık dağılımı gözlenirken özellikle kare ve trapezoid kesitli kanatlı pillerde sıcaklık farkının 10 °C e yaklaştığı görülmektedir.

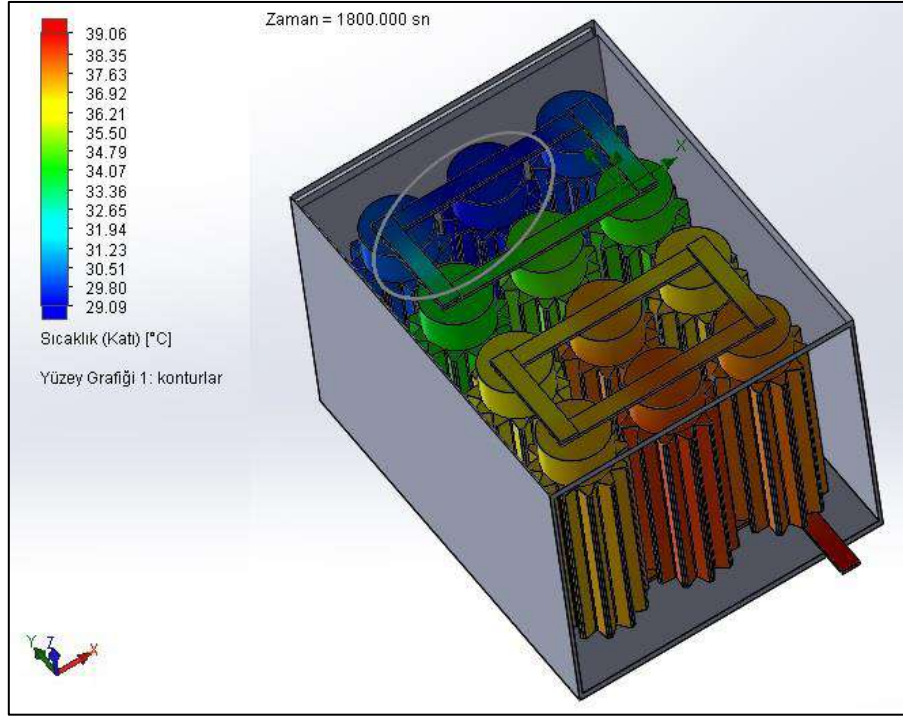


Şekil 9 Zorlanmış taşınım koşulları için paket içi maksimum sıcaklık farklarının değişimi

Zorlanmış taşınım koşullarındaki sıcaklık değişimi Şekil 10’da pim ve Şekil 11’de trapezoid tipteki kanatlar için görselleştirilerek verilmiştir.



Şekil 10 Pim tipi kanatlı batarya paketi için sıcaklık dağılımı



Şekil 11 Trapezoid tip kanatlı batarya paketi sıcaklık değişimi

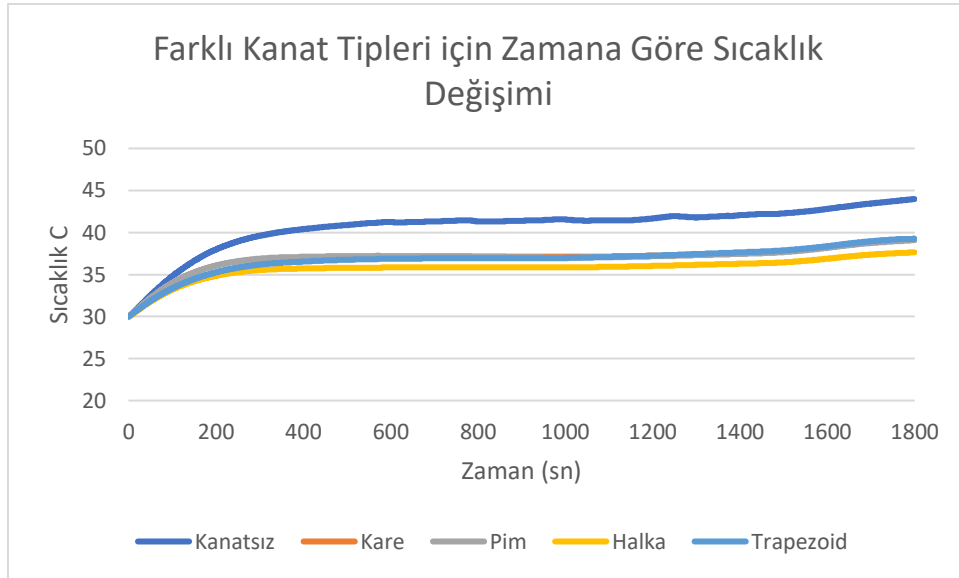
Li-ion pillerin termal yönetiminde en önemli koşullardan birisi de ortam sıcaklığı olduğundan, yapılan analizler 30 °C ortam sıcaklığı için de tekrarlanmıştır. Ancak 20 °C ortam sıcaklığına göre yapılan analizlerde pillerin yükselen sıcaklığı sınır değerlerine yaklaştığından bu analizlerde havanın pil paketi içine giriş hızı 4 m/s olarak alınmıştır.

Bu koşullar altında ulaşılan maksimum pil sıcaklıkları Çizelge 5’te verilmiştir. Benzer şekilde kanatlı pillerin sıcaklıkları, kanatsız pillere kıyasla 6 °C dereceye varan farklar göstermektedir.

Çizelge 5 Yüksek ortam sıcaklığında pillerin maksimum sıcaklıklarının değişimi (°C)

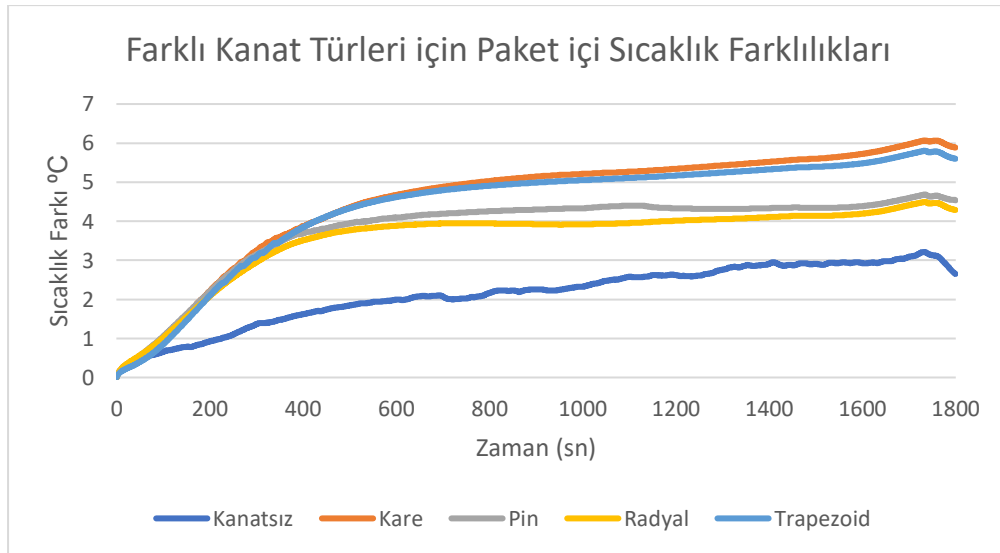
Kanat Durumu/Türü Pil No	Kanatsız	Kare	Pim	Halka	Trapezoid
Pil 1	42,05	36,32	37,23	36,14	36,30
Pil 2	41,35	35,87	36,58	35,59	36,00
Pil 3	42,30	36,28	37,31	36,05	36,40
Pil 4	43,64	40,08	40,31	38,81	40,23
Pil 5	43,73	40,97	40,28	38,94	41,09
Pil 6	43,56	39,89	40,26	38,81	40,18
Pil 7	43,93	38,78	39,08	37,62	38,92
Pil 8	43,97	39,13	39,09	37,63	39,26
Pil 9	44,00	38,73	39,14	37,59	38,85
Pil 10	43,50	40,93	40,98	39,88	40,82
Pil 11	43,75	41,75	41,12	39,41	41,60
Pil 12	43,78	40,95	41,01	39,72	40,67
Ortalama Sıcaklık	43,30	39,14	39,37	38,01	39,19

Ortam ve materyal için başlangıç sıcaklığının 30 °C ve hava giriş hızının 4 m/s olduğu zorlanmış taşınım koşulları için 30 dakikalık deşarj süresi boyunca erişilen maksimum pil sıcaklıklarının değişimi Şekil 12’de verilmiştir. Kanatsız pillerin ortalama sıcaklığı 43,30 °C iken en iyi performansı sergileyen halka tipi kanatların kullanıldığı pillerin maksimum sıcaklıklarının ortalaması 38,01 °C olarak hesaplanmıştır.



Şekil 12 Farklı Kanat tipleri için maksimum pil sıcaklıklarının zamana göre değişimi

Sıcaklık dağılımının bir ölçüsü olan paket içinde oluşan maksimum sıcaklık değeri, farklı kanat türleri için Şekil 13'te verilmiştir. İlgili koşullar altında sıcaklık farkının 6 °C dereceye kadar yaklaştığı gözlenmiştir. Bu değer 2m/s hava giriş hızı koşullarında gerçekleştirilen simülasyonda ulaşılan 10 °C değerinin altındadır.

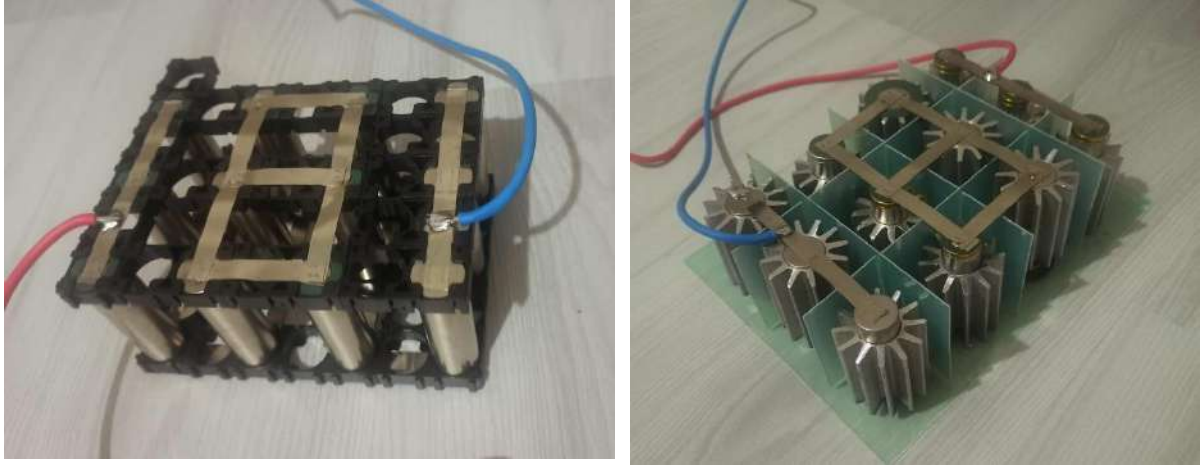


Şekil 13 Farklı kanat tipleri için paket içi maksimum sıcaklık farklarının değişimi

Li-ion pillerin termal yönetiminde en önemli faktörlerden birisi de şarj/deşarj hızıdır. Sistemin yüksek şarj vedeşarj hızlarında çalıştırılması sıcaklık artışına sebep olur. Bu durum C ve 2C hızlarında yapılan şarj vedeşarj işlemlerinde gözlenmiştir. Eşdeğer Devre Modeli kullanılarak sayısal ortamda yapılan C ve 2C hızlarındaki şarj işlemleri de aynı hızlardakideşarj işlemleri ile benzer sıcaklık değerleri ortaya koymuştur.

Deneysel çalışma kanatsız pillerin kullanıldığı 4S3P pil paketi ve trapezoid kesitli pillerin kullanıldığı 4S3P pil paketi kullanılarak gerçekleştirilmiştir. Deneysel çalışmada 2000 mAh kapasiteli 18650 Li-ion piller kullanılmış olup, pillerin dış yalıtım bandı çıkarılmış, trapezoid kanatçıkların silindirik pil üzerine montajı sıkı geçme yapılarak ve termal macun kullanılarak sağlanmıştır. Oluşturulan her iki modül yüke maruz bırakılmış, 3Cdeşarj hızı ile doğal taşınım ortamında yapılan denemelerde pil yüzey sıcaklığı termokupl kullanılarak ölçümlenmiştir. Yapılan ölçümlerde kanatlı hücrelerin pil sıcaklığının sayısal

çalışmayı doğrular şekilde kanatsız hücelere göre 2 °C-3 °C bandında daha düşük seyrettiği gözlenmiştir.

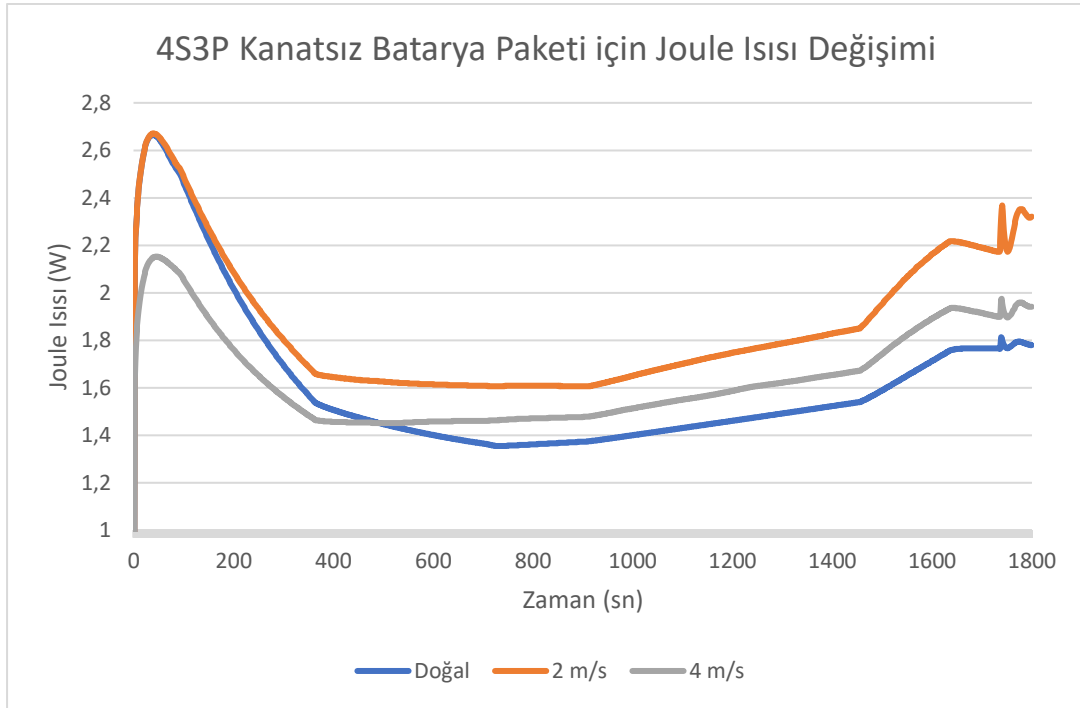


Şekil 14 4S3P Batarya Paketleri; a) kanatsız b) trapezoid kanatlı

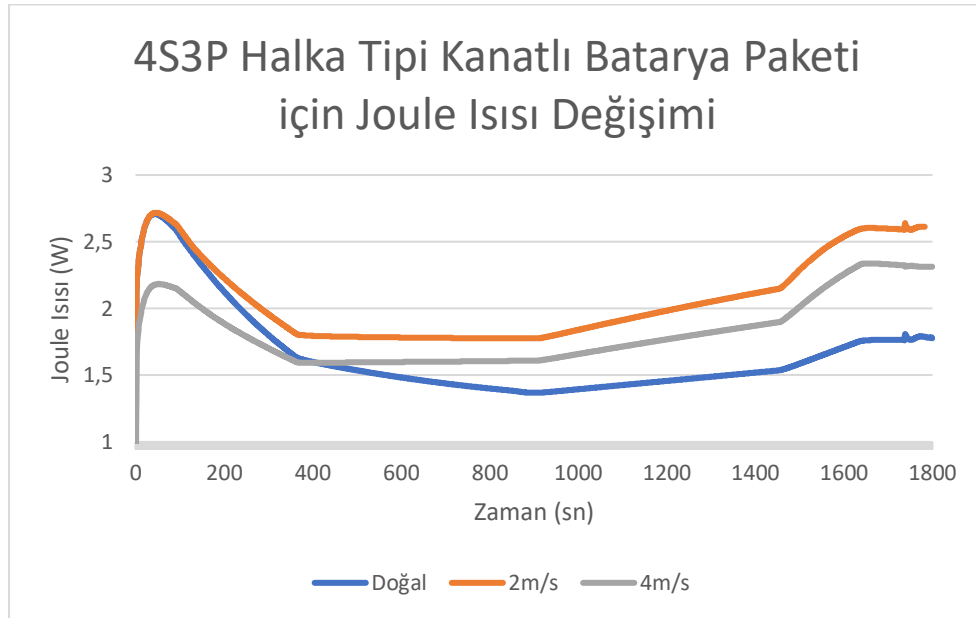
TARTIŞMA

Çalışmada, hava soğutmalı batarya termal yönetim sistemlerine yenilikçi bir yaklaşım getirmek amacıyla önerilen hücre düzeyindeki farklı kesitlerde kanat uygulamalarının, doğal taşınım koşullarında kanat tipine göre 2 °C - 4 °C sıcaklık avantajı sağladığı, zorlanmış taşınım koşullarında bu avantajın 7 °C – 8 °C dolayına çıkabildiği tespit edilmiştir. Çalışılan kanat tipleri, alan ve hacim için %150-%200 aralığında, ağırlık için %33 - %40 aralığında bir artışa sebep olacaktır. Hava soğutma sistemlerinin avantajları dikkate alındığında, termal yönetimin önemli olduğu, ağırlık ve hacim sorununun bulunmadığı mühendislik uygulamalarında söz konusu yaklaşımın kullanılabilmesi öngörülmektedir. Seri şekilde bağlanmış iki pilin ısı akıları incelendiğinde kanat kullanımı halinde %5 dolayında bir ısı akısı avantajı gözlenmiş olup, bu durum toplam kanat etkinliğinin 1,05 olduğunu göstermektedir. Bilindiği üzere uygulamada kanat etkinlik değerinin en az 2 olması benimsenmektedir (Incropera & DeWitt, 1996). Ancak elektrikli araç ve şarjlı alet bataryalarının yüksek maliyetleri ve menzil handikapları birlikte düşünüldüğünde kanat etkinlik değerini artırmaya yönelik uygulamalar yapmanın faydalı olacağı değerlendirilmektedir.

Batarya yüzeyine takılan kanatların bir diğer etkisi ise, bataryaların ısınmasına temel teşkil eden joule ısısındaki değişimdir. 4S3P konfigürasyonunda oluşturulan paket için farklı kanat tiplerinde ve farklı taşınım koşullarında joule ısısının zamanla değişimi farklılık göstermektedir. Joule ısısının kanatsız batarya paketi ve halka tipi kanatlı batarya paketi için değişimi Şekil 15 ve Şekil 16’te verilmiştir. Kanat türüne ve taşınım koşullarına göre değişen joule ısısı doğal olarak pil sıcaklıklarını da etkilemektedir.



Şekil 15 4S3P Kanatsız Batarya Paketi için Joule Isısı Değişimi



Şekil 16 4S3P Halka Tipi Kanatlı Batarya Paketi için Joule Isısı Değişimi

Çalışmada, basit ve düşük maliyetli olmasından dolayı hava soğutmalı sistemler hedeflenmiştir. Önerilen kanat yapısı PCM veya sıvı soğutmalı batarya termal yönetim sistemlerinde de kullanılabilir. Zorlanmış taşınım ile yapılan soğutma uygulamasının paket içi sıcaklık farkını istenmeyecek düzeyde artırdığı görülmüştür. Bu durumun önlenmesi için paket içinde birden fazla noktada fan uygulaması yapılabilir veya pillerin alt veya üst kısmına yerleştirilecek fan(lar) ile aksenal akış sağlanabilir. Benzer şekilde fanın konumlandırılmasına uygun şekilde kanat yönü belirlenebileceği gibi, sıcaklığın homojen şekilde dağılmasını sağlamak üzere hava yönlendirici plakalar da eklenebilir.

SONUÇ

Literatürde rastlanmayan hücre düzeyinde farklı kanat tiplerinin termal etkilerini incelemeye yönelik çalışma sonucunda, önerilen kanat tiplerinin batarya paketi ve hacminde önemli derecede artışa sebep

olacağı, buna kıyasla sağlayacağı termal avantajın kısıtlı kalacağı gözlenmiştir. Dolayısıyla söz konusu dizaynın termal yönetimin önemli olduğu, hava ile soğutmanın avantajlı veya kaçınılmaz olduğu, alan ve hacim sorunu bulunmayan sistemler için bir alternatif teşkil edebileceği değerlendirilmektedir. Alan, hacim ve ağırlığı azaltmaya yönelik yeni çalışmalar yapılabileceği gibi fanların farklı konumlandırılması, kanat geometrilerinin değiştirilmesi ve kanat optimizasyonu yapılması gibi ileri çalışmaların yapılması önerilmektedir.

TEŞEKKÜR

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KAYNAKÇA

- Adair, D., Ismailov, K., & Baken, Z. (2014). Thermal Management of Lithium-ion Battery Packs. *Comsol Conference*.
- Akinlabi, A., & Solyali, D. (2020). Configuration, design, and optimization of air-cooled battery thermal management system for electric vehicles: A review. *Renewable and Sustainable Energy Reviews*(125). doi:<https://doi.org/10.1016/j.rser.2020.109815>.
- Al-Zareer, M., Dinçer, I., & Rosen, M. (2019). A novel approach for performance improvement of liquid to vapor based battery cooling systems. *Energy Conversion and Management*(187), 191-204.
- Aslan, E., Aydın, Y., & Yaşa, Y. (2022). Consideration of graphene material in PCM with aluminum fin structure for improving the battery cooling performance. *Int. Journal of Energy Research*(46), 10758-10769. doi:10.1002/er.7878
- Cao, J., Luo, M., Fang, X., Ling, Z., & Zhang, Z. (2020). Liquid cooling with phase change materials for cylindrical Li-ion batteries: An experimental and numerical study. *Energy*(191).
- Chaudhari, J., Singh, G., Rathod, M., & Muhammad Ali, H. (2024). Experimental and computational analysis on lithium-ion battery thermal management system utilizing air cooling with radial fins. *Journal of Thermal Analysis and Calorimetry*(149), 203-218.
- Chen, D., Jiang, J., Kim, G., Yang, C., & Pesaran, A. (2016). Comparison of different cooling methods for lithium ion battery cells. *Applied Thermal Engineering*(94), 846-854.
- Chen, K., Han, T., Khalighi, B., & Kalus, P. (2017). Air Cooling Concepts for Li-Ion Battery Pack in Cell Level. *ASME Heat Transfer Summer Conference*.
- Chen, K., Wang, S., Mengxuan, S., & Chen, L. (2017). Structure optimization of parallel air-cooled battery thermal management system. *International Journal of Heat and Mass Transfer*(111), 943-952.
- Dinçer, İ., Hamut, H. S., & Javani, N. (2017). *Thermal Management of Electric Vehicle Battery Systems*. John Wiley & Sons Ltd.
- Duan, X., & Naterer, G. (2010). Heat transfer in phase change materials for thermal management of electric vehicle battery modules. *Int. J. Heat Mass Transf.*(53), 5176–5182.
- Electropaedia*, 2014. (2020, 07 06). Lithium Battery Failures: http://www.mpoweruk.com/lithium_failures.htm adresinden alındı
- Fan, L., Khodadadi, J., & Pesaran, A. (2013). A parametric study on thermal management of an air-cooled lithium-ion battery module for plug-in hybrid electric vehicles. *Journal of Power Sources*(238), 301-312.
- Hoş, İ., & Türkakar, G. (2021). Heat transfer and thermal management of lithium-ion battery pack system with forced air convection, Vol:6, No:1, Page 25-30 (2021). *Turkish Journal of Electromechanics and Energy*, 1(6), 25-30.
- Incropera, F., & DeWitt, D. (1996). *Fundamentals of Heat and Mass Transfer* (4th edition b.). John Wiley & Sons.
- Jarrett, A., & Kim, Y. (2011). Design optimization of electric vehicle battery cooling plates for thermal performance. *Journal of Power Sources*(196), 10359-10368.
- Karimi, G., & Li, X. (2013). Thermal management of lithium-ion batteries for electric vehicles. *Int. J. Energy Res.*(37), 13-24.
- Kumaresan, K., Sikha, G., & White, R. (2008). Thermal model for a Li-ion cell. *J. Electrochem. Soc.*(155), A164–A171.

- Lazrak, A., Fourmigue, J., & Robin, J. (2018). An innovative practical battery thermal management system based on phase change materials: Numerical and experimental investigations. *Applied Thermal Engineering*(128), 20-32.
- Li, X., Zhao, J., Yuan, J., Duan, J., & Liang, C. (2021). Simulation and analysis of air cooling configurations for a lithium-ion battery pack. *Journal of Energy Storage*(35).
- Lin, C., Chen, K., Sun, F., Tang, P., & Zhao, H. (2009). Research on thermo-physical properties identification and thermal analysis of EV Li-ion battery. *In Proceedings of the 2009 Vehicle Power and Propulsion Conference (VPPC)*, (s. 1426-1431). Dearborn.
- Mahamud, R., & Park, C. (2011). Reciprocating air flow for Li-ion battery thermal management to improve temperature uniformity. *Journal of Power Sources*(196), 5685-5696. doi:<https://doi.org/10.1016/j.jpowsour.2011.02.076>.
- Matthe, R., Turner, L., & Mettlach, H. (2011). Battery System for Electric Vehicle with Extended Range. *SAE International Journal of Engines*(4 (1)), 1944-1962.
- Moaveni, A., Siavashi, M., & Mousavi, S. (2024). Passive and hybrid battery thermal management system by cooling flow control, employing nano-PCM, fins, and metal foam. *Energy*(288). doi:<https://doi.org/10.1016/j.energy.2023.129809>.
- Motloch, C., Christophersen, J., Belt, J., Wright, R., Hunt, G., Sutula, R., . . . Miller, T. (2002). High-power battery testing procedures and analytical methodologies for HEV's. *SAE Transactions Journal of Passenger Cars; Electronic and Electrical Systems*, 7(111), 797-802.
- Padalkar, A., Cahudhari, M., Kore, K., Nevaskar, S., Nilegave, D., & Funde, A. (2024). Effects of circumferential fin on cooling performance improvement of forced air-cooled battery pack. *Applied Thermal Engineering*(238).
- Pesaran, A. A. (2001). Battery Thermal Management in EVs and HEVs : Issues and Solutions. *Advanced Automotive Battery Conference*.
- Pesaran, A. A. (2002). Battery thermal models for hybrid vehicle simulations. *J. Power Sources*(110), 377-382. doi:[https://doi.org/10.1016/S0378-7753\(02\)00200-8](https://doi.org/10.1016/S0378-7753(02)00200-8)
- Pesaran, A., & Santhanagopalan, G. (2013). Addressing the impact of temperature extremes on large format Li-ion batteries for vehicle applications. *30th Int Battery Seminar*.
- Rahmani, A., Dibaj, M., & Akrami, M. (2024). Recent Advancements in Battery Thermal Management Systems for Enhanced Performance of Li-Ion Batteries: A Comprehensive Review. *Batteries*, 10(8), 265. doi:<https://doi.org/10.3390/batteries10080265>
- Rao, Z., Wen, Y., & Zhao, J. (2019). Thermal performance of battery thermal management system using composite matrix coupled with mini-channel. *Energy Storage*. doi:<https://doi.org/10.1002/est2.59>
- Sefidan, A., Sojoudi, A., & Saha, S. (2017). Nanofluid-based cooling of cylindrical lithium-ion battery packs employing forced air flow. *International Journal of Thermal Sciences*(117), 44-58.
- Thakur, A., Prabakaran, R., Elkadeem, M., Sharshir, S., Arıcı, M., Wang, C., . . . Saidur, R. (2020). A state of art review and future viewpoint on advance cooling techniques for Lithium-ion battery system of electric vehicles,. *Journal of Energy Storage*(32). doi:<https://doi.org/10.1016/j.est.2020.101771>
- Vayrynen, A., & Salminen, J. (2012). Lithium ion battery production. *Journal of Chem. Thermodynamics*(46), 80-85.
- Viswanathan, V., Choi, D., Wang, D., Xu, W., Towne, S., Williford, R., . . . Yang, Z. (2010). Effect of entropy change of lithium intercalation in cathodes and anodes on Li-ion battery thermal management. *J. Power Sources*(195), 3720-3729.
- Wang, T., Tseng, K., Zhao, J., & Wei, Z. (2014). Thermal investigation of lithium-ion battery module with different cell arrangement structures and forced air-cooling strategies. *Applied Energy*(134), 229-238. doi:<https://doi.org/10.1016/j.apenergy.2014.08.013>.
- Williford, R., Viswanathan, V., & Zhang, J.-G. (2009). Effects of entropy changes in anodes and cathodes on the thermal behavior of lithium ion batteries. *J. Power Sources*(189), 101-107.
- Wiriyasart, S., Hommalee, C., Sirikasemsuk, S., Prupark, R., & Naphon, P. (2020). Thermal management system with nanofluids for electric vehicle battery cooling modules. *Case Studies in Thermal Engineering*(18).

- Xiao, H., Shaohua, L., & Stanton, S. (2010). A novel thermal model for HEV/EV battery modeling based on CFD calculation. *In Proceedings of the 2010 IEEE Energy Conversion Congress and Exposition (ECCE)*, (s. 893-900). Atlanta. 2010 tarihinde alındı
- Xing, Y., Ma, E., Tsui, K., & Pecht, M. (2011). Battery Management Systems in Electric and Hybrid Vehicles. *Energies*, 1840-1857.
- Yang, N., Zhang, X., Li, G., & Hua, D. (2015). Assessment of the forced air-cooling performance for cylindrical lithium-ion battery packs: A comparative analysis between aligned and staggered cell arrangements. *Applied Thermal Engineering*(80), 55-65.
- Yang, W., Zhou, F., Zhou, H., & Liu, Y. (2020). Thermal performance of axial air cooling system with bionic surface structure for cylindrical lithium-ion battery module, Vol. 161, 2020, 120307. *Int. J. of Heat and Mass Transfer*(161).
- Zhao, C., Sousa, A., & Jiang, F. (2019). Minimization of thermal non-uniformity in lithium-ion battery pack cooled by channeled liquid flow. *International Journal of Heat and Mass Transfer*(129), 660-670.
- Zhao, J., Rao, Z., & Li, Y. (2015). Thermal performance of mini-channel liquid cooled cylinder based battery thermal management for cylindrical lithium-ion power battery. *Energy Conversion and Management*(103), 157-165.

MINDFULNESS IN LANGUAGE TEACHING

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ABSTRACT

In the recent years, there has been a rise of stress and anxiety in almost every part of our lives. This has led to an increased interest in the use of mindfulness and mindfulness training as a beneficial method for resolving these problems. Several research in the field of Education have highlighted mindfulness as a promising approach to increase both students' well-being and academic achievement. In light of this context, this current research examines the possible incorporation of mindfulness into language acquisition guidance. The purpose of this study is to investigate the fundamental aspects of mindfulness in advising for language learning practice, with the aim of facilitating future research projects. Additionally, this study aims to suggest additional pathways for continuing professional development for advisers in this field.

Keywords: language learning, mindfulness, education, language learning environments, learners

INTRODUCTION

Learning another language can be quite a bit of an intimidating task for many folks, as the foreign language classroom often turns out to be the only place where learning takes place (Ellis, 2015). Picking up new words, getting comfortable with complex grammar rules, speaking correctly, and dealing with switching from one's native tongue to a second language (Birch & Fulop, 2021) usually requires determination, dedication, and actually enjoying the process (Zhao, 2023). Also, picking up English as another language has become pretty important in today's interconnected world. English is one of those languages that's spoken far and wide across the globe and tends to serve as a key tool for international talking points like business dealings or even political discussions. That's why being good at English might be just about necessary for all sorts of career progressions you might think of. Having a proficient English is also an important tool for the access university education and conducting research and is crucial for international communication. However foreign language learning can sometime become a stressful process which eventually result in foreign language learning anxiety. The Common European Framework of Reference for Languages (CEFR) advocates for significant and intentional language acquisition, perceiving it as a means to facilitate more purposeful, collaborative classroom activities, thereby utilizing the language through various mediums rather than treating English merely as a subject to be studied (CEFR 2001, 2020). According to the studies done on the field by many scholars, enhancing the purposefulness and enjoyment of language learning increases the academic performances of the students.

A primary objective of CEFR is to enable learners to become social actors of language (CEFR, 2001, 2020). The CEFR advocates for an action-oriented approach that perceives language acquisition as a means to facilitate collaborative tasks in the learning setting, emphasizing the practical application of language rather than treating it merely as another subject to be taught. Incorporating mindfulness into the English Foreign Language (EFL) classroom aligns with the CEFR's objective of enhancing the intentionality of language acquisition. Additionally, the Organization for Economic Cooperation and Development (OECD) has recently identified student well-being as a primary objective (OECD, 2018). Mindfulness programs are increasingly prevalent in global education. Engaging in mindfulness enhances metacognitive awareness, attention, and the capacity to concentrate on the present moment, while also improving students' ability to recognize and discern explicit linguistic input (Bishop et al., 2004; Hussain, 2015; Mrazek et al., 2013). Moreover, mindfulness enhances self-efficacy (Fallah, 2016) and diminishes foreign language anxiety (Önem, 2015).

Mindfulness, characterized by the capacity to concentrate on and acknowledge the present moment with curiosity and without judgment, has emerged as a prominent concept in Western civilization over the

last two decades. Workplaces, educational institutions, medical facilities, and mental health practitioners are increasingly engaging in Mindfulness-Based Interventions (MBIs) to enhance productivity and focus. Academic institutions provide mindfulness classes to assist students in achieving academic achievement (Chapman-Clarke, 2016; Schaufenbuel, 2014; Schmidt, 2011; Shapiro et al., 2006). An increasing number of educational institutions are implementing mindfulness programs to assist students in alleviating anxiety and enhancing their academic engagement (Ergas, 2021, pp. 40-45). Mindfulness-Based Interventions (MBIs) have been documented to positively influence the reduction of anxiety in educational settings, enhance attention, foster cognitive flexibility, create creativity, assist emotional regulations of adolescents, and improve academic performance (Laukkonen et al., 2020). Especially after the pandemic era, societies confronted social and emotional distress, learning deficits, diminished motivation, and an overall decline in the well-being of both teachers and students worldwide. Consequently, instructing mindfulness in the classroom serves as a method to restore social and emotional equilibrium, create motivation, both with the students and the educators (Tan, 2021). Mindfulness-Based Interventions (MBIs) are becoming prevalent in educational contexts, accompanied by a substantial body of research (Albrecht et al., 2012; Ergas, 2019; Renshaw et al., 2017; Zenner et al., 2014). This article aims to describe the definition of Mindfulness, the practices of mindfulness and the need for Mindfulness in the field of English as a Foreign Language (EFL). By the help of this current study, the attitudes of students towards mindfulness in their English studies, their perceptions of mindfulness learning will be identified in order to be considered to be used in all learning settings.

DEFINITION OF MINDFULNESS

In the past ten years, mindfulness has gained importance in the emotional well-being. Mindfulness has demonstrated beneficial effects on mental health and psychological well-being (Baer, Carmody, & Hunsinger, 2012; Brown & Ryan, 2003). Shapiro and Carlson (2009) articulated mindfulness as process and an outcome. The former denotes an innate humanly ability to perceive and engage with life, enabling discernment of experiences that yield greater advantages for oneself and others; whereas the latter pertains to a structured training comprising three fundamental components: intention, attention, and attitude (Shapiro et al., 2006). Focusing on the present moment poses a significant difficulty for many individuals, particularly in today's digital age, when attention is perpetually fragmented and diverted by a multitude of stimuli at any given time.

Mindfulness typically denotes a condition of exercising awareness and focus (Bodhi, 2000). Some definitions emphasize an individual's capacity to assess the present circumstances (Kabat-Zinn, 1990), which is described as 'being in the moment.' Mindfulness is defined as a collection of skills (Dimidjian & Linehan, 2003) and as a method for self-regulating attention (Bishop et al., 2004), particularly in relation to current situations (Brown & Ryan, 2003). Since its introduction to psychology, numerous models have been developed to either delineate mindfulness more precisely or to assess it successfully for empirical reasons. Dimidjian and Linehan (2003) categorize into two groups of three attributes: one group pertains to the actions of practicing mindfulness (observing/noticing, describing/labeling, and participating), while the other group concerns the manner in which these actions are executed (non-judgmentally, with present-moment awareness, and effectively). Leary et al. (2007) present their perspective, delineating five components: focused attention, reduced self-talk, non-judgment, non-doing, and a collection of metaphysical or ethical views. Chadwick et al. (2008) delineate four elements: decentered awareness, sustained attention during challenging situations, acceptance of distressing thoughts, and the experience of varied cognitions without response. Common themes arise from these definitions, indicating a consensus that mindfulness constitutes a mental state characterized by the observation of one's actions in a detached and non-reactive manner, particularly emphasizing the utilization of awareness and attention.

For educators, maintaining focus on the present moment can be especially challenging due to the inherent attentional demands of teaching. In every lesson, educators are required to be authorities in their subject matter, concentrate on instructional content, manage a class full of students, evaluate their involvement and behavior, and comprehend the classroom dynamics. These numerous, attention-grabbing stimuli are distressing and fragment the social and emotional and the cognitive requirements of instruction. Consequently, educators, particularly those who are inexperienced. In various circumstances, educators experience anxiety, stress, self-doubt, and adverse emotions which eventually results in burnout.

MINDFULNESS IN EDUCATIONAL SETTINGS

Mindfulness techniques may contribute to learners' retention or enhancement of knowledge in educational environments. In addition to knowledge retention for examinations, several factors significantly influence overall learning. Numerous research have shown that mindfulness meditation enhances wellness, enhances social connections, interpersonal relationships, reduces stress, and prevents burnout (Bernay, 2014; Hue and Lau, 2015; Kerr et al., 2017). Mindfulness exercises and meditation both help people to cope with the academic and social problems. Recent studies have revealed the efficacy of meditation in educational settings (e.g. Ramsburg & Youmans, 2014). Fiebert and Mead (1981) and Mrazek et al. (2013) both determined that mindfulness had a substantial impact on exam results. Their study demonstrated that students who practiced meditation before they study and before the exams achieved higher results than those who did not meditate. Mrazek et al. (2013) conducted a study which is similar to this one. In his study a group of undergraduates received two weeks of meditation instruction, while a control group had nutrition training. A significant difference in test scores was noted between the two groups on the Graduate Record Examination (GRE). Multiple studies have established a correlation between many types of assessments and contemplative activities (e.g. Goldin et al., 2009). This research indicates that contemplative and mindfulness exercises may boost information retention in educational situations.

Ergas and Hadar (2019) delineated the two key aspects of mindfulness in education: mindfulness in education, which focuses on interventions with tangible measurable impacts on physical and mental health which functions as a framework for educational settings, marked by lifelong learning, and occasional comprehensive school practices. Mindfulness is widely recognized as a skill that can be cultivated and improved to elicit happy emotions.

Gold et al. (2010) found out that an 8-week Mindfulness-Based Stress Reduction (MBSR) training positively influences teachers' self related perceptions such as self-confidence, self-efficacy, problem-solving abilities, and relaxation time, while diminishing anxiety, stress, and depression. Flook et al. (2013) indicate a relationship between mindfulness and its effects on educators. A modified MBSR training designed for teachers demonstrates a substantial impact on reducing psychological symptoms, enhancing classroom management, and fostering self-compassion. Teaching necessitates effective communication, the establishment of relationships with students, the capacity to excite them, and the creation of a pro-social classroom environment (Jennings and Greenberg, 2009). Mindfulness practices in the learning settings enhances teachers' both social and emotional capability, leading to a more harmonious and cohesive environment, improved student relationships (Jennings and Greenberg, 2009; Roeser, 2016). Furthermore, educators employ mindfulness techniques in curriculum development and execution to promote beneficial transformations in the classroom, such as aiding students in focusing their attention and fostering active learning engagement (Napoli, 2004). According to Jennings (2015), mindfulness enables educators to recognize their own emotions and inclinations. Additionally, mindfulness fosters educators' awareness on social issues, facilitating an understanding of how their behavior and emotions influence interactions with students. This awareness aids in the development of supportive and encouraging relationships with students and assists in identifying effective conflict resolution strategies, thereby stimulating students' inherent propensity for enjoyment in learning.

NEED FOR MINDFULNESS IN FOREIGN LANGUAGE CLASSROOMS

In the past decade it appears that exploring the potential of mindfulness techniques to enhance students' language acquisition is a valuable endeavor. Furthermore, comprehending the manifestation of components present in both mindfulness and second language acquisition may assist educators in fostering an environment more favorable to successful learning. To date, the application of mindfulness activities in language learning classrooms remains exceedingly uncommon. In an empirical research, Jenkins (2015) used instructed meditations in English as a second language (ESL) classes comprising students of diverse ethnic backgrounds, with a mean age of 12.5 years. Prior to the initial guided meditation, she elucidated the notion of meditation and its potential advantages.

Mortimore (2017) asserts that mindfulness is also considered to be more efficacious in the first language acquisition, owing to the intricacy of the concepts involved' (p. 40). Mortimore conducted a nine-week study with second and third-year primary school pupils who are native Spanish speakers and are learning English as a second language. At the outset of the study, the students' attitudes towards English and their levels of mindfulness were assessed, while pre-test and post-test language scores evaluated their

linguistic proficiency. The study's findings indicate that implementing mindfulness techniques in elementary classrooms may facilitate a more tranquil environment conducive to language acquisition and attentional skills development. Moreover, the instructor noted a more tranquil classroom environment and heightened student focus on the instructional material following the mindfulness sessions.

The research conducted by Önem (2015) sought to determine the efficacy of meditation in relation to anxiety and vocabulary acquisition. Sixty-one Turkish-speaking students of English were allocated to intervention and control groups to examine English vocabulary acquisition. Both groups underwent an anxiety and vocabulary assessment (pre-testing), followed by identical instruction for each group. The students in the intervention group received guidance for 10 minutes prior to the commencement of instruction. The researcher administered and articulated various meditation instructions, including breath attention, a fantasy excursion to the beach, and a picnic in the park. Post-testing was conducted using the identical anxiety and vocabulary assessments. Despite no differences observed between the groups in the pre-test, the post-test results indicated reduced anxiety levels in the experimental group, which also demonstrated considerably superior performance in the vocabulary test relative to the control group.

Charoensukmongkol (2016) examined the impact of mindfulness on anxiety levels encountered in ESL public speaking. A survey was conducted with marketing students, all of whom are native Thai speakers (L1 = Thai). Students exhibiting elevated awareness while speaking English generally experienced reduced anxiety during their presentations. These students achieved superior results on their presentations compared to those who indicated elevated levels of nervousness. This study's findings indicate that mindfulness has a correlation with reduced ESL public speaking anxiety and improved academic performance.

CONCLUSION

The current literature indicates that while mindfulness has been examined regarding its conceptual definition and its association with emotions, as well as its application among groups such as preservice teachers, early childhood educators, and primary school instructors, there has been limited investigation into the impact of mindfulness on second language acquisition and pedagogy. Examining mindfulness practices within a second language acquisition environment is a pursuit worth undertaking, as it may establish clearer connections to self-regulation in the future.

Laukkonen et al. (2020) examined the scientific basis of mindfulness programs in education and concluded that mindfulness-based interventions (MBIs) diminish stress, regulate mind wandering, enhance present-moment awareness, and increase academic performance. Zenner et al. (2014) and Tan (2021) assert that mindfulness programs enhance students' well-being and bolster their social and emotional stability.

The lockdowns during the pandemic have pretty much thrown a wrench in the smooth flow of learning for all students, with teenagers, in particular, getting caught up and facing obstacles both socially and academically. Teachers from every corner of the globe have seen an increase in student anxiety, those sneaky social media habits, trouble keeping order in class, shorter attention spans, a lack of drive for hitting the books (you know), and a drop in students' general happiness levels. In some respects, using English classes as a tool to make positive social changes is among the goals laid out by CEFR back in 2020. Additionally or so it seems (if I recall correctly), there's this organization called OECD that puts quite a bit of weight on how well students are doing overall when looking at what education should be about moving forward.

Mindfulness often turns out to be one way to boost teenagers' well-being. Moreover, studies indicate that tapping into mindfulness practices tends to enrich EFL learning experiences by encouraging students just like yours truly—uh—to participate more eagerly within classrooms; thus making language-learning processes considerably more fun yet also meaningful.

With all things considered future research might dig deeper into other SEL programs rolled out inside EFL classrooms since these environments give both teachers and their pupils not only opportunities but sometimes windows open wide towards gaining useful skills.

REFERENCES

- Albrecht, N. J., Albrecht, P., & Cohen, M. (2012). Mindfully Teaching in the Classroom: a Literature Review. *Australian Journal of Teacher Education*, 37(12). <https://doi.org/10.14221/ajte.2012v37n12.2>
- Baer, R. A., Carmody, J., & Hunsinger, M. (2012). Weekly change in mindfulness and perceived stress in a mindfulness-based stress reduction program. *Journal of Clinical Psychology*, 68(7), 755-765.
- Bernay, R. S. (2014). Mindfulness and the beginning teacher. *Australian Journal of Teacher Education* 39(7), 58-69.
- Bishop, S. R., Lau, M., Shapiro, S., Carlson, L., Anderson, N. D., Carmody, J., Segal, Z. V., Abbey, S., Speca, M., Velting, D., & Devins, G. (2004). Mindfulness: A proposed operational definition. *Clinical Psychology: Science and Practice*, 11(3), 230-241. <https://doi.org/10.1093/clipsy.bph077>
- Birch, B. M., & Fulop, S. (2021). *English L2 reading: Getting to the bottom*. Fourth Edition, Routledge.
- Bodhi, B. (2000). *The connected discourses of the Buddha: A translation of the Samyutta Nakaya*. Boston, MA: Wisdom.
- Brown, K.W., & Ryan, R.M (2003). The benefits of being present: Mindfulness and its role in psychological well-being. *Journal of Personality and Social Psychology*, 84, 822–848.
- Chapman-Clarke, M. A. (2016). *Mindfulness in the workplace: An evidence-based approach to improving wellbeing and maximizing performance*. Kogan Page Limited.
<https://doi.org/10.15405/epes.23056.1> Corresponding Author: Sharon Fayerberger
Selection and peer-review under responsibility of the Organizing Committee of the conference eISSN: 2672-815X
- Chadwick, P., Hember, M., Symes, J., Peters, E., Kuipers, E., & Dagnan, D. (2008). Responding mindfully to unpleasant thoughts and images: Reliability and validity of the Southampton Mindfulness Questionnaire (SMQ). *British Journal of Clinical Psychology*, 47, 451–455.
- Council of Europe. (2020). *Common European Framework of Reference for Languages: Learning, teaching, assessment – Companion volume*. Council of Europe Publishing. www.coe.int/lang-cefr
- Council of Europe. Council for Cultural Co-operation. Education Committee. Modern Languages Division. (2001). *Common European framework of reference for languages: Learning, teaching, assessment*. Cambridge University Press.
- Dimidjian, S., & Linehan, M.M. (2003). Defining an agenda for future research on the clinical application of mindfulness practice. *Clinical Psychology: Science and Practice*, 10, 166–171.
- Ergas, O. (2019). Mindfulness in, as and of education: Three roles of mindfulness in education. *Journal of Philosophy of Education*, 53(2), 340-358. <https://doi.org/10.1111/1467-9752.12349>
- Ergas, O., and Hadar, L. L. (2019). Mindfulness in and as education: a map of a developing academic discourse from 2002 to 2017. *Rev. Educ.* 7, 757–797. doi: 10.1002/rev3.3169
- Ergas, O. (2021). *Mindfulness and the Quiet Revolution in Education*. Resling Publishing. Israel.
- Fallah, N. (2016). Mindfulness, coping self-efficacy and foreign language anxiety: a mediation Analysis. *Educational Psychology*, 37(6), 745-756. <http://doi.org/10.1080/01443410.2016.1149549>
- Fiebert, M., & Mead, T. (1981). Meditation and academic performance. *Perceptual And Motor Skills*, 53, 447–450.
- Flook, L., Goldberg, S. B., Pinger, L., Bonus, K., & Davidson, R. J. (2013). Mindfulness for teachers: A pilot study to assess effects on stress, burnout, and teaching efficacy. *Mind, Brain and Education* 7(3), 182-195.
- Gold, E., Smith, A., Hopper, I., Herne, D., Tansey, G., and Hulland, C. (2010). Mindfulness based stress reduction (MBSR) for primary school teachers. *J. Child. Fam. Stud.* 19, 184–189. doi: 10.1007/s10826-009-9344-0
- Goldin, P., Ramel, W., & Gross, J.J. (2009). Mindfulness meditation training and self-referential processing in social anxiety disorder: Behavioral and neural effects. *Journal of Cognitive Psychotherapy*, 23, 242–257.
- Jenkins, A. (2015). Guided meditation in the English language classroom. In *English teaching forum* (Vol. 53, No. 1, pp. 35-38).
- Jennings, P. A. (2015). *Mindfulness for Teachers: Simple Skills for Peace and Productivity in the Classroom*. New York, NY: W. W. Norton.

- Jennings, P. A., and Greenberg, M. T. (2009). The prosocial classroom: teacher social and emotional competence in relation to student and classroom outcomes. *Rev. Educ. Res.* 79, 491–525. doi: 10.3102/0034654308325693
- Kabat-Zinn, J. (1990). *Full catastrophe living: Using the wisdom of your mind and body to face stress, pain, and illness*. New York: Delacorte.
- Kerr, L. et al. (2017). Is mindfulness training useful for pre-service teachers? An exploratory investigation. *Teaching Education*, 28(4), 349-359.
- Laukkonen, R., Leggett, J. M. I., Gallagher, R., Biddell, H., Mrazek, A., Slagter, H. A., & Mrazek, M. (2020). *The Science of Mindfulness-Based Interventions and Learning: A Review for Educators*.
- Leary, M.R., Tate, E.B., Adams, C.E., Allen, A.B., & Hancock, J. (2007). Self-compassion and reactions to unpleasant self-relevant events: The implications of treating oneself kindly. *Journal of Personality and Social Psychology*, 92, 887–904
- Ming-tak Hue & Ngar-sze Lau. (2015). Prompting well-being and preventing burnout in teacher education: a pilot study of a mindfulness-based programme for pre-service teachers in Hong Kong. *Teacher Development*, 19(3), 381-401. <http://doi.org/10.1080/13664530.2015.1049748>
- Mortimore, L. (2017). Mindfulness and foreign language anxiety in the bilingual primary classroom. *Educación y Futuro*, 37, 15–43.
- Mrazek, M.D., Franklin, M.S., Phillips, D.T., Baird, B., & Schooler, J.W. (2013). Mindfulness training improves working memory capacity and GRE performance while reducing mind wandering. *Psychological Science*, 24, 776–781.
- Napoli, M. (2004). Mindfulness training for teachers: a pilot program. *Comple. Health. Prac. Rev.* 9, 31–42. doi: 10.1177/1076167503253435
- Organisation for Economic Co-operation and Development. (OECD) (2018). *The future of education and skills: Education 2030*. OECD Education Working Papers.
- Önem, E. (2015). A study on the effects of meditation on anxiety and foreign language vocabulary learning. *Journal of Language and Literature Education*, 15, 134–148.
- Ramsburg, J.T., & Youmans, R.J. (2014). Meditation in the higher-education classroom: Meditation training improves student knowledge retention during lectures. *Mindfulness*, 5, 431–431.
- Renshaw, T. L., Fischer, A. J., & Klingbeil, D. A. (2017). Mindfulness-based intervention in school psychology. *Contemporary school psychology*, 21(4), 299-303. <https://doi.org/10.1007/s40688-017-0166-6>
- Shapiro, S. L., and Carlson, L. E. (2009). *The Art and Science of Mindfulness: Integrating Mindfulness into Psychology and the Helping Professions*. Washington, DC: American Psychological Association.
- Shapiro, S. L., Carlson, L. E., Astin, J. A., and Freedman, B. (2006). Mechanisms of mindfulness. *J. Clin. Psychol.* 62, 373–386.
- Schaufenbuel, K. (2014). *Bringing mindfulness to the workplace*. UNC Kenan-Flagler Business School, 1, 13.
- Schmidt, S. (2011). Mindfulness in East and West – Is It the Same?. In: H. Walach, S. Schmidt, & W. Jonas (Eds.), *Neuroscience, Consciousness and Spirituality*. Studies in Neuroscience, Consciousness and Spirituality, vol 1. Springer, Dordrecht.
- Tan, C. (2021). Mindful education for a post-pandemic world. In *Mindful education* (pp. 179-197). Springer, Singapore.
- Zenner, C., Herrnleben-Kurz, S., & Walach, H. (2014). Mindfulness-based interventions in schools—a systematic review and meta-analysis. *Frontiers in psychology*, 5, 603. <https://doi.org/10.3389/fpsyg.2014.00603>
- Zhao Y. (2023). On the relationship between second language learners' grit, hope, and foreign language enjoyment. *Heliyon*, 9(3), <https://doi.org/10.1016/j.heliyon.2023.e13887>

MIMO-FBMC/OQAM SİSTEMİ İÇİN BİYO-İLHAMLI SEMBOL ALGILAMA YAKLAŞIMI BIO-INSPIRED SYMBOL DETECTION APPROACH FOR MIMO-FBMC/OQAM SYSTEM

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Özet

Filtre bankası çoklu taşıyıcı/ofset dördün genlik modülasyonu (FBMC/OQAM), beşinci nesil (5G) ve ötesi kablosuz sistemlerde sorunsuz bir iletişim sağlamak amacıyla geliştirilen en yenilikçi iletişim şemaları arasında yer almaktadır. Çoklu anten yapısı kullanılmadığında bile zaten üstün avantajlara sahip olan FBMC/OQAM şemasında, çoklu anten üzerinden veri iletimi gerçekleştirilerek çoklu-giriş çoklu-çıkış (MIMO) tekniğinden yararlanılması, mevcut avantajlara yenilerini eklemektedir. FBMC/OQAM sistemi MIMO teknolojisi ile birleştirilince, hem kablosuz kanalların sönmüleme etkilerine karşı direnç hem de daha yüksek veri oranlarında iletişim kabiliyeti kazanmaktadır. MIMO-FBMC/OQAM sisteminin bütün bu gelişmiş özellikleri, ancak alıcı tarafında etkin bir sembol dedektörü kullanıldığında anlam kazanabilmektedir. Klasik maksimum olasılık (ML) dedektörü kullanılması durumunda, en yüksek sembol algılama performansı elde edilmesine rağmen, en uygun sembol dizisini bulmak için tüm olası sembol kombinasyonlarının test edildiği kapsamlı arama metodu ile sonuca gidilmesinden dolayı, sistem karmaşıklığı inanılmaz seviyelere ulaşmaktadır. Diğer taraftan, ideal bir sembol dedektöründen, hesaplama karmaşıklığını önemli ölçüde artırmadan sembol dizilerini doğru bir şekilde elde etmesi beklenmektedir. Bu çalışmada, genetik algoritmanın (GA) etkin optimizasyon yeteneğinden faydalanarak minimum hesaplama maliyetiyle optimuma yakın bir sembol algılama performansının elde edilmesi hedeflenmektedir. Bu amaçla GA, sembol optimizatörü olarak kullanılmak üzere geleneksel ML dedektörüne entegre edilmiştir. Böylelikle, MIMO-FBMC/OQAM sistemi için, GA-ML adı verilen biyo-ilhamlı bir sembol algılama stratejisi geliştirilmiştir. ML dedektörünün karmaşıklığını, herhangi bir sistemde pratik olarak kullanılamayacak derecede yüksek hale getiren kapsamlı arama prosedürü yerine, GA tabanlı sembol optimizasyonu kullanımı sayesinde, klasik ML performansına çok daha düşük hesaplama karmaşıklığı ile yaklaşmak mümkün hale gelmiştir.

Anahtar kelimeler: Maksimum olasılık, FBMC/OQAM, sembol algılama, MIMO, genetik algoritma.

Abstract

Filter bank multicarrier/offset quadrature amplitude modulation (FBMC/OQAM) is among the most innovative transmission schemes developed for the purpose of ensuring smooth communication in the fifth generation (5G) and beyond wireless systems. Benefiting from multi-input multi-output (MIMO) technic by performing the data transmission over multiple antennas in the FBMC/OQAM scheme, which already has outstanding advantages even without the usage of multi-antenna structure, adds further advantages to the existing ones. Combined with MIMO technology, FBMC/OQAM gains both the resistance to the fading effects of the wireless channels and capability of communicating at higher data rates. All these advanced attributes of the MIMO-FBMC/OQAM system can only be meaningful with the usage of efficient symbol detector at the receiver side. In case of using the classical maximum likelihood (ML) detector, even though the highest symbol detection performance is achieved, the system complexity reaches to incredible levels because of getting the result via an exhaustive searching method, by which all of the possible symbol combinations are tested to find the optimal symbol sequence. On the other hand, it is expected from an ideal symbol detector to accurately recover the symbol sequences without significantly increasing the computational complexity. In this study, it is aimed to attain near optimal symbol detection performance with minimal computational cost by benefiting from the efficient optimization capability of the genetic algorithm (GA). To this end, the GA has been integrated to the conventional ML detector for being employed as a symbol optimizer.

By doing so, a bio-inspired symbol detecting strategy called GA-ML has been developed for the MIMO-FBMC/OQAM scheme. Thanks to the usage of GA-based symbol optimization instead of the exhaustive searching procedure that makes the complexity of ML detector too high to be practically employed in any system, it becomes possible to approach the classical ML performance with considerably smaller computational complexity.

Keywords: Maximum likelihood, FBMC/OQAM, symbol detection, MIMO, genetic algorithm.

1. GİRİŞ

Son otuz yılda kablosuz iletişim teknolojisinde muazzam bir gelişim kaydedilmiştir. Birinci nesil (1G) sistemler sadece analog formda ses iletişimini destekleyebilirken, dördüncü nesil (4G) kablosuz haberleşme teknolojisi ile birlikte akıllı evler, video konferans, e-sağlık hizmetleri, afet yönetimi vb. gibi çok sayıda mobil internet tabanlı hizmetten faydalanmak mümkün hale gelmiştir. Bununla birlikte, kablosuz haberleşme alanında hızla artan yeni gereksinimler nedeniyle, beşinci nesil (5G) ve ötesi iletişim teknolojilerinden çok daha fazlası beklenmektedir. Makine tipi iletişim (MTC) ve nesnelere interneti (IoT) gibi teknolojilerin de hayatımıza girmesi ile birlikte, yeni nesil haberleşme sistemlerinin sadece insanlar arası değil, makineler ve hatta nesnelere arası iletişimi de desteklemesi beklenmektedir. Bu nedenle, gelecekteki kablosuz sistemlerin çok daha yüksek veri hızı ve daha düşük gecikme süresi ile iletişim sağlayarak daha iyi hizmet kalitesi sunması gerekecektir (Rinaldi vd., 2021; Lien vd., 2017; Agiwal vd., 2016; Rajoria ve Mishra, 2022).

Filtre bankası çoklu taşıyıcı/ofset dördün genlik modülasyonu (FBMC/OQAM) (Farhang-Boroujeny, 2014; Nissel vd., 2017b), mobil iletişimde karşılaşılan çeşitli zorluklarla başa çıkmayı kolay hale getiren gelişmiş özelliklerinden dolayı, son yıllarda araştırmacılar tarafından büyük ilgi görmektedir. FBMC/OQAM, sahip olduğu önemli potansiyel göz önünde bulundurularak, gelecekteki kablosuz sistemlerde kullanılmaya aday dalga formları arasında gösterilmiştir (Zhang vd., 2016). FBMC/OQAM'in mevcut potansiyeli, çoklu-giriş çoklu-çıkış (MIMO) (Zakaria ve Le Ruyet, 2010; Nissel vd., 2017a) olarak isimlendirilen çoklu anten teknolojisi kullanılarak daha da artırılabilir. Alıcı ve vericisinde MIMO teknolojisinin kullanımı, FBMC/OQAM sisteminin sönümlü kanalın bozucu etkilerine karşı daha az duyarlı olmasını sağlamaktadır. Bunun yanı sıra, daha yüksek veri oranlarında bilgi iletimi mümkün hale gelmektedir.

Diğer taraftan, bilgi verilerinin minimum hata ile tutarlı bir şekilde elde edilmesi, MIMO-FBMC/OQAM sisteminin alıcı tarafında güçlü bir sembol dedektörünün kullanılmasına bağlıdır. Maksimum olasılık (ML) (Zhu ve Murch, 2002) dedektörü kullanılarak sembol vektörlerinin alıcıda kusursuz bir şekilde algılanması mümkündür. Ancak, alınan sinyale minimum Öklid mesafesinde olan optimum sembol vektörünü bulmak için, iletme olasılığı bulunan bütün sembol kombinasyonlarının test edildiği kapsamlı arama prosedürünün kullanılması, ML dedektörünü literatürdeki mevcut sembol algılama stratejileri arasında en yüksek karmaşıklığa sahip yöntem haline getirmektedir. ML dedektörünün aksine, sıfır zorlama (ZF) (Spencer vd., 2004) olarak adlandırılan oldukça basit ve uygulaması kolay bir sembol algılama yöntemi kullanılarak, sembol vektörleri oldukça düşük bir hesaplama maliyeti ile tespit edilebilmektedir. Ancak bu sefer de ZF dedektörünün en büyük dezavantajı olan zayıf sembol algılama performansına razı olmak gerekecektir.

MIMO-FBMC/OQAM sisteminde yüksek performanslı ancak aynı zamanda da düşük karmaşıklık bir sembol algılayıcısına olan ihtiyaç göz önünde bulundurularak, genetik algoritma (GA) (Goldberg, 1989; Goldberg ve Deb, 1991) tabanlı bir ML stratejisi (GA-ML) önerilmiştir. Söz konusu sembol algılama stratejisinde, optimum sembol vektörünü bulmak için arama uzayındaki her bir potansiyel sembol dizisini test etmek yerine, sembol vektörleri üzerinde genetik algoritmaya dayalı bir optimizasyon işlemi gerçekleştirilmektedir. Böylelikle, önerilen GA-ML stratejisi kullanılarak klasik ML yöntemine kıyasla çok daha düşük hesaplama karmaşıklığı ile optimum çözüme yakınsamak mümkün hale gelmektedir. Bu çalışmada MIMO-FBMC/OQAM sistemi için önerilen GA-ML dedektörü, bit hata oranı (BER) başarımı bakımından hem ZF hem de ML yöntemi ile karşılaştırılmış olup, söz konusu sistemdeki sembol algılama performansı test edilmiştir.

Literatürde, farklı iletim teknolojilerinde metasezgisel yaklaşımların kullanılarak sembol algılama probleminin ele alındığı bazı çalışmalara rastlamak mümkündür: Khan vd. (2008) tarafından yapılan çalışmada, MIMO haberleşme sistemleri için düşük karmaşıklığa sahip birkaç modifiye edilmiş ML dedektörü geliştirmek amacıyla, ikili ve orijinal parçacık sürü optimizasyonu (PSO) varyantı kullanılmıştır. Mandloi ve Bhatia (2016) tarafından yapılan çalışmada, karınca koloni optimizasyon

(ACO) ve PSO algoritmaları hibritleştirilmiştir. Daha sonra, elde edilen hibrit algoritma geniş MIMO sistemlerinde sembol tespiti amacıyla kullanılmıştır. Seyman ve Taşpınar (2013) tarafından yapılan çalışmada yazarlar, MIMO-dikgen frekans bölmeli çoğullama (MIMO-OFDM) alıcısında sembol vektörlerinin optimizasyonu için farksal gelişim (DE) algoritmasından yararlanmışlardır. Li vd. (2016) tarafından yapılan çalışmada, masif MIMO alıcısındaki sembol vektörleri, başlangıç çözümleri doğrusal sembol dedektörü çıkışından alınan yapay arı kolonisi (ABC) algoritması tarafından optimize edilmiştir. Seyman (2022) tarafından yapılan çalışmada, ML yönteminin aşırı karmaşıklığı geri-izleme arama algoritması (BSA) vasıtasıyla düşürüldükten sonra, elde edilen düşük karmaşık sembol dedektörü MIMO anten yapısına sahip dikgen olmayan çoklu erişim (NOMA) sistemine uygulanmıştır.

2. MIMO-FBMC/OQAM İLETİŞİM TEKNOLOJİSİNİN ÇALIŞMA İLKESİ

Bu bölümde, MIMO-FBMC/OQAM sistemine ait sinyal iletim ve alım prosedürü basit bir şekilde açıklanmıştır (Zakaria ve Le Ruyet, 2010). Gerçek değerli $\sigma_{k,l}$ sembolünün sadece tek bir anten kullanılarak gönderilmesi durumunda, FBMC/OQAM alıcısındaki demodüle edilmiş sinyal aşağıdaki gibi olmaktadır:

$$y_{k,l} \approx h_{k,l} \cdot (\sigma_{k,l} + j \cdot \xi_{k,l}) + \omega_{k,l} \quad (1)$$

Burada $h_{k,l}$, $\omega_{k,l}$ ve $\xi_{k,l}$ sırasıyla kanal katsayıları, gürültü ve içsel girişimi ifade etmektedir. FBMC/OQAM sisteminde MIMO iletimi için N_R adet alıcı ve N_T adet verici anten kullanacak olursak, demodüle edilmiş sinyali aşağıdaki gibi tanımlayabiliriz:

$$y_{k,l}^{(j)} = \sum_{i=1}^{N_T} h_{k,l}^{(ji)} \cdot (\sigma_{k,l}^{(i)} + j \cdot \xi_{k,l}^{(i)}) + \omega_{k,l}^{(j)} \quad (2)$$

Burada alıcı ve verici anten indisleri sırasıyla j ve i ile gösterilmektedir. Denklem (2)'yi aşağıda gösterildiği gibi matris formunda ifade etmek mümkündür:

$$\begin{bmatrix} y_{k,l}^{(1)} \\ \vdots \\ y_{k,l}^{(N_R)} \end{bmatrix} = \begin{bmatrix} h_{k,l}^{(11)} & \cdots & h_{k,l}^{(1N_T)} \\ \vdots & \ddots & \vdots \\ h_{k,l}^{(N_R1)} & \cdots & h_{k,l}^{(N_R N_T)} \end{bmatrix} \begin{bmatrix} \sigma_{k,l}^{(1)} + j \cdot \xi_{k,l}^{(1)} \\ \vdots \\ \sigma_{k,l}^{(N_T)} + j \cdot \xi_{k,l}^{(N_T)} \end{bmatrix} + \begin{bmatrix} \omega_{k,l}^{(1)} \\ \vdots \\ \omega_{k,l}^{(N_R)} \end{bmatrix} \quad (3)$$

$$\mathbf{y}_{k,l} = \mathbf{H}_{k,l} \cdot (\boldsymbol{\sigma}_{k,l} + j \cdot \boldsymbol{\xi}_{k,l}) + \boldsymbol{\omega}_{k,l} \quad (4)$$

Burada $N_R \times N_T$ boyutlu $\mathbf{H}_{k,l}$ matrisi, kanal katsayılarını temsil etmektedir.

3. PROBLEMİ TANIMLAMA

3.1. Matris Gösterimli FBMC/OQAM

FBMC/OQAM sistemini matris formatında ifade ederek ilgili sistemdeki sembol algılama problemini daha sade ve anlaşılır hale getirmek mümkündür (Nissel vd., 2017a). Aşağıda tanımlanan $\mathbf{T} \in \mathbb{R}^{D \times KL}$ iletim matrisi, prototip filtrenin matris tabanlı gösterimini temsil etmektedir:

$$\mathbf{T} = [\mathbf{t}_{1,1} \ \mathbf{t}_{2,1} \ \cdots \ \mathbf{t}_{K,1} \ \mathbf{t}_{1,2} \ \cdots \ \mathbf{t}_{K,L}] \quad (5)$$

Burada her biri D adet zaman örneği içeren ve $\mathbf{t}_{k,l} \in \mathbb{R}^{D \times 1}$ şeklinde ifade edilen iletim vektörleri, $\mathbf{T} \in \mathbb{R}^{D \times KL}$ iletim matrisini oluşturmaktadır. K ve L 'nin sırasıyla toplam alt taşıyıcı ve toplam sembol sayılarına karşılık geldiğine dikkat edilmelidir. Gerçek değerli semboller de aşağıda gösterildiği gibi matris formatında tanımlanabilmektedir:

$$\boldsymbol{\sigma} = \text{vec} \left\{ \begin{bmatrix} \sigma_{1,1} & \cdots & \sigma_{1,L} \\ \vdots & \ddots & \vdots \\ \sigma_{K,1} & \cdots & \sigma_{K,L} \end{bmatrix} \right\} = [\sigma_{1,1} \ \sigma_{2,1} \ \cdots \ \sigma_{K,1} \ \sigma_{1,2} \ \cdots \ \sigma_{K,L}]^T \quad (6)$$

$\mathbf{s} \in \mathbb{R}^{D \times 1}$ iletim sinyalini elde edebilmek için, $\boldsymbol{\sigma} \in \mathbb{R}^{KL \times 1}$ sembol vektörü aşağıdaki gibi $\mathbf{T} \in \mathbb{R}^{D \times KL}$ iletim matrisi ile çarpılır:

$$\mathbf{s} = \mathbf{T} \boldsymbol{\sigma} \quad (7)$$

Çok yollu kanalın $\mathbf{H} \in \mathbb{R}^{D \times D}$ konvolüsyon matrisi ile temsil edilmesi durumunda, alıcıya gelen sinyal $\mathbf{r} \in \mathbb{R}^{D \times 1}$ aşağıdaki gibi tanımlanır:

$$\mathbf{r} = \mathbf{H}\mathbf{s} + \boldsymbol{\omega} = \mathbf{H}\mathbf{T}\boldsymbol{\sigma} + \boldsymbol{\omega} \quad (8)$$

Burada $\boldsymbol{\omega}$, Gauss gürültüsünü belirtmektedir. Son olarak, alınan semboller aşağıdaki formül vasıtasıyla elde edilir:

$$\mathbf{y} = \mathbf{T}^H \mathbf{r} = \mathbf{T}^H \mathbf{H} \mathbf{T} \boldsymbol{\sigma} + \mathbf{T}^H \boldsymbol{\omega} \quad (9)$$

3.2. FBMC/OQAM Sistemi için Blok Frekans Yayılım Yaklaşımı

FBMC/OQAM için Nissel vd. (2017a) tarafından yapılan çalışmada önerilen blok frekans yayılım stratejisi, MIMO-FBMC/OQAM sistemindeki dikgenlik kısıtını ortadan kaldırarak söz konusu sisteme MIMO algılama tekniklerinin direkt olarak uygulanabilmesine olanak sağlamaktadır. Bu nedenle, bu çalışmada blok frekans yayılım yaklaşımına dayanan FBMC/OQAM sistemi kullanılmıştır. Bu

yaklaşımına göre, $\mathbf{x} \in \mathbb{C}^{\frac{KL}{2} \times 1}$ QAM sembol vektörünü yaymak için, $\mathbf{Z} \in \mathbb{C}^{KL \times \frac{KL}{2}}$ şeklinde belirtilen bir ön kodlama matrisi kullanılmaktadır. İlgili sembol vektörünü yayma işlemi, aşağıda gösterildiği gibi $\boldsymbol{\sigma} \in \mathbb{C}^{KL \times 1}$ gerçekte değerli sembollerin üretilmesine yol açmaktadır:

$$\boldsymbol{\sigma} = \mathbf{Z}\mathbf{x} \quad (10)$$

Alınan semboller ise, ön kodlama matrisinin Hermit transpozunu kullanılarak aşağıdaki gibi ters yayma işlemine tabi tutulmaktadır:

$$\hat{\mathbf{y}} = \mathbf{Z}^H \mathbf{y} \quad (11)$$

Denklem (11)'i aşağıda gösterildiği gibi genişletmek mümkündür:

$$\hat{\mathbf{y}} = \mathbf{Z}^H \mathbf{T}^H \mathbf{H} \mathbf{T} \mathbf{Z} \mathbf{x} + \mathbf{Z}^H \mathbf{T}^H \boldsymbol{\omega} \quad (12)$$

3.3. Sembol Algılama Probleminin MIMO-FBMC/OQAM Sistemi için Formüle Edilmesi

$\mathbf{x} \in \mathbb{C}^{\frac{KL}{2} \times 1}$ sembol matrisinde bulunan QAM sembollerinin $N_T \times N_R$ MIMO yapısı kullanılarak iletilmesi durumunda, ilgili matrisin her bir bileşeni $x_{k,l} = [x_{k,l}^{(1)}, x_{k,l}^{(2)}, \dots, x_{k,l}^{(N_T)}]^T$ şeklinde ifade edilen N_T uzunluklu bir sembol vektörüne dönüşmektedir. Benzer şekilde, MIMO-FBMC/OQAM alıcısında N_R sayıda anten tarafından alınan sembol vektörü, $\hat{y}_{k,l} = [\hat{y}_{k,l}^{(1)}, \hat{y}_{k,l}^{(2)}, \dots, \hat{y}_{k,l}^{(N_R)}]^T$ şeklinde tanımlanmaktadır. Bu çalışmada Q ile sembolize edilen QAM modülasyon seviyesi, $x_{k,l}$ dizisi içerisinde yer alan her bir QAM sembolünün kaç adet karmaşık değer alabileceğini belirlemektedir. Buna göre, $x_{k,l}$ dizisinin her bir bileşeni Q farklı değer alma olasılığına sahip olduğundan dolayı, vericide üretilme ihtimali bulunan alternatif sembol dizilerinin toplam sayısı Q^{N_T} değerine eşit olacaktır. Geleneksel ML dedektörü, söz konusu Q^{N_T} adet alternatif sembol dizisi arasından en yüksek iletilme olasılığına sahip olanı bulmak için aşağıdaki denklemi kullanmaktadır:

$$x_{k,l}^* = \arg \min_{x_{k,l}} \left\{ \left\| \hat{y}_{k,l} - \hat{H}_{k,l} \cdot x_{k,l} \right\|^2 \right\} \quad (13)$$

ML stratejisinde, Q^{N_T} farklı $x_{k,l}$ dizisi, kestirilmiş kanal katsayıları ile tek tek çarpılır. Ardından elde edilen vektörler, Öklid mesafelerini hesaplamak için alınan sembol vektörü $\hat{y}_{k,l}$ 'den çıkarılır. Son olarak, minimum Öklid mesafesini veren $x_{k,l}$ dizisi, optimum sembol dizisi olarak belirlenir. Kestirilmiş kanal katsayıları aşağıdaki gibi tanımlanabilir (Wang vd., 2007):

$$\hat{H}_{k,l} = H_{k,l} + \lambda \cdot \Omega \quad (14)$$

Burada Ω ve λ , sırasıyla karmaşık Gauss değişkeni ve kestirim hatası oranıdır.

4. GENETİK ALGORİTMAYA DAYALI ML STRATEJİSİ

Genetik algoritma, başlangıçta ikili optimizasyon problemleri için tasarlanmıştır (Goldberg, 1989; Goldberg ve Deb, 1991). $x_{k,l} = [x_{k,l}^{(1)}, x_{k,l}^{(2)}, \dots, x_{k,l}^{(N_T)}]^T$ şeklinde tanımlanan sembol dizilerinin karmaşık değerli QAM sembollerinden oluşması sebebiyle, söz konusu sembol dizilerini optimize etmek için genetik algoritma ML dedektörüne doğrudan uygulanamamaktadır. Bu nedenle, sembol optimizasyon problemini genetik algoritma tarafından direkt olarak ikili araştırma uzayında çözülmeye uygun hale getirmek için, $x_{k,l}$ dizilerinin ikili formları kullanılmıştır. GA-ML stratejisinde, karmaşık QAM sembol dizileri ve bu dizilerin ikili formlardaki karşılıkları, sırasıyla Denklem (15) ve Denklem (16)'da ifade edildiği gibi kromozomlar ile temsil edilmektedir:

$$x_m^{(i)} = [x_m^{(1)}, x_m^{(2)}, \dots, x_m^{(N_T)}] \quad , \quad m = 1, 2, \dots, M \quad (15)$$

$$b_m^{(j)} = [b_m^{(1)}, b_m^{(2)}, \dots, b_m^{(v \cdot N_T)}] \quad , \quad m = 1, 2, \dots, M \quad (16)$$

Burada $x_m^{(i)}$ vektöründeki her bir karmaşık QAM sembolü $\log_2^Q = v$ basamaklı ikili sayıya karşılık geldiğinden dolayı, ikili $b_m^{(j)}$ vektörünün uzunluğu $v \cdot N_T$ değerine eşit olmaktadır. Yukarıdaki denklemlerde m kromozom indeksini belirtirken, M toplam kromozom sayısını ifade etmektedir. GA-ML stratejisinin ayrıntılı açıklaması aşağıda adım adım verilmiştir:

Adım 1: Başlangıç popülasyonunu oluşturmak amacıyla, ikili formda M adet rastgele sembol dizisi üretilir. Sırasıyla Cr ve Mr ile temsil edilen çaprazlama oranı ve mutasyon oranı değerleri belirlenir.

Adım 2: $b_m^{(j)}$ şeklinde ifade edilen ikili formdaki popülasyon üyelerinin uygunluk değerleri, $x_m^{(i)}$ ile sembolize edilen karmaşık eşdeğerleri kullanılarak aşağıdaki gibi hesaplanır:

$$f_m = \text{fit}(x_m^{(i)}) = \left\| \hat{y}_{k,l} - \hat{H}_{k,l} \cdot x_m^{(i)} \right\|^2 \quad , \quad m = 1, 2, \dots, M \quad ; \quad i = 1, 2, \dots, N_T \quad (17)$$

Buradaki f_m ifadesi, m . kromozomun uygunluk değerine karşılık gelmektedir.

Adım 3: Aşağıdaki işlemler uygulanarak yeni popülasyon üretilir:

3.1. Ebeveyn ismi verilen iki adet popülasyon üyesi turnuva yöntemi (Goldberg ve Deb, 1991) kullanılarak seçilir. Bu yöntemde göre, öncelikle popülasyon içerisinde rastgele iki adet kromozom seçilir. Ardından bu kromozomlardan hangisinin uygunluk değeri daha iyi ise, ilgili kromozom 1. Ebeveyn olarak belirlenir. 2. Ebeveyn de aynı yolla belirlenerek seçim işlemi tamamlanır. 1. ve 2. Ebeveyn kromozomları sırasıyla aşağıdaki gibi tanımlanabilir:

$$b_{E1}^{(j)} = [b_{E1}^{(1)}, b_{E1}^{(2)}, \dots, b_{E1}^{(v \cdot N_T)}] \quad (18)$$

$$b_{E2}^{(j)} = [b_{E2}^{(1)}, b_{E2}^{(2)}, \dots, b_{E2}^{(v \cdot N_T)}] \quad (19)$$

(19)

3.2. $r_1 \in [0,1]$ olacak şekilde rastgele bir sayı üretilir.

3.3. Eğer $r_1 < Cr$ ise;

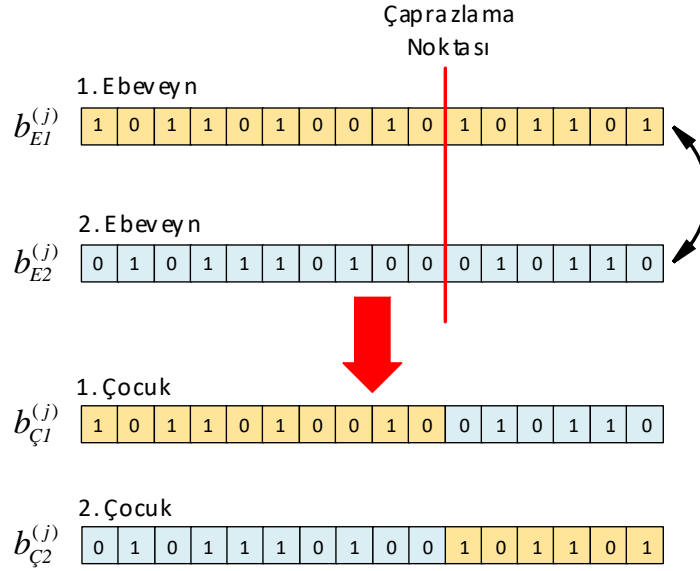
- Seçilmiş olan ebeveyn kromozomlarına tek noktalı çaprazlama işlemi uygulanır. Tek noktalı çaprazlama işlemi şu şekilde gerçekleştirilmektedir: Öncelikle ebeveyn kromozomları için $[1, v \cdot N_T]$ aralığında rastgele bir boyut numarası belirlenir. Sonrasında ilgili kromozomların belirlenen boyut numarasının ötesinde kalan parçaları yer değiştirilerek aşağıdaki gibi tanımlanan iki adet çocuk kromozom oluşturulur.

$$b_{C1}^{(j)} = [b_{C1}^{(1)}, b_{C1}^{(2)}, \dots, b_{C1}^{(v \cdot N_T)}] \quad (20)$$

(20)

$$b_{C2}^{(j)} = [b_{C2}^{(1)}, b_{C2}^{(2)}, \dots, b_{C2}^{(v \cdot N_T)}] \quad (21)$$

(21)



Şekil 1. Çaprazlama İşlemi.

Şekil 1'de $v \cdot N_T = 16$ için tek noktalı çaprazlama işleminin nasıl gerçekleştirildiği görsel olarak anlatılmıştır:

- Tek noktalı çaprazlama sonucu üretilen iki adet çocuk birey, yeni popülasyona aktarılır.

3.4. Eğer $r_1 \geq Cr$ ise;

- Seçilmiş olan iki adet Ebeveyn kromozom, çaprazlama işlemine tabi tutulmadan direkt olarak yeni popülasyona aktarılır.

Adım 4: Adım 3'te gerçekleştirilen işlemler, yeni popülasyon toplam M adet üyeye ulaşıncaya kadar tekrarlanır.

Adım 5: Yeni popülasyon üyelerinin her bir boyutu için $r_2 \in [0,1]$ olacak şekilde rastgele bir sayı üretilir.

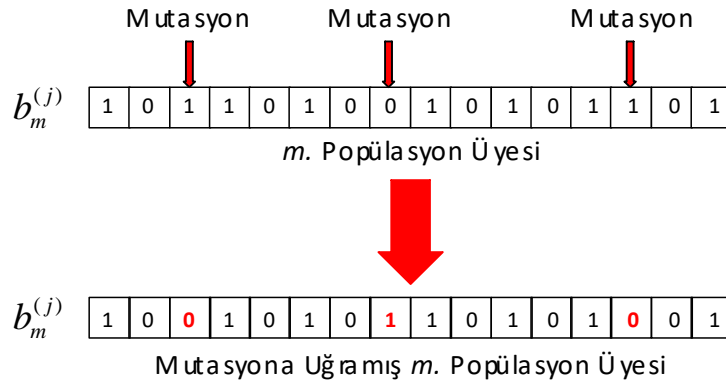
5.1. Eğer $r_2 < Mr$ ise;

- İlgili vektör boyutu (kromozom geni) mutasyona uğratarak 0 ise 1, 1 ise 0 yapılır.

5.2. Eğer $r_2 \geq Mr$ ise;

- İlgili vektör boyutunda herhangi bir değişiklik yapılmaz.

Aşağıda $v \cdot N_T = 16$ için herhangi bir popülasyon üyesi üzerinde mutasyon işleminin nasıl gerçekleştirildiği görsel olarak anlatılmıştır:



Şekil 2. Mutasyon işlemi.

Adım 6: Adım 2'den devam edilerek bir sonraki iterasyona geçilir.

Adım 7: Tek bir iterasyona karşılık gelen Adım 2 – Adım 6 arasındaki işlemler maksimum iterasyon sayısına (\hat{J}_{maks}) ulaşıncaya kadar tekrarlanır.

Adım 8: Durdurma kriterinin sağlanması ardından, mevcut popülasyondaki en iyi uygunluk değerine sahip olan çözüm, optimum sembol vektörü olarak belirlenir.

5. SİMÜLASYON SONUÇLARI

Bu bölümde, önerilen GA-ML stratejisinin MIMO-FBMC/OQAM sistemindeki QAM sembollerini ne kadar etkin bir şekilde algılayabildiği test edilmiştir. Bu amaçla, ilgili stratejinin hem 5×5 hem de 8×8 MIMO konfigürasyonları için bit hata oranı ve yakınsaklık eğrileri elde edilerek ZF ve ML dedektörleri ile sembol algılama performansı bakımından karşılaştırması yapılmıştır. Tüm bunların yanı sıra, GA-ML stratejisinin klasik ML yöntemi üzerindeki karmaşıklık kazancını ortaya koyan detaylı bir karmaşıklık analizi gerçekleştirilmiştir. Tablo 1’de, simülasyonlar için belirlenen sistem parametreleri verilmiştir.

Tablo 1. Sistem parametreleri

Parametreler	Semboller	Değerler
QAM modülasyonu seviyesi	Q	4
Anten konfigürasyonları	$N_T \times N_R$	$5 \times 5, 8 \times 8$
Filtre tipi	-	PHYDYAS
Örtüşme katsayısı	-	4
Alt taşıyıcı sayısı	K	64
Sönümlü kanal modeli	-	SUI-6
Taşıyıcı frekansı	-	2.5 GHz
FBMC sembolü sayısı	L	30
Kestirim hatası oranı	λ	0.25
Alt taşıyıcı frekans aralığı	-	15 KHz
İlave çarpım parametresi	μ	2

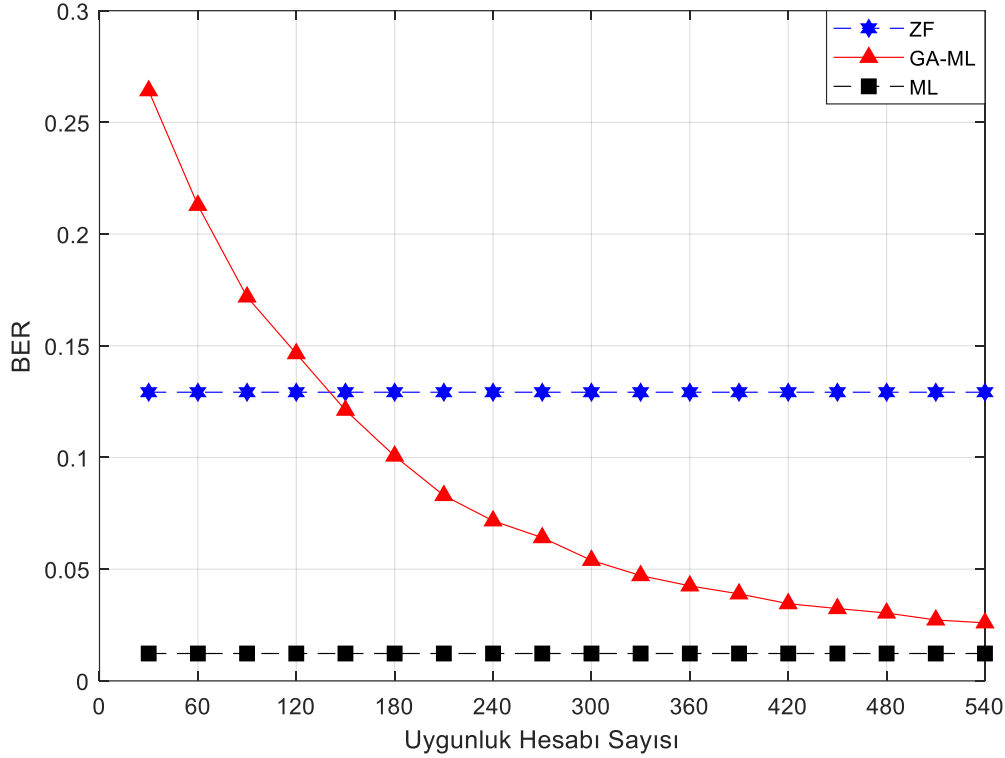
Tablo 2. GA-ML ve geleneksel ML yöntemleri için hesaplama karmaşıklığı analizi.

Sembol Algılama Prosedürleri		5×5	8×8
GA-ML	Kromozom sayısı	$M = 20$	$M = 40$
	Maksimum İterasyon Sayısı	$\dot{I}_{\text{maks}} = 27$	$\dot{I}_{\text{maks}} = 120$
	Araştırma karmaşıklığı	$AK = M \cdot \dot{I}_{\text{maks}} = 540$	$AK = M \cdot \dot{I}_{\text{maks}} = 4800$
	Bit hata oranı (SNR=12 dB)	0.02599	0.01012
ML	Araştırma karmaşıklığı	$AK = Q^{N_r} = 4^5 = 1024$	$AK = Q^{N_r} = 4^8 = 65536$
	Bit hata oranı (SNR=12 dB)	0.01226	0.002702

Tablo 2’de, GA-ML ve ML yöntemlerinin araştırma karmaşıklıkları üzerine bir inceleme gerçekleştirilmiştir. Tablodan da açıkça görüleceği üzere, optimizasyon sürecinin tamamlanmasıyla birlikte GA-ML tarafından ulaşılan toplam uygunluk hesabı sayısı söz konusu yöntemin araştırma karmaşıklığını verirken, geleneksel ML yönteminin araştırma karmaşıklığı, en yüksek iletilme olasılığına sahip optimum sembol dizisi arayışı boyunca kaç adet Öklid hesabı gerçekleştirildiğine bağlı olarak değişmektedir. Bunun haricinde, anten sayısındaki artışa bağlı olarak araştırma uzayı daha da genişlediğinden dolayı, 8×8 anten konfigürasyonunda, 5×5 anten konfigürasyonuna oranla daha geniş popülasyon boyutuna ve daha fazla araştırma sayısına ihtiyaç duyulmaktadır. Tablo 3’te GA-ML stratejisinin simülasyonlarda kullanılan diğer parametre değerleri verilmiştir.

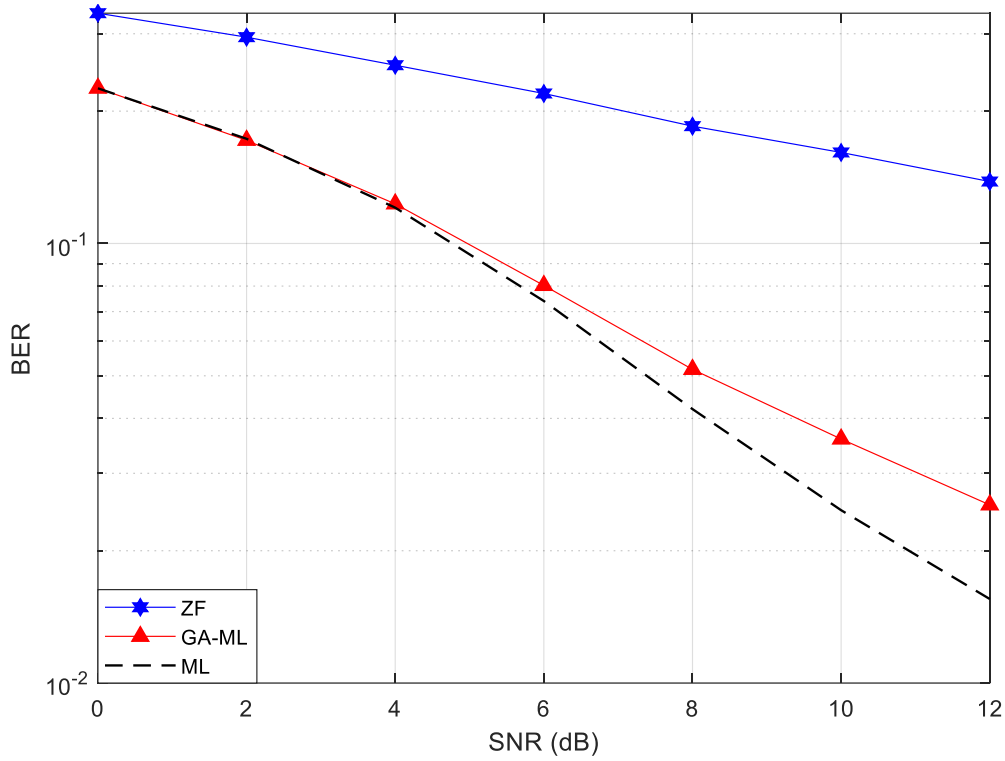
Tablo 3. Genetik algoritmaya dayalı ML stratejisinin optimizasyon parametreleri.

Strateji	Parametre	Sembol	Değer
GA-ML	Çaprazlama oranı	Cr	0.9
	Mutasyon oranı	Mr	0.1

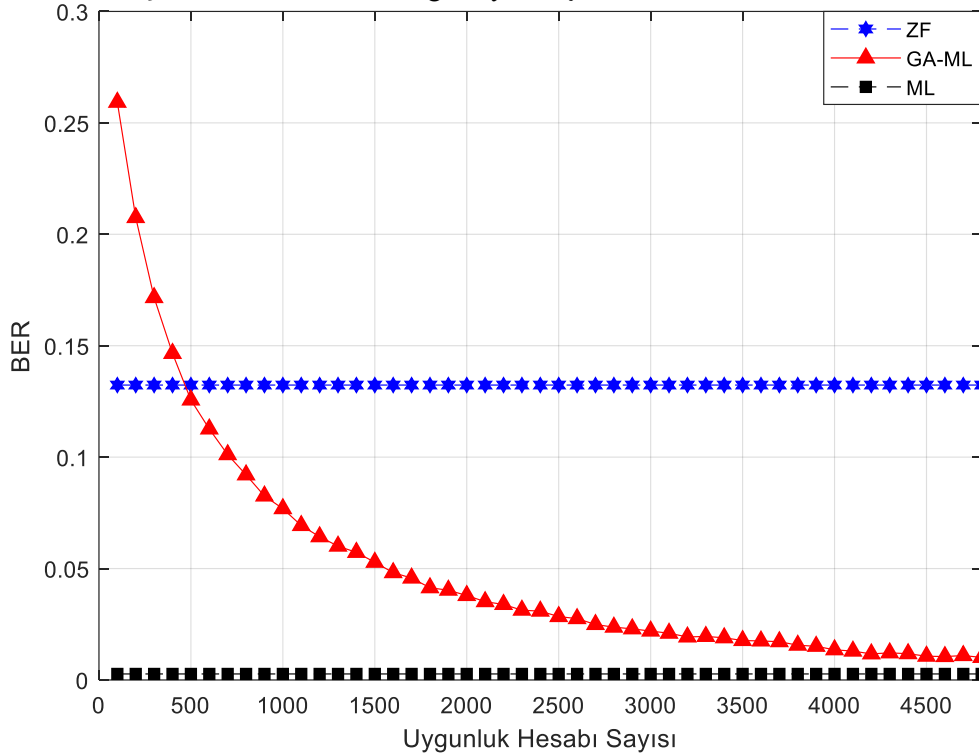
**Şekil 3.** 5×5 MIMO yapısı için yakınsaklık analizi.

Şekil 3'te, MIMO-FBMC/OQAM sisteminde sinyal iletimi için 5×5 anten yapısı kullanılması durumunda GA-ML stratejisinin nasıl bir yakınsama davranışı sergilediği görülmektedir. Önerilen stratejinin yakınsaklık eğrisi elde edilirken, ilgili sistemin sinyal/gürültü oranı (SNR) değeri 12 dB'de sabit tutulmuştur. Klasik ML yöntemine ait olan düz çizgi, ulaşılabilecek optimum BER seviyesini temsil ederken daha yukarıda yer alan doğru ise, ZF yönteminin 12 dB SNR değerinde ulaştığı BER seviyesini göstermektedir. Şekil 3'ten de açıkça görüldüğü gibi, GA-ML stratejisi 540 uygunluk hesabının ardından optimum seviyeye oldukça yaklaşarak ZF yöntemine ciddi bir fark atmıştır.

Şekil 4'te, önerilen GA-ML stratejisi 5×5 MIMO-FBMC/OQAM sistemindeki BER performansı bakımından makalede ele alınan diğer iki yöntemle kıyaslanmıştır. Şekilde yer alan BER eğrilerinden de net bir şekilde anlaşıldığı üzere, ZF yöntemi zayıf BER performansı ile diğer yöntemlerden ayrılmaktadır. Herhangi bir sisteme uygulandığında oldukça küçük bir işlem yüküne sebep olan basit yapısına karşın, sahip olduğu düşük sembol algılama performansı, ZF yönteminin söz konusu karmaşıklık avantajını tamamen önemsiz hale getirmektedir. Bir diğer klasik sembol algılama yöntemi olan ML dedektörünün kullanmış olduğu kapsamlı arama prosedürü nedeniyle en düşük BER seviyesine ulaşması sürpriz olmamıştır. Söz konusu arama prosedürü, optimum çözüme ulaşmayı garanti etse de oldukça yüksek bir hesaplama karmaşıklığına neden olmaktadır. GA-ML dedektörü ise, kullanmış olduğu genetik algoritma tabanlı sembol optimizasyonu sayesinde, çok daha az hesaplama karmaşıklığı ile ML yöntemine yakın bir BER performansı ortaya koymuştur.



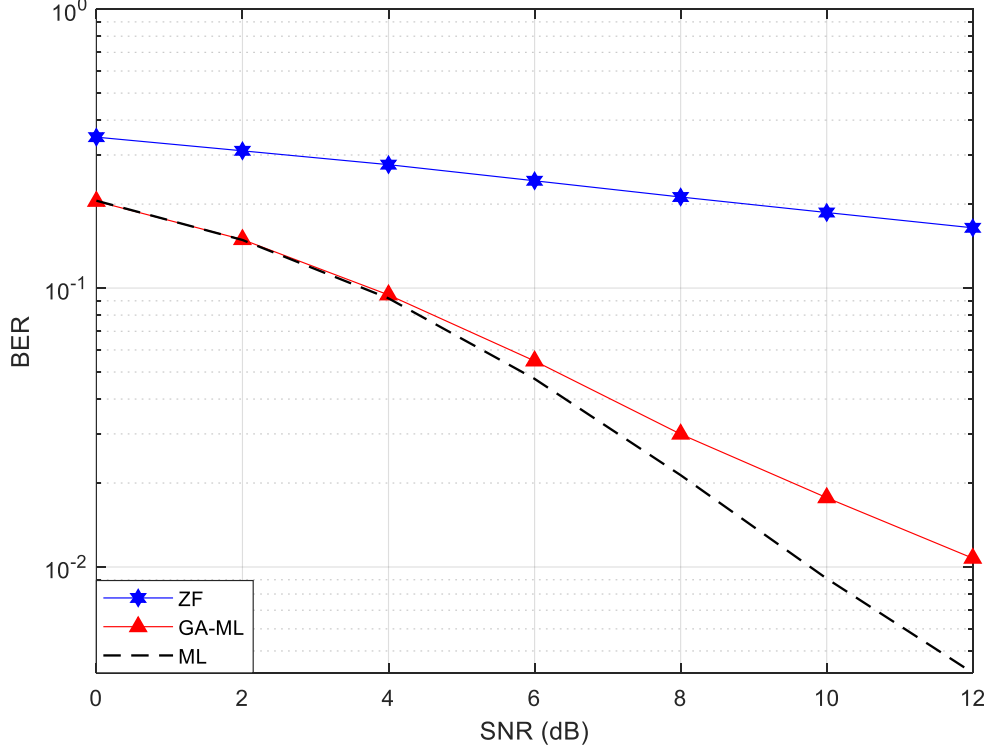
Şekil 4. 5×5 anten konfigürasyonu için bit hata oranı analizi.



Şekil 5. 8×8 MIMO yapısı için yakınsaklık analizi.

Şekil 5'te verilen yakınsama eğrileri, MIMO yapısının 5×5'ten 8×8'e artırılması sonucu elde edilmiştir. Şekil 5' ile Şekil 3 karşılaştırıldığında, söz konusu anten artışının yol açtığı araştırma uzayındaki genişleme nedeniyle, GA-ML stratejisinin optimum BER seviyesine yakınsayabilmek için daha fazla uygunluk hesabına ihtiyaç duyduğu açık bir şekilde görülebilmektedir. Bunun haricinde GA-ML, başarılı bir yakınsama performansı sergilemiştir. ZF dedektörünün ulaştığı BER seviyesini sadece 468 uygunluk hesabı ile geride bırakarak hızla yakınsamaya devam etmiş olup, 4800 uygunluk hesabı sonucu ML seviyesine oldukça yaklaşmıştır.

Makalede ele alınan sembol dedektörlerinin BER performanslarının anten artışından nasıl etkilendiğini incelemek amacıyla, Şekil 6'da ilgili dedektörlerin BER eğrileri 8×8 anten konfigürasyonu için elde edilmiştir. Şekil 6 ile Şekil 4 karşılaştırıldığında görülebileceği gibi, anten yapısının 5×5 'ten 8×8 'e genişletilmesi GA-ML ve ML dedektörlerinin daha iyi BER seviyelerine ulaşmasını sağlarken, bir tür doğrusal sembol dedektörü olması sebebiyle ZF, söz konusu anten artışından olumsuz olarak etkilenecek performans kaybına uğramıştır. Bunun dışında, önerilen GA-ML stratejisi 8×8 anten konfigürasyonunda da geleneksel ML yöntemine yakın BER sonuçları elde ederek ZF yöntemi üzerindeki performans üstünlüğünü korumuştur.



Şekil 6. 8×8 anten konfigürasyonu için bit hata oranı analizi.

5.1. Hesaplama Karmaşıklığı Analizi

Bu bölümde, makalede ele alınan sembol dedektörlerinin hesaplama karmaşıklıkları karmaşık çarpım sayısı cinsinden elde edilmiştir (Khan vd., 2008). Daha sonra, önerilen GA-ML stratejisinin farklı anten sayıları için geleneksel ML dedektörü üzerinde elde etmiş olduğu karmaşıklık kazançları hesaplanmıştır. ZF dedektörünün mevcut sembol algılama yöntemleri arasında en düşük hesaplama karmaşıklığına sahip yöntem olduğu, ancak aynı zamanda oldukça düşük bir sembol algılama performansı sergilediği unutulmamalıdır.

ZF dedektöründe, sözde-ters matris hesabından dolayı, $4N_T^3 + 2N_T^2N_R$ adet karmaşık çarpıma ihtiyaç duyulmaktadır (Khan vd., 2008). Buna göre, ZF dedektörünün hesaplama karmaşıklığı aşağıdaki gibi ifade edilebilir:

$$C_{ZF} = 4N_T^3 + 2N_T^2N_R \quad (22)$$

ML dedektöründe, matrisler arası çarpma işlemleri $Q^{N_T} \cdot (N_R \cdot N_T)$ adet karmaşık çarpıma yol açarken, kare alma işlemleri ise $Q^{N_T} \cdot N_R$ adet ek karmaşık çarpım işlemine neden olmaktadır. Buna göre, ML dedektörü tarafından ihtiyaç duyulan toplam karmaşık çarpım sayısı, aşağıda ifade edildiği gibi söz konusu dedektörün nihai hesaplama karmaşıklığını verecektir:

$$C_{ML} = Q^{N_T} \cdot (N_R \cdot N_T) + Q^{N_T} \cdot N_R = Q^{N_T} \cdot (1 + N_T) \cdot N_R \quad (23)$$

Burada Q^{N_T} , ML dedektörünün Tablo 2'de verilen araştırma karmaşıklığına (AK) karşılık gelmektedir. Bu durumda, Denklem (23) aşağıdaki şekilde de ifade edilebilir:

$$C_{ML} = AK \cdot (1 + N_T) \cdot N_R \quad (24)$$

GA-ML stratejisinde ise, her bir uygunluk hesabı için ihtiyaç duyulan karmaşık çarpım sayısı $(N_T \cdot N_R + \mu)$ değerine eşit olmaktadır. Burada μ , parametre güncelleme işlemlerinden dolayı uygunluk hesabı başına ihtiyaç duyulan ek karmaşık çarpım sayısını ifade etmektedir. Tablo 2’den de bilindiği üzere, GA-ML stratejisinin araştırma karmaşıklığı, optimizasyon süreci boyunca gerçekleştirmiş olduğu uygunluk hesabı sayısına karşılık gelmektedir. Bu nedenle, Tablo 2’de verilen araştırma karmaşıklığı ile $(N_T \cdot N_R + \mu)$ ifadesinin çarpımı, ilgili stratejinin hesaplama karmaşıklığını verecektir:

$$C_{GA-ML} = M \cdot \dot{I}_{maks} \cdot (N_T \cdot N_R + \mu) \quad (25)$$

GA-ML stratejisinin klasik ML dedektöründe elde etmiş olduğu karmaşıklık kazancını aşağıdaki gibi hesaplamak mümkündür:

$$Kazanç (\%) = \frac{C_{ML} - C_{GA-ML}}{C_{ML}} \times 100 \quad (26)$$

Tablo 4. GA-ML stratejisi tarafından farklı anten sayıları için elde edilen karmaşıklık kazançları

Yöntemler	5×5	8×8
ML	$C_{ML} = Q^{N_T} \cdot (1 + N_T) \cdot N_R$ $= 4^5 \cdot (1 + 5) \cdot 5$ $= 30720$	$C_{ML} = Q^{N_T} \cdot (1 + N_T) \cdot N_R$ $= 4^8 \cdot (1 + 8) \cdot 8$ $= 4718592$
GA-ML	$C_{GA-ML} = M \cdot \dot{I}_{maks} \cdot (N_T \cdot N_R + \mu)$ $= 540 \cdot (5 \cdot 5 + 2)$ $= 14580$	$C_{GA-ML} = M \cdot \dot{I}_{maks} \cdot (N_T \cdot N_R + \mu)$ $= 4800 \cdot (8 \cdot 8 + 2)$ $= 316800$
Karmaşıklık Kazancı (%)	% 52.539	% 93.286

Tablo 4’te, klasik ML ve GA-ML dedektörlerinin sırasıyla Denklem (23) ve Denklem (25)’te verilen karmaşıklık ifadeleri kullanılarak hesaplama karmaşıklığı değerleri nümerik olarak elde edildikten sonra, önerilen stratejinin ML dedektörü üzerinde elde etmiş olduğu karmaşıklık kazancı, 5×5 ve 8×8 anten konfigürasyonları için Denklem (26) vasıtasıyla hesaplanmıştır. Tablodan da açıkça görüleceği üzere, anten konfigürasyonundaki artış, klasik ML dedektörünün hesaplama karmaşıklığında aşırı bir yükselmeye yol açmıştır. Öte yandan, söz konusu anten artışı, GA-ML stratejisinde geleneksel ML dedektörüne oranla çok daha düşük bir karmaşıklık artışına neden olmuştur. Bu nedenle, ML dedektöründe GA-ML tarafından elde edilen karmaşıklık kazancı, anten konfigürasyonundaki artışla birlikte daha da yükselmektedir. Örneğin, 5×5 MIMO-FBMC/OQAM sistemi için en az % 52 karmaşıklık kazancı elde edilirken, anten konfigürasyonunun 5×5’ten 8×8’e yükseltilmesiyle birlikte söz konusu karmaşıklık kazancı % 93’ün üzerine çıkmıştır.

6. SONUÇ

Bu çalışmada, MIMO-FBMC/OQAM sistemi için GA-ML olarak isimlendirilen biyo-ilhamlı bir sembol algılama yaklaşımı önerilmiştir. Bu yaklaşımda genetik algoritma, sembol optimizasyon işlemini yerine getirmek amacıyla klasik ML yöntemine entegre edilmiş olup, kapsamlı arama adı verilen oldukça yüksek karmaşık ve kullanışsız olan geleneksel arama prosedürü devre dışı bırakılmıştır. GA-ML stratejisinin geliştirilmesinin ardından, ilgili stratejinin MIMO-FBMC/OQAM sistemindeki sembol algılama performansı, 5×5 ve 8×8 anten konfigürasyonları için gerçekleştirilen simülasyonlar aracılığıyla test edilerek deneysel bir analiz gerçekleştirilmiştir. Yapılan deneysel analizle de açıkça ortaya konduğu üzere, önerilen strateji kullanılarak önemli bir sembol algılama performansına ulaşmak mümkündür. Çok fazla hesaplama karmaşıklığına neden olmadan ML yöntemine yakın bir performans elde edebilmesi, GA-ML’yi MIMO-FBMC/OQAM alıcısında pratik olarak kullanılmaya uygun ciddi bir dedektör adayı haline getirmektedir.

7. REFERANSLAR

- Agiwal, M., Roy, A., & Saxena, N. (2016). Next generation 5G wireless networks: A comprehensive survey. *IEEE Communications Surveys & Tutorials*, 18(3), 1617–1655.
- Farhang-Boroujeny, B. (2014). Filter bank multicarrier modulation: A waveform candidate for 5G and beyond. *Advances in Electrical Engineering*, 2014, 1–25.
- Goldberg, D. E. (1989). *Genetic Algorithms in Search, Optimization and Machine Learning*. Addison-Wesley.
- Goldberg, D. E., & Deb, K. (1991). A comparative analysis of selection schemes used in genetic algorithms. In G. J. E., Rawlins (Ed), *Foundations of Genetic Algorithms* (pp. 69–93). Morgan-Kaufman.
- Khan, A. A., Bashir, S., Naeem, M., Shah, S. I., & Li, X. (2008). Symbol detection in spatial multiplexing system using particle swarm optimization meta-heuristics. *International Journal of Communication Systems*, 21(12), 1239–1257.
- Li, L., Meng, W., & Ju, S. (2016). A novel artificial bee colony detection algorithm for massive MIMO system. *Wireless Communications and Mobile Computing*, 16(17), 3139–3152.
- Lien, S.-Y., Shieh, S.-L., Huang, Y., Su, B., Hsu, Y.-L., & Wei, H.-Y. (2017). 5G new radio: Waveform, frame structure, multiple access, and initial access. *IEEE Communications Magazine*, 55(6), 64–71.
- Mandloi, M., & Bhatia, V. (2016). A low-complexity hybrid algorithm based on particle swarm and ant colony optimization for large-MIMO detection. *Expert Systems with Applications*, 50, 66–74.
- Nissel, R., Blumenstein, J., & Rupp, M. (2017a, July 3-6). *Block frequency spreading: A method for low-complexity MIMO in FBMC-OQAM* [Conference presentation]. IEEE 18th International Workshop on Signal Processing Advances in Wireless Communications (SPAWC), Sapporo, Japan.
- Nissel, R., Schwarz, S., & Rupp, M. (2017b). Filter bank multicarrier modulation schemes for future mobile communications. *IEEE Journal on Selected Areas in Communications*, 34(10), 1768–1782.
- Rajoria, S., & Mishra, K. (2022). A brief survey on 6G communications. *Wireless Networks*, 28, 2901–2911.
- Rinaldi, F., Raschellà, A., & Pizzi, S. (2021). 5G NR system design: a concise survey of key features and capabilities. *Wireless Networks*, 27, 5173–5188.
- Seyman, M. N. (2022). Symbol detection based on back tracking search algorithm in MIMO-NOMA systems. *Computer Systems Science & Engineering*, 40(2), 795–804.
- Seyman, M. N., & Taşpınar, N. (2013). Symbol detection using the differential evolution algorithm in MIMO-OFDM systems. *Turkish Journal of Electrical Engineering and Computer Sciences*, 21(2), 373–380.
- Spencer, Q. H., Swindlehurst, A. L., & Haardt, M. (2004). Zero-forcing methods for downlink spatial multiplexing in multiuser MIMO channels. *IEEE Transactions on Signal Processing*, 52(2), 461–471.
- Wang, C., Au, E. K. S., Murch, R. D., Mow, W. H., Cheng, R. S., & Lau, V. (2007). On the performance of the MIMO zero-forcing receiver in the presence of channel estimation error. *IEEE Transactions on Wireless Communications*, 6(3), 805–810.
- Zakaria, R., & Le Ruyet, D. (2010, September 26-30). *On maximum likelihood MIMO detection in QAM-FBMC systems* [Conference presentation]. 21st Annual IEEE International Symposium on Personal, Indoor and Mobile Radio Communications, Istanbul, Turkey.
- Zhang, X., Chen, L., Qiu, J., & Abdoli, J. (2016). On the waveform for 5G. *IEEE Communications Magazine*, 54(11), 74–80.
- Zhu, X., & Murch, R. D. (2002). Performance analysis of maximum likelihood detection in a MIMO antenna system. *IEEE Transactions on Communications*, 50(2), 187–191.

INFLUENCE OF HOT CLIMATE ON BOND BEHAVIOUR BETWEEN SELF COMPACTING MORTAR AND SUPPORT

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Abstract

Sediment transported by rivers, particularly during periods of flooding, contributes to the accumulation of sediment in dams. Dredging can prolong the lifespan of dams, but the excessive storage of unusable sediment poses a threat to the environment. The aim of this work is to study the adhesion behavior between self-compacting mortars (SCM) containing calcined dam mud sediments (CDMS) and support, in a hot environment. Four SCM mixtures containing 0%, 10%, 20% and 30% CDMS replacing cement were prepared and cast on a prismatic support measuring 40x40x80mm. The resulting composite prisms with dimensions 40x40x160 mm were cured in hot environments for 7, 28 and 90 days. To evaluate the bond between support and SCM, the 3-pd test was used. The results showed that after the age of 28 days, replacement of cement up to 20% CDMS resulted in cohesion failure at the support and no cracks occurred in the interface.

Keywords : Calcined dam mud sediments, self compacting mortar, Adhesion, Repair, hot environment.

1 Introduction

The durability issues of concrete structures in hot regions are largely attributed to the high temperatures during the summer and the fluctuation in temperature between day and night. The thermal and mechanical stresses resulted in significant cracks, leading to a decrease in the lifespan of these structures (Neville 2000). In 1980, a highly fluid mortar, which appeared in Japan, caused a real revolution in the concrete industry. This type of concrete can flow and compact simply by the effect of gravity. The high fluidity of the material enables easy filling of the formwork and application on reinforcements, ensuring uniformity. This makes it a suitable option for concrete repair work. Various research studies have highlighted the use of self-compacting mortar with significant amounts of supplementary cementitious materials to enhance properties in both fresh and hardened states. Exploring the potential of recycling environmentally friendly waste, such as Dredged sludge, as a sustainable alternative to traditional construction materials is crucial for resource conservation and energy efficiency. In addition, Dredged sludge is mainly composed of silicon dioxide, aluminum oxide, and calcium oxide. As a result, the inclusion of more oxides can be helpful in creating more pozzolanic calcium-silicate-hydrate (C-S-H) gel. A study conducted by Aouad et al. (2012) and Faure et al. (2017) reported that when sediments are thermally treated (calcination) they become more reactive and can be useful for clinker production or as supplementary cementitious materials. The effect of incorporating 10%, 20%, and 30% cement replacement of uncontaminated sediments on the properties of mortar and concrete mixtures was investigated by Zhao et al. (2018). The reported findings demonstrated that dried and finely ground sediments can be used as partial substitutes for cement by up to 20% without compromising the mechanical properties of the mixtures. Bouhamou et al. (2016) al. examined the impact of incorporating 10%, 15%, and 20% replacements of cement with calcined dam mud sediments treated at 750 °C for 5 hours on the fresh properties of SCC. Their findings indicated that higher levels of calcined mud led to a less workable and more viscous SCC at a constant water content. It was observed that SCC with 10% calcined mud displayed greater mechanical strength. Interestingly, the control SCC mix showed the highest strength

development. In terms of compatibility of mortars containing pozzolanic materials in the hot climate, few studies are available. Benyahia et al. (2018) developed a self-compacting repair mortar compatible for hot climates (45°C), which includes 30% natural pozzolan. The research conducted by Ezziane et al. [9] revealed that the optimal optimal content of natural pozzolan is considered to be 15% and 20% for curing at 20°C and 60°C, respectively. The objective of the study is to investigate the effect of hot climate on the bond between self-compacting mortars containing calcined dam mud sediments. In this study, the cement was replaced by 0%, 10%, 20% and 30% CDMS. In order to validate the effectiveness of the developed mortars in the field, a detailed experimental study (mechanical resistance and adhesion) was carried out.

2 Experimental

2.1 Materials used

The mortar mixes studied in this work were prepared with ordinary Portland cement (CEMI 42.5), which complies with the requirements of standard en 197-1 (Table 1).



Fig. 1 Dam mud sediments in the different states.

Table 1 - Physical and chemical properties of raw materials

Properties	OPC (%)	CDMS (%)
Fineness (m ² /kg)	385	470
Density	310	2465
Oxides		
SiO ₂	21.28	53.71
Al ₂ O ₃	5.75	4.3
FeO ₃	3.10	10.10
CaO	64.67	10.50
MgO	1.40	0.96
SO ₃	1.83	1.4
K ₂ O	0.75	1.01
Na ₂ O	0.12	0.52
L.O.I	1.06	16.2

The studied CDMS was taken downstream of the Chorfa dam in the discharge zone after dredging. The physical and chemical characterization tests were carried out on samples obtained through by the following treatment process : Drying at 105°C ,Crushing, Grinding, Sifting and Calcination at 850°C during 2-h. To achieve the approximate fineness of cement, CDMS was ground in the laboratory. The retained mass of dust is approximately 2.5% on an 65 µm sieve. Table 1 also summarizes the chemical composition and physical properties of cement and CDMS. The sand used is river sand with a D_{max} of 1 mm. A super plasticizer based on acrylic copolymer conforming to standard EN 934-2, was used to improve the flow of the mixtures. To improve the ductility of mortars, polypropylene fibers of 6mm length were used.

2.2 Proportions of mixes

Three mortars were prepared in the laboratory and compared with reference mortar (Table 2). The water/binder ratio and fibre volume fraction were kept constant in all mortar mixes.

Appropriate dosages of SP were added to each mortar mix to achieve the desired rheological properties.

Table 2 – Proportions of mixes (kg/m³)

Designation	OPC	CDMS	W	B	W/B	S	SP	F
M0	472	0	179.36	472	0.38	1225	6.3	5.66
M10	424.8	47.2	179.36	472	0.38	1225	6.3	5.66
M20	377.6	94.4	179.36	472	0.38	1225	6.3	5.66
M30	330.4	141.6	179.36	472	0.38	1225	6.3	5.66

2.3 Test methods

2.3.1 Workability

In this experimental, mini-slump flow and mini-V-Funnel tests were used to measure the fresh properties of mortar mixes. The procedures of using these tests are outlined in the EFNARC .

2.3.2 Compressive strength

To evaluate the compressive strength of the mortar mixes, prismatic molds with dimensions of 40 mm × 40 mm × 160 mm, in accordance with the EN 12190-6, were used. Each type of mortar sample was casted, then kept after demoulding in water at a temperature of 20°C±2°C, until the age of 7, 28 and 90 days.

2.3.3 Adherence

To assess the adhesion of mortars, composite prismatic specimens (half mortar/half support) with dimensions of 40 mm × 40 mm × 160 mm were made. Adhesion between the support and mortars was characterized by a three-point bending test, at ages of 7,28 and 90 days.

3 Results and discussions

3.1 Slump flow

Figure 2 shows the evolution of the slump flow of mortars as a function of the cement replacement content with CDMS. It can be seen that the workability values of all mortars are within the range allowed by EFNARC (24-26cm). It is noted that the workability of mortars containing CDMS reduces as the cement is replaced. This is due to the fineness of CDMS which is greater than that of cement. This result is consistent with that reported by Bouhamou et al. 2016.

3.2 Flow time

Figure 2 shows the evolution of the flow time of mortars as a function of the cement replacement content with CDMS. It can be seen that the flow time values of all mortars are within the range allowed by EFNARC (7 -11s). We note that the mortars developed are more viscous compared to the reference mortar. For example, the flow time of the reference mortar is 7.3s, however, when the cement is replaced with 30% CDMS, the flow time value is 10.4s.

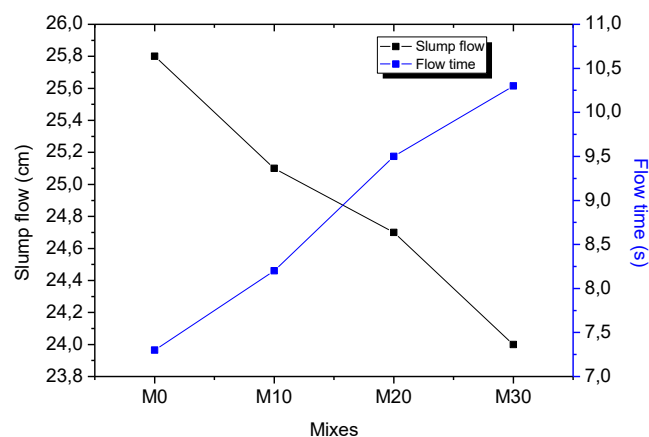


Fig.2 Mini-slump flow diameter and flow time changes for mixes

3.4 Compressive strength

The values of compressive strength obtained by experimentally are presented in Figure 3. It can be seen from the figure that the compressive strengths of the mortar with 10% CDMS decreased compared to control mortar by about 8%, 5%, 3%, after 7, 28 and 90 days, respectively. The improvement of compressive strength of the mortar containing 10% CDMS (M10) is related to the formation of C-S-H gel. However, for a high level replacement (30% CDMS), the corresponding values were 35%, 25% and 20%, respectively. This owing to the lower amount of hydration products (Wong et al., 2009).

3.5 Flexural strength

The investigated mortar mixtures showed a similar tendency of increase in strength with curing time (Figure 4).

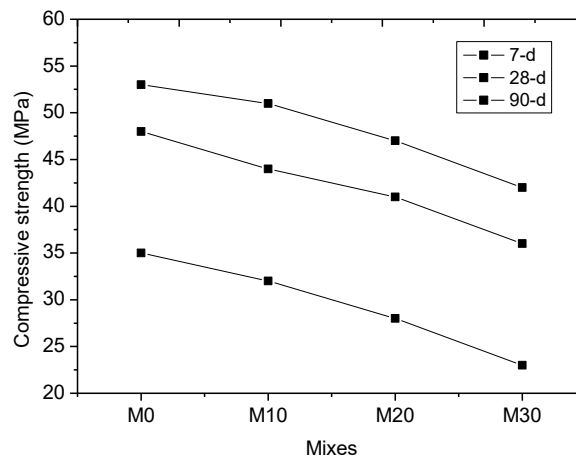


Fig.3 Influence of CDMS content on compressive strength of mixes

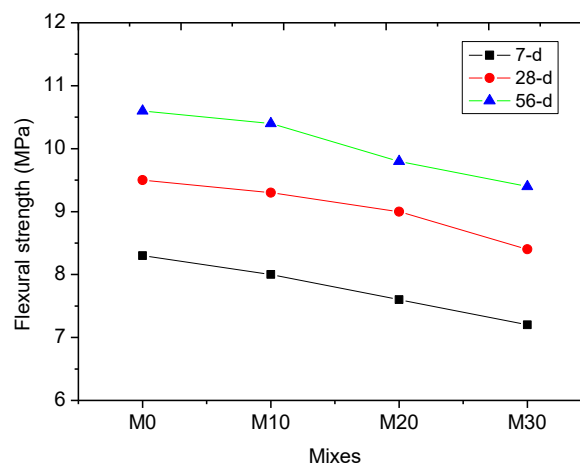


Fig.4 Influence of CDMS content on flexural strength of mixes

3.6 Adherence

Figure 5 shows the bonding values obtained by the 3-point bending test on composite prisms (Mortar /Support), cured in the hot climate until the age of 90 days. The three-point bending test results, showed that the replacement of the cement with 10% CDMS exhibited a good adhesion with the support at all ages (7, 28 and 90 days) and cracks occurred at the level of the support. In fact, the adhesion value of the composite (M10/Support) was reduced

compared to that of the control composite by 7%, 4% and 3%, respectively. The improvement in the adhesion of the M10 mortar is linked to the improvement of the interfacial transition zone due to the C-S-H gel. When the cement was replaced by 30% CDMS, cracks occurred at the level of the mortar (28 and 90 days) with detachment of the latter at the age of 7 days. The reductions in adhesion values compared to those of the control composite were 25%, 10% and 6%, respectively. This phenomenon can be attributed to dilution which results in higher porosity and low strength (Wong et al., 2009). Furthermore, Figure 6 shows the existence of a linear correlation between adhesion and bending resistance with a strong correlation coefficient $R^2=0.95$

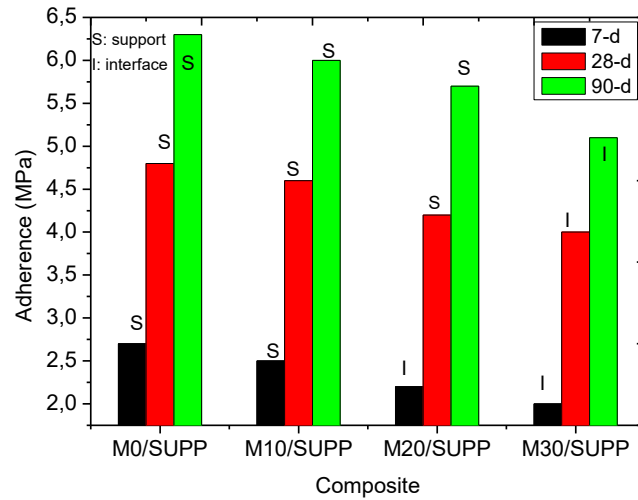


Fig.5 Influence of CDMS content on adherence of mixes

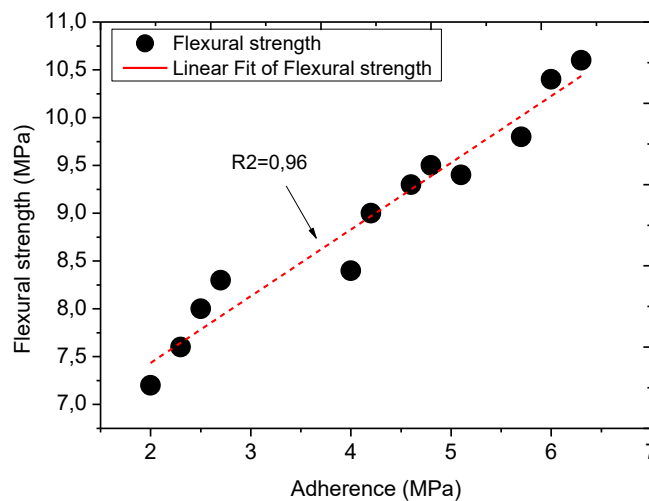


Fig.6 Relationship between flexural strength and adherence at all ages

4 Conclusion

The main conclusions drawn from the experimental results are summarized below:

- The replacement of cement by CDMS resulted in less workable and more viscous mortars.
- The replacement of cement with 10% CDMS generated mechanical strengths comparable to the reference mortar at all ages.

- The three-point bend test confirms that mortars containing up to 20% CDMS exhibit acceptable bond strength with the support in hot, environments as curing time increases.
- Linear relationship between flexural strength and adhesion of mortar mixes at all curing ages was found where the coefficient of correlation (R^2) was achieved above 0.95, which means an extremely good fit.

References

- A. Neville, Good reinforced concrete in the Arabian Gulf, *Mater and struct* 33.10, pp. 655-64 (2000).
- Aouad, G., Laboudigue, A., Gineys, N., Abriak, N.E., 2012. Dredged sediments used as novel supply of raw material to produce Portland cement clinker. *Cement Concr. Compos.* 34, 788e793.
- Benzerzour, M., Maherzi, W., Amar, Mouhamadou A.A., Abriak, N.-E., Damidot, D., 2018. Formulation of mortars based on thermally treated sediments. *J. Mater. Cycles Waste Manag.* 20, 592e603.
- Bouhamou, N.-E., Mostefa, F., Mebrouki, A., Bendani, K., Belas, N., 2016. Influence of dredged sediment on the shrinkage behavior of self-compacting concrete. *Mater. Tehnol.* 50, 127e135.
- EFNARC specifications, The European Guidelines for Self-Compacting Concrete: Specification, Production and Use, European Federation for Specialist Construction Chemicals and Concrete Systems (2005).
- EN 12190, Products and Systems for the Protection and Repair of Concrete Structures-Test Methods-Determination of Compressive Strength of Repair Mortar (2000).
- EN 197-1, Cement, Composition, Specifications and Conformity Criteria for Common Cements (2000).
- EN 934-2, Admixtures for Concrete, Mortar and Grout-Part 2: Concrete Admixtures-Definitions, Requirements, Conformity, Marking and Labeling (2009).
- Faure, A., Smith, A., Coudray, C., Anger, B., Colina, H., Moulin, I., They, F., 2017. Ability of two dam fine-grained sediments to be used in cement industry as raw material for clinker production and as pozzolanic additional constituent of portland-composite cement. *Waste Biomass Valorization* 8, 2141e2163. [https:// doi.org/10.1007/s12649-017-9870-8](https://doi.org/10.1007/s12649-017-9870-8).
- Wong, H.s., Zobel, M., Buenfeld, N.r., Zimmerman, R.w., 2009. Influence of the interfacial transition zone and microcracking on the diffusivity, permeability and sorptivity of cement-based materials after drying. *Mag. Concr. Res.* 61, 571.

**KEDİLERDE CYSTOISOPOROSIS
CYSTOISOSPOROSIS IN CATS**

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Özet

Kedileri *Cystoisospora felis* ve *Cystoisospora rivolta* enfekte eder. Bu protozoon parazitler zorunlu hücre içi yerleşim gösterir. *Cystoisospora* türleri konak spesifiktir. Köpekleri enfekte eden türlerin ookist morfolojisi kedilerdekine benzer olmasına rağmen köpek ve kedi arasında parazit geçişi yoktur. *Cystoisospora* cinsinde bulunan protozoonlar dışkı ile ookist formunu atar. Fare ve diğer pek çok konak parazitin biyolojisinde paratenik ya da transport konak olarak rol oynar. Prepatent süre enfeksiyondan oluşturan parazit sayısına ve safhasına göre değişir. Yavru kedilerde paratenik konak dokularının yenilmesi ile şekillenen enfeksiyonda minimum prepatent süre 4 günken bu süre ookistle olan enfeksiyonda 7 gündür. Enfekte kedilerin dışkı muayenesinde parazite özgü ookistlerin mikroskopik tespiti teşhiste yardımcıdır. Kedilerde *Cystoisospora felis* patojenitesine dair çelişkili raporlar bulunmaktadır. Bazı raporlarda, enfekte kedilerde şiddetli ishal bildirilmiştir. Dışkının doymuş sıvılar kullanılarak yapılan flotasyon ve santrifüj flotasyon yönteminde parazitin ookist formları mikroskopik olarak görülür. Ookist büyüklüğü bakımından *Cystoisospora felis*, *Cystoisospora rivolta*'dan kolaylıkla ayrılır. Ancak kedi dışkısında isosorid tipte ookist üreten farklı protozoonlara (*Toxoplasma gondii*, *Hammondia hammondi* ve *Besnoitia* spp.) ait ookistler görülebilir. *Cystoisospora felis*'e ait ookistler bunlar içinde en büyüğüdür, *C. rivolta* ookistleri ise orta büyüklüktedir. Diğer türleri ise *Cystoisospora rivolta*'dan küçüktür. Dışkı muayenesinde görülen 16 µm'den küçük çaptaki sporlanmamış ookistin tanısı güçtür, *Toxoplasma gondii* ookistlerinden ayırt etmek gerekir. Bu amaçla tanının PCR ya da biyoassay yapılarak desteklenmesi tavsiye edilir. PCR tekniğinde 18S rRNA and ITS1 gen bölgelerinin çoğaltılması tanıda yardımcıdır. Biyoassay için ise şüpheli ookistlerin fareye oral yolla uygulanması gerekir. Nekropsi esnasında ince bağırsaktan hazırlanan smearlarda ya da histopatolojik doku kesitlerinin mikroskopik incelenmesinde parazitlerin gelişim formları görülebilir. Bazı *Sarcocystis* türlerinin sporocystleri de dışkıda bulunur ve bunlar konak içinde sporandığından yeni dışkılanmış dışkıda bile sporlanmış formdadır

Anahtar kelimeler: Kedi, *Cystoisospora*, Protozoon

Abstract

Cats are infected with *Cystoisospora felis* and *Cystoisospora rivolta*. These are obligate intracellular protozoan parasites. *Cystoisospora* species are host specific. Although the oocyst morphology of parasites infecting dogs is similar to that in cats, there is no parasite transmission between dogs and cats. Protozoa in the *Cystoisospora* genus shed oocyst form in the feces. Mice and many other animal species play a role as paratenic or transport hosts in the biology of the parasite. The prepatent period varies according to the number and infective stage of the parasite that causes the infection. The minimum prepatent period is 4 days in kittens caused by ingestion of paratenic host tissues, while this period is 7 days during infection with sporulated oocysts. Microscopic detection of oocysts in fecal samples is helpful for diagnosis in infected cats. There are conflicting reports regarding the pathogenicity of *Cystoisospora felis* in cats. In some reports, severe diarrhea has been reported in infected cats. The oocyst forms of the parasite are seen in fecal samples microscopically after prepared with flotation or centrifugal flotation methods with saturated fecal fluids. *Cystoisospora felis* can be easily distinguished from *Cystoisospora rivolta* in terms of oocyst size. However, oocysts belonging to different protozoa (*Toxoplasma gondii*, *Hammondia hammondi* and *Besnoitia* spp.) that produce isosporid type oocysts can be seen in cat feces. *Cystoisospora felis* oocysts are the largest among these, while *Cystoisospora rivolta* oocysts are medium-sized. Other species are smaller than *Cystoisospora rivolta*. The diagnosis of unsporulated oocysts smaller than 16 µm seen in fecal examination is difficult, and it is necessary to distinguish them from *Toxoplasma gondii* oocysts. For this purpose, it is recommended to support the diagnosis by performing PCR or bioassay. In the PCR technique, amplification of 18S rRNA and ITS1 gene regions is helpful in diagnosis. For bioassay, suspected oocysts must be administered orally to mice. During necropsy, the developmental forms of the parasites can be seen in smears prepared from the small intestine or in microscopic examination of histopathological tissue sections. Sporocysts of some *Sarcocystis* species are also found in feces and since they sporulate inside the host, they are in sporulated form even in freshly defecated feces.

Keywords: Kedi, *Cystoisospora*, Protozoon

INTRODUCTION

Cystoisospora felis and *Cystoisospora rivolta* are obligat intracellular protozoon parasites, commonly found in cats's intestine. The aim of this paper is to give an information about cystoisosporiasis frequently seen in cats (Taylor et al., 2007).

Cystoisospora felis oocysts are the largest coccidial oocysts in cats. Unsporulated oocysts are ovoid, 32–53×26–43 µm (mean 42–43×31–33 µm) in diameter, smooth-walled. Sporocysts are 20–27×17–22 µm (mean 23×18 µm) and sporozoites are 10–15 µm long. Unsporulated *C. rivolta* oocysts are 22.3 (18–25) x 19.7 (16–23) µm in diameter. Sporocysts are 13–21×10–15 µm (mean 17.2×15 µm) and sporozoites are 10–14×2.5–3.0 µm (Figure 1) (Bowman et al., 2002; Barta et al., 2005)).



Figure 1. Sporulated *Cystoisospora felis* (right) and *Cystoisospora rivolta* oocyst (left) during fecal examination of infected cat (original, x40).

There are three stages in the life cycle of *Cystoisospora* spp. (sporogony, excystation and endogenous development). Oocysts develop in the host cells after completed syngami. Unsporulated *Cystoisospora* spp. oocysts are excreted with cat feces (Bowman et al. 2002). Oocysts sporulate in 40 hours at 20°C, 24 hours at 25°C, 12 hours at 30°C, and 8 hours at 38°C in nature. Thus, oocysts turn into infective forms. Temperature, oxygen and humidity affect the sporulation process. Temperatures above 35°C or below 10°C negatively affect sporulation inside the oocyst. Unsporulated oocysts can survive for almost 2 months at air temperatures around -7°C, but die within 24 hours at 40°C (Eckert et al., 2005). When the sporulation stage is completed, two sporocysts develop inside the *Cystoisospora* spp. oocyst, and four sporozoites develop inside each of them. Cat is infected after ingesting sporulated oocysts.

Other infection routes are eating tissues of paratenic hosts. The mouse (*Mus musculus*), Norway rat (*Rattus norvegicus*), golden hamster (*Mesocricetus auratus*), cattle (*Bos taurus*) and dogs (*Canis familiaris*) are paratenic hosts in the life cycle of *Cystoisospora* spp. When these hosts ingest sporulated oocysts, the sporozoite stages of the parasite lie dormant in various cells within the lymphatic system of the peritoneal cavity without further development (Skyles, 2014).

Sporozoites are released from the oocysts in the digestive tract of cat. Two stages are found in the excystation process in the host. Firstly, the oocyst wall is affected by gastric acid, thus, bile salts and pancreatic enzymes easily enter the sporulated oocyst. Bile salts and pancreatic enzymes activate the sporozoites in the sporulated oocysts. Sporozoites leave from sporocysts through Stieda bodies of the oocyst and they are released by passing through the cracks and breaks in the oocyst wall (Figure 2) (Florin-Christensen and Schnittger, 2018).

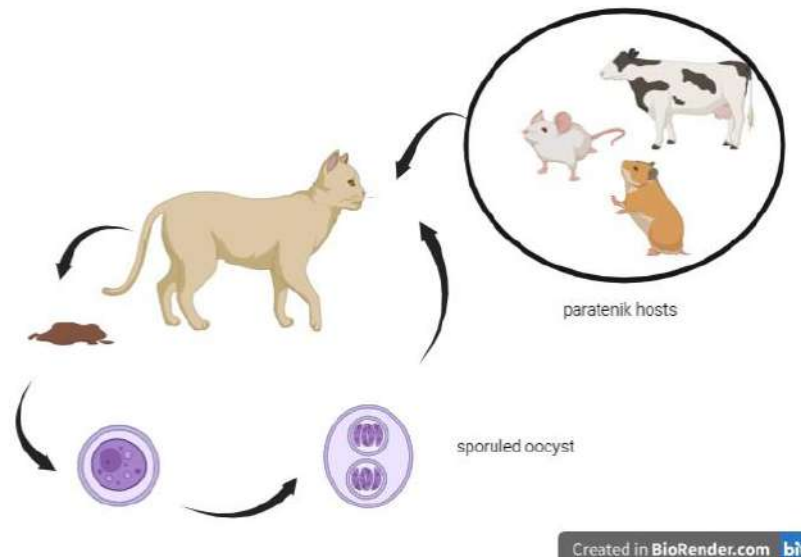


Figure 2. Life cycle of *Cystoisospora* spp. in cat (original).

Clinic signs are remarkable in kitte. Clinically affected kittens are often emaciated. Clinically ill kittens may have thickened small intestines. Microscopic lesions observed in some infected animals include villous atrophy, dilatation of the lacteals, and hyperplasia of lymph nodes in Peyer's patches. Other parasites such as roundworms or hookworms may also be noted (Florin-Christensen and Schnittger, 2018).

Cystoisosporosis is usually self-limiting in infected cats, and clinical signs resolve in most kittens without treatment. However, treatment can hasten resolution of clinical disease and reduce environmental contamination and the potential for infection of other animals (Lappin 2010). Several anticoccidial drugs such as amprolium, furazolidone, ponazuril, diclazuril, toltrazuril, sulfadimethoxine, and trimethoprim-sulfonamide are generally used to treat cystoisosporosis in cats. Besides treatment of anticoccidial drugs, electrolyte replacement should be administered as symptomatic treatment in clinical cases (Bowman 2014).

CONCLUSION

- Cystoisosporosis is a common parasitic disease in cats.
- Cats should not be fed raw animal tissue.
- Litterbox should daily cleaned in home.
- Cats should undergo regular veterinary check-up.

REFERENCES

1. Barta JR, Schrenzel MD, Carreno R, Rideout BA. 2005. The genus *Atoxoplasma* (Garnham 1950) as a junior objective synonym of the genus *Isospora* (Schneider 1881) species infecting

birds and resurrection of *Cystoisospora* (Frenkel 1977) as the correct genus for *Isospora* species infecting mammals. *J Parasitol.* 91, 726-727.

2. Bowman DD 2014. *Georgi's Parasitology for Veterinarians*. 10th Edition. Elsevier Saunders, St Louis Missouri.
3. Bowman DD, Hendrix CM, Lindsay DS, Barr SC. 2002. *Feline Clinical Parasitology*. Iowa State University Press.
4. Eckert J, Friedhoff KT, Zahner H, Deplazes P. 2005. *Lehrbuch der Parasitologie für die Tiermedizin*. 2., vollständig überarbeitete Auflage. Enke Verlag, Stuttgart.
5. Florin-Christensen M, Schnittger L. 2018. *Parasitic Protozoa of Farm Animals and Pets*. Springer International Publishing AG, part of Springer Nature
6. Lappin, MR. 2010. Update on diagnosis and management of *Isospora* spp. infections in dogs and cats. *Topics in Companion Animal Medicine*, 25, 133-135.
7. Skyes, JE. 2014. *Canine and Feline Infectious Diseases*. Elsevier Saunders, St Louis, Missouri.
8. Taylor, MA, Coop, RL, Wall, RL. 2007. *Veterinary Parasitology*. Third edition, Blackwell Publishing, Oxford, UK.

KOLZA (*Brassica napus* L.) ÇEŞİTLERİNE UYGULANAN FARKLI GİBERELLİK ASİT DOZLARININ ÇİMLENME VE FİDE GELİŞİMİNE ETKİLERİ
THE EFFECTS OF DIFFERENT GIBBERELIC ACID DOSES APPLIED TO RAPESEED (*Brassica napus* L.) CULTIVARS ON GERMINATION AND SEEDLING DEVELOPMENT

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ÖZET

Kolza dünyada ve ülkemizde yetiştirilen önemli yağ bitkileri arasında yer almaktadır. Bununla birlikte bitkisel yağlar insanların sağlıklı ve dengeli beslenmesi için son derece önemli besin kaynakları arasında yer almaktadırlar. Son derece önemli olan bu bitkinin verim ve kalitesinin artırılması için çeşitli uygulamalar yapılmaktadır. Bu çalışmanın amacı kolza tohumlarının çimlenmesi ve fide gelişimi üzerine farklı giberellik asit uygulamalarının etkilerinin belirlenmesidir. Bu amaçla 3 kolza çeşidinin (NK Caravel, Elvis, Champlain) tohumlarına 4 farklı giberellik asit dozu (0, 25, 50, 100 mg/l) uygulaması yapılmıştır. Araştırma tesadüf parselleri deneme desenine göre 3 tekerrürlü olarak yürütülmüştür. Çalışmada çimlenme oranı (%), fide boyu (cm), kök boyu (cm), fide yaş ağırlığı (mg), kök yaş ağırlığı (mg) parametreleri incelenmiştir. Araştırma sonucunda uygulamaların dozları arttıkça bütün özelliklerde artışlara sebep olduğu belirlenmiştir. Bununla beraber en yüksek değerler giberellik asitin 100 mg/l dozunda belirlenmiştir. Çalışmada kullanılan çeşitlerden ise Elvis çeşidinin uygulamalardan daha olumlu yönde etkilendiği belirlenmiştir.

Anahtar Kelimeler: Bitkisel yağlar, çimlenme, giberellik asit, kolza

ABSTRACT

Rapeseed is among the important oil crops grown in the world and in our country. In addition, vegetable oils are among the extremely important nutritional sources for peoples healthy and balanced diet. Various practices are carried out to increase the yield and quality of this extremely important plant. The aim of this study is to determine the effects of different gibberellic acid applications on germination and seedling development of rapeseeds. For this purpose, 4 different doses of gibberellic acid (0, 25, 50, 100 mg/l) were applied to the seeds of 3 rapeseed varieties (NK Caravel, Elvis, Champlain). The research was conducted using a randomized plots design with three replications. In the study, germination percentage (%), seedling length (cm), root length (cm), seedling fresh weight (mg), root fresh weight (mg) parameters were examined. As a result of the research, it was determined that as the doses of the applications increased, all parameters increased. However, the highest values were determined at the 100 mg/l dose of gibberellic acid. Among the varieties used in the study, it was determined that the Elvis variety was more positively affected by the applications.

Key Words: Vegetable oils, germination, gibberellic acid, rapeseed

GİRİŞ

Kolza bitkisinin ekiliş ve üretimi dünyada ve ülkemizde giderek artmaktadır (Gürsoy ve ark., 2015; Gürsoy, 2016; 2019a; 2024). Bunun yanı sıra bitkinin tohumlarında %38-50 oranında yağ ve %16-24 protein bulunması nedeniyle değerli bir besin kaynağı olduğu belirtilmektedir (Arslan ve ark., 2007; Arslan ve Culpan, 2022). Kolza bitkisinin oleik asitçe zengin ve Omega3 yağ asitleri grubunda yer aldığı da araştırmacılar tarafından bildirilmektedir (Başalma, 2004). Bununla birlikte yazlık ve kışlık çeşitlerinin olması (Başalma, 2004) bitkinin ekiliş ve üretiminde avantajlar sağlamaktadır. Kolza bitkisinin yağı bitkisel yemeklik yağ olarak kullanılmasının yanı sıra sabun yapımı, vernik, cila yapımı ve biyodizel üretiminde de kullanılmaktadır (Anğın ve Vurarak, 2012).

Tarımsal üretimde verim ve kalitenin artırılması amacıyla günümüzde çok çeşitli yöntemler uygulanmaktadır. Bu yöntemlerden birisi de fitohormonların kullanımınıdır (Gürsoy, 2022). Bitki büyüme düzenleyicisi olarak kullanılan fitohormonlardan birisi giberellik asittir (Novita, 2017).

Giberellik asitin bitkilerde tohum çimlenmesi, fide gelişimi, çiçeklenme ve meyve oluşumu gibi birçok gelişme faaliyetinde önemli rol oynadığı bilinmektedir (Huang ve ark., 2014).

Bu çalışmanın amacı kolza çeşitlerinin çimlenme ve ilk fide gelişimine giberellik asit dozlarının etkisinin belirlenmesidir.

MATERYAL VE METOT

Bu araştırma Aksaray Üniversitesi Güzelyurt Meslek Yüksekokulu'nda yürütülmüştür. Çalışmada kullanılan kolza çeşitleri (NK Caravel, Elvis, Champlain) Kırşehir Ahi Evran Üniversitesi'nden temin edilmiştir. Araştırma tesadüf parselleri deneme deseninde ve 3 tekerrürlü olarak yürütülmüş olup kolza çeşitlerinin tohumlarına 4 farklı giberellik asit dozu (0, 25, 50, 100 mg/l) uygulaması yapılmıştır. Çalışmada her bir petri kabında 25 tohum konularak belirlenen çözeltilerden 10 mL eklenerek oda koşullarında (20±1°C) çimlenmeye bırakılmışlardır. Her iki günde bir kurutma kağıtları değiştirilerek 10 mL uygun dozdaki çözeltilerden eklenmiştir. Deneme süresince her gün tohumlar gözlemlenerek 1 mm kökçük uzunluğuna sahip tohumlar çimlenmiş kabul edilmiştir. Çalışmanın 7. gününde toplam çimlenen tohumlar sayılarak çimlenme oranı belirlenmiştir. Denemenin yine 7. gününde fide uzunluğu (cm), kök uzunluğu (cm), fide yaş ağırlığı (mg), kök yaş ağırlığı (mg) değerleri her petriden 10 fide ölçümü yapılarak belirlenmiştir (ISTA, 2003). Elde edilen verilere MSTAT-C programı ile varyans analizi uygulanmış ve farklılıkların önem düzeyini belirlemek için de Duncan testi uygulanmıştır (Düzgüneş ve ark., 1987).

Ölçümler

Çalışmada ölçülen parametreler aşağıdaki yöntemlerle belirlenmiştir.

Çimlenme yüzdesi (%) = (çimlenmiş tohum sayısı / toplam tohum sayısı) × 100 (Siddiqi et al. 2007)

Fide boyu (cm): Her bir petrideki bitkilerin fideleri ile kökleri birbirinden ayrılarak ve fide kısmının cetvel ile ölçülmesiyle belirlenmiştir.

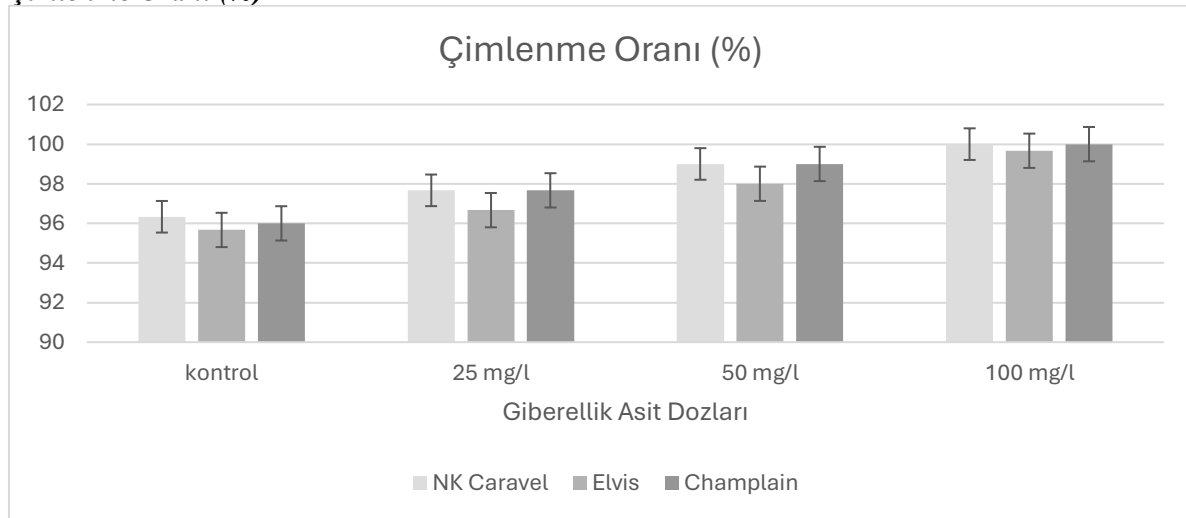
Kök boyu (cm): Fide ve kök kısımları ayrılmış olan bitkilerin köklerinin cetvel ile ölçülmesiyle belirlenmiştir.

Fide ve kök yaş ağırlığı (g): Fide ve kök kısımları ayrılan bitkilerin fidelerinin ve köklerinin ayrı ayrı hassas terazide tartılmasıyla belirlenmiştir.

BULGULAR

Yapılan varyans analizi sonucunda çimlenme oranı ve fide yaş ağırlığı bakımından çeşitler ve uygulanan dozlarda %1 oranında, fide boyu ve kök boyu bakımından çeşitler, dozlar, çeşitler × dozlar interaksyonu %1 oranında, kök yaş ağırlığı özelliğinde ise çeşitler ve dozlar bakımından %1, çeşitler × dozlar bakımından ise %5 düzeyinde önemli farklılık belirlenmiştir. İncelenen özelliklere ait ortalamalar ve Duncan grupları aşağıda verilmiştir.

Çimlenme Oranı (%)

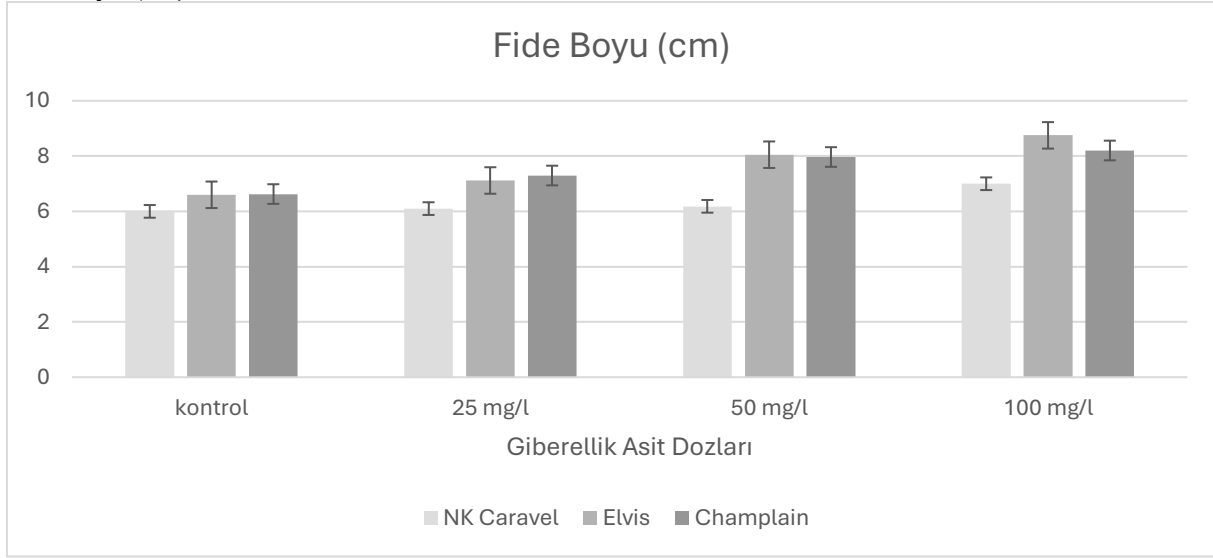


Şekil 1. Kolza çeşitlerine uygulanan giberellik asit dozlarının çimlenme ve fide gelişimine etkilerine ait ortalama değerler

Çimlenme oranı (Şekil 1) incelendiğinde giberellik asitin dozları arttıkça çimlenme oranının da arttığı görülmektedir. Bununla beraber en fazla çimlenme 100 mg/l dozunda belirlenmiştir. Giberellik asitin

çimlenmeyi teşvik etmede etkili olduğu saptanmıştır. NK Caravel çeşidinde en fazla çimlenmenin elde edildiği görülmektedir.

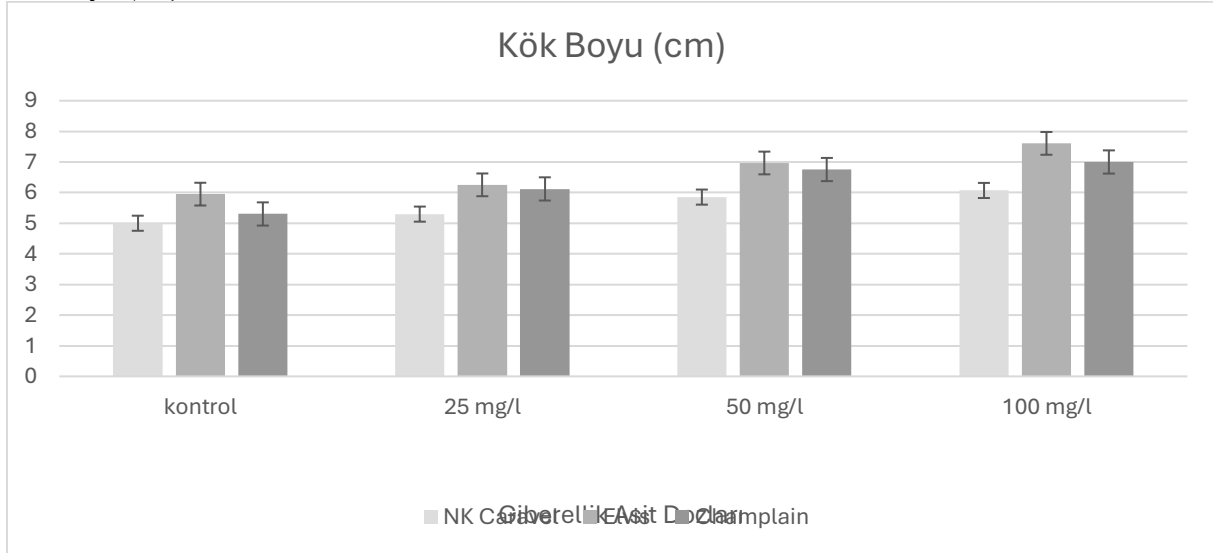
Fide boyu (cm)



Şekil 2. Kolza çeşitlerine uygulanan giberellik asit dozlarının çimlenme ve fide gelişimine etkilerine ait ortalama değerler

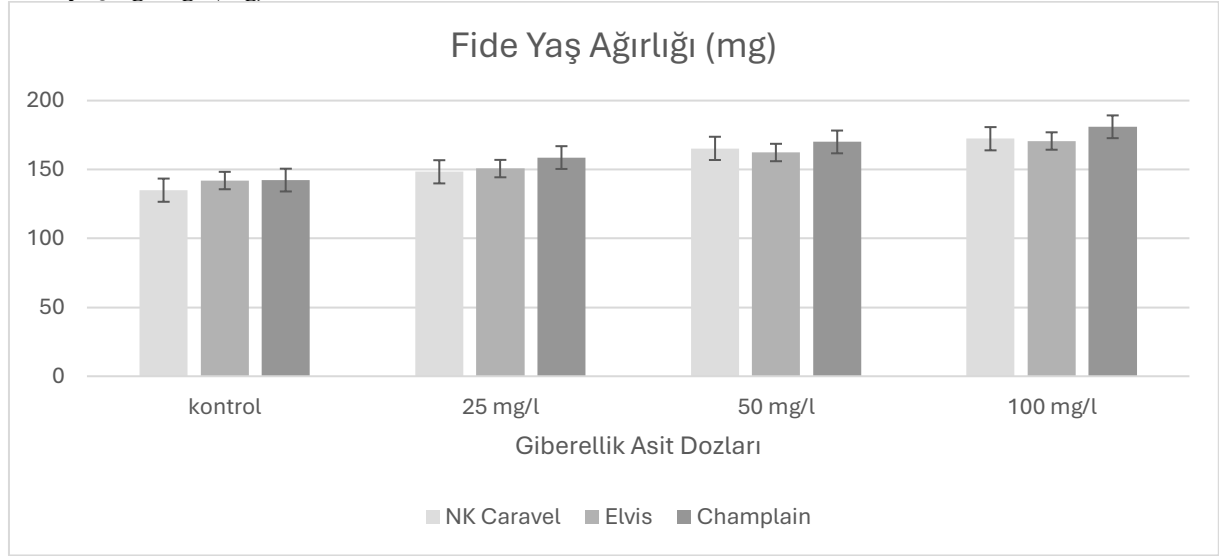
Şekil 2 incelendiğinde ise fide boyunun da giberellik asit dozları arttıkça uzama eğiliminde olduğu görülmektedir. En uzun fide boyu Elvis çeşidinde ve 100 mg/l dozunda belirlenmiştir. Bunun yanı sıra kontrole göre fide boyunun özellikle 100 mg/l dozunda uzama gösterdiği belirlenmiştir.

Kök boyu (cm)



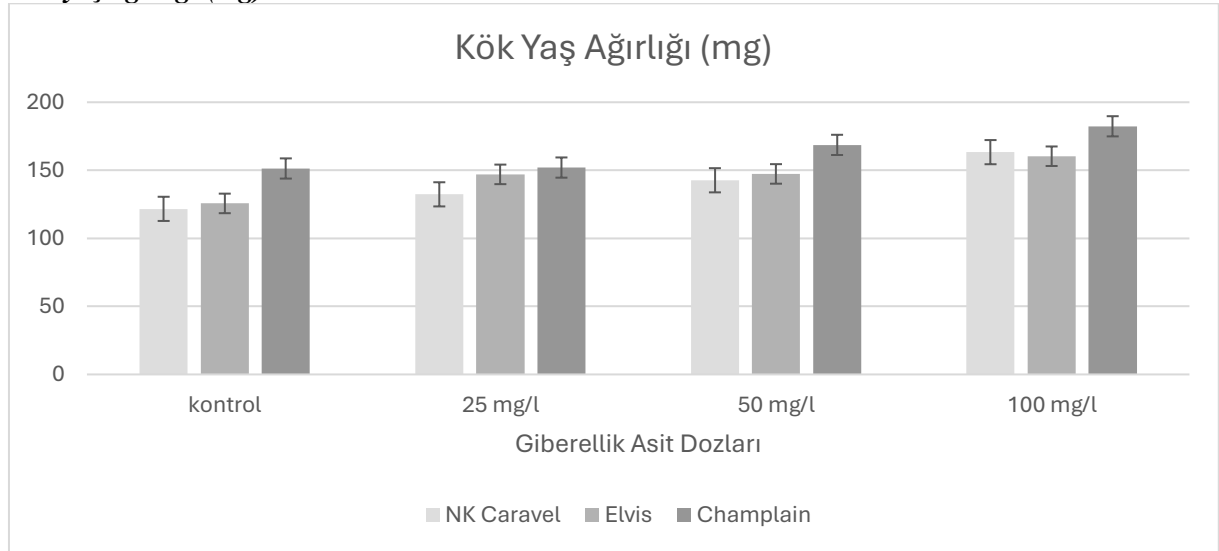
Şekil 3. Kolza çeşitlerine uygulanan giberellik asit dozlarının çimlenme ve fide gelişimine etkilerine ait ortalama değerler

Kök boyu (Şekil 3) grafiği incelendiğinde kontrole göre bütün giberellik asit dozlarında uzama olduğu belirlenmiştir. Bunun yanı sıra bütün uygulamalarda (kontrol dahil) Elvis çeşidinde kök boyunun en uzun olduğu belirlenmiştir. Diğer çeşitlerde de giberellik asitin dozu arttıkça kök boyunun uzadığı belirlenmiştir.

Fide yaş ağırlığı (mg)

Şekil 4. Kolza çeşitlerine uygulanan giberellik asit dozlarının çimlenme ve fide gelişimine etkilerine ait ortalama değerler

Şekil 4 incelendiğinde fide yaş ağırlığının uygulamaların dozlarının artışına paralel olarak artış gösterdiği belirlenmiştir. Bununla beraber deneme de kullanılan kolza çeşitlerinde en fazla fide yaş ağırlığı 100 mg/l dozunda belirlenmiştir. Çalışmada kullanılan çeşitlerden Champlain çeşidinde en fazla fide yaş ağırlığı belirlenmiştir.

Kök yaş ağırlığı (mg)

Şekil 5. Kolza çeşitlerine uygulanan giberellik asit dozlarının çimlenme ve fide gelişimine etkilerine ait ortalama değerler

Kök yaş ağırlığına ait ortalama değerler incelendiğinde (Şekil 5) kontrole göre bütün çeşitlerde giberellik asit uygulamasının dozları arttıkça artışlar olduğu belirlenmiştir. Bununla beraber 100 mg/l dozunda ve Champlain çeşidinde en fazla kök yaş ağırlığı saptanmıştır. Ancak kontrolle kıyaslandığında Elvis çeşidindeki artışın çok daha fazla olduğu belirlenmiştir.

TARTIŞMA

Bu çalışmada elde edilen bulgular giberellik asitin kolza çeşitlerinin çimlenme ve fide gelişimine olumlu etkide bulunduğunu göstermektedir. Li ve ark., (2010) kolza bitkisine kuraklık şartlarında giberellik asit uygulaması yaptıkları çalışmada stresin etkilerinin azaltılması ve çimlenmenin olumlu

yönde teşvik edilmesi bakımından giberellik asitin olumlu yönde etkide bulunduğunu bildirmişlerdir. Virtanen ve ark., (2013) patates çeşitlerine 2 farklı gelişme döneminde giberellik asit uygulaması yaptıkları çalışmada uygulamaların patatesteki yumru göz sayısını artırmada etkili olduğunu bildirmişlerdir.

Korkmaz ve ark., (2020) kolza çeşitlerine tuz stresi koşullarında giberellik ve salisilik asit uygulaması yaptıkları çalışmada kontrolde 10.62 cm olan ortalama bitki boyunun artan dozlarda GA₃ uygulamalarından olumlu yönde etkilendiğini ve 100 mg/l GA₃ uygulamasıyla %64 artış göstererek 17.42 cm'e ulaştığını bildirmişlerdir. Turan ve Samur (2024) kolza tohumlarına kuraklık stresi koşullarında ön uygulama şeklinde giberellik asit ve borik asit uygulaması yaptıkları çalışmada en uzun fide boyunun giberellik ait uygulamasından elde edildiğini bildirmişlerdir.

Gürsoy (2019b) aspir çeşitlerine giberellik asit uygulaması yaptığı çalışmada en kısa kök uzunluğunun kontrol uygulamasından, en uzun olanların ise 100mg/l ve 200mg/l giberellik asit uygulamalarından elde edildiğini bildirmiştir. Kök uzunluğunun fazla olması bitkilerin topraktan besin maddelerini almaları ve beslenmeleri açısından önemli olup, giberellik asit uygulamaları bu yönde teşvik edici etkide bulunmuştur (Gürsoy, 2019b). Çetinkaya ve ark., (2021) mısır tohumlarına ön uygulama şeklinde giberellik asit, alfa tokoferol ve askorbik asit uygulaması yaptıkları çalışmada uygulamaların 0.01 düzeyinde önemli fark oluşturduğunu bildirmişlerdir.

Nofouzi ve ark. (2015) pamuk tohumlarına ön uygulama şeklinde değişik uygulamalar yaptıkları çalışmada en yüksek fide yaş ağırlığının giberellik asit uygulamasından elde edildiğini bildirmişlerdir. Paşa (2024) *Salvia sclarea* L. bitkisine tuz stresi koşullarında giberellik asit ön uygulaması yaptığı çalışmanın sonucunda giberellik asit uygulamasının olumlu yönde etkileri olduğunu bildirmiştir. Özellikle 150 ppm dozunun en etkili düzey olduğunu belirlediğini bildirmiştir.

Gürsoy (2019b) aspir çeşitlerine giberellik asit uygulamaları yaptığı çalışmada en düşük kök yaş ağırlığını kontrolde, en yüksek ise 100 mg/l giberellik asit dozunda belirlediğini bildirmiştir. Matter ve ark., (2024) mısır çeşitlerine giberellik asit uygulaması yaptıkları çalışmada yüksek dozlarda giberellik asit uygulamasının fide gelişim parametreleri açısından olumlu sonuçlar verdiğini bildirmişlerdir.

SONUÇ

Kolza çeşitlerine giberellik asit uygulamalarının yapıldığı bu çalışmada incelenen özelliklerin hepsinde kontrole göre daha olumlu sonuçlar elde edilmiştir. Çalışmada kullanılan çeşitlerden Elvis çeşidi, uygulanan dozlardan ise 100 mg/l dozu daha etkili doz olarak belirlenmiştir. Ancak bu çalışma bir laboratuvar çalışması olup sera ve tarla koşullarında da denemeler yapılarak sonuçları değerlendirilmelidir.

KAYNAKLAR

- Arslan, M., Üremiş, İ., Çalışkan, S., Çalışkan, M. E. 2007. Bazı Kanola (*Brassica napus* ssp. *oleifera* L.) Çeşitlerinin Amik Ovası Koşullarında Yetiştirilebilme Olanaklarının Belirlenmesi, Türkiye 7. Tarla Bitkileri Kongresi 25-27 Haziran 2007, 597-599, Erzurum/Türkiye.
- Arslan, B., Culpan, E. 2022. Innovative Agricultural Practises in Soil, Plant and Environment. Kolza (Kanola) Yetiştiriciliği ve Islah Amaçları. Chapter:14437-458. İksad Yayınevi. Chapter:14437-458.
- Anğın, N., Vurarak, Y. 2012. Çukurova Bölgesine Uygun Kolza (*Brassica napus* L.) Çeşitlerinin Belirlenmesi. Tarım Bilimleri Araştırma Dergisi 5(1): 90-92.
- Başalma, D. 2004. Kışlık Kolza (*Brassica napus* ssp. *oleifera* L.) Çeşitlerinin Ankara Koşullarında Verim ve Verim Ögeleri Yönünden Karşılaştırılması. Tarım Bilimleri Dergisi 10(2):211-217. DOI: 10.1501/Tarimbil_0000000896.
- Çetinkaya, H., Akgün, M., Dinler, B., S. 2021. The Effects of Pretreatment of Giberellic Acid, Alpha Tocopherol and Ascorbic Acid on Germination in Maize Seeds. Global Journal of Science Frontier Research: C Biological Science 21(3):39-46.
- Düzgüneş, O., Kesici, T., Kavuncu, O., Gürbüz, F., 1987. Araştırma ve Deneme Metotları (İstatistik Metotları II). Ankara Üniversitesi Ziraat Fakültesi Yayınları:1021. 295 s. Ankara.
- Gürsoy, M., Nofouzi, F., Başalma, D. 2015. Ankara Koşullarında Kışlık Kolzada Uygun Ekim Zamanının Belirlenmesi. Tarla Bitkileri Merkez araştırma Enstitüsü Dergisi 24(2): 96-102.

- Gürsoy, M. 2016. The Role of Differential Humic Acid Levels on Quantative and Qualitive Characteristics of Summer Rapeseed Plant (*Brassica napus* ssp. *oleifera* L.): An Investigation of Leonardite under Ankara Conditions. PhD Thesis, 80 p
- Gürsoy M (2019a) Importance of Some Oil Crops in Human Nutrition. Turkish J Agriculture-Food Sci Technol.,7:2154–2158.
- Gürsoy, M. 2019b. Farklı Giberellik Asit Dozlarının Aspir (*Carthamus tinctorius* L.) Çeşitlerinin Çimlenme Özellikleri Üzerine Etkisi. Uluslararası Gıda, Tarım ve Hayvancılık Kongresi, Tam Metin Kitabı, 395-404. 19-22 Eylül 2019 Gaziantep/ Türkiye
- Gürsoy, M. 2022. Enhancing Germination Performance Early Seedling Growth Chlorophyll Stability Index and Salt Tolerance Percentage of Safflower (*Carthamus tinctorius* L.) Seeds by Application Different Plant Growth Regulators under Salinity Stress. *Agrociencia* 56(1): 82-92.
- Gürsoy, M. 2024. Alone or Combined Effect of Seaweed and Humic Acid Applications on Rapeseed (*Brassica napus* L.) under Salinity Stress. *J Soil Sci Plant Nutr* 24, 3364–3376. <https://doi.org/10.1007/s42729-024-01759-0>.
- Huang X, He R, Liao X, Zhou B, Peng W, Lin J, Liu XM. 2014. Effect of Exogenous Gibberellin on Reserve Accumulation During the Seed Filling Stage of Oilseed Rape. *Genetics and Molecular Research*. 13(2):2827-2839.
- ISTA. 2003. International Rules for Seed Testing. International Seed Testing Association Switzerland.
- Korkmaz, K., Akgün, M., Kırılı, A., Özcan, M., M., Dede, Ö., Kara, Ş., M. 2020. Effects of Gibberellic Acid and Salicylic Acid Applications on Some Physical and Chemical Properties of Rapeseed (*Brassica napus* L.) Grown Under Salt Stress. *Turkish Journal of Agriculture - Food Science and Technology*, 8(4), 873–881. <https://doi.org/10.24925/turjaf.v8i4.873-881.3044>.
- Li, Z., Lu, G.,Y., Zhang, X.,K., Zou, C.,S., Cheng, Y., Zheng, P.,Y. 2010. Improving Drought Tolerance of Germination Seeds by Exogenous Application of Gibberellic Acid (GA₃) in Rapeseed (*Brassica napus* L.), *Seed Science and Technology*, 38(2):432-440.
- Matter, H., M., A., H., Ahmed, B., E., A., M., Idris, A., O., A. 2024. Germination Indices and Seedling Growth Parameters in Maize under Salinity Stress With Varying Concentrations of Gibberellic Acid (GA). *Asian Journal of Advances in Agricultural Research* 24(6):82-88. <https://doi.org/10.9734/ajaar/2024/v24i6515>.
- Nofouzi, F., Gürsoy, M., Başalma, D. 2015. Pamukta (*Gossypium hirsutum* L.) Uygulanan Farklı Priming İşlemleri ve Değişik Tuz Konsantrasyonlarının Çimlenme ve Erken Fide Gelişimine Etkisi. 11. Tarla Bitkileri Kongresi, Bildiriler Kitabı syf: 213, 7-10 Eylül 2015, Çanakkale.
- Novita, A., 2017. Respons of Gibberellic Acid and Salicylic Acid Under Salt Stress on Roselle (*Hibiscus sabdarifa* L.). *Agrosamudra Jurnal Penelitian* 4(2) Jul–Des.
- Paşa, C. 2024. Effect of salt (NaCl) stress on germination in clary sage (*Salvia sclarea* L.) subjected to gibberellic acid pre treatment. *International Journal of Nature and Life Sciences*, 8 (1), 17-22.
- Siddiqi E, Ashraf M, Aisha AN (2007). Variation in seed germination and seedling growth in some diverse line of safflower (*Carthamus tinctorius* L.) under salt stress. *Pak J Bot.*, 39:1937-1944.
- Turan, F., Samur, S. 2024. Kolza (*Brassica napus* L.) Tohumuna Borik Asit ve Gibberellik Asit Ön Uygulamalarının Kuraklık Stresine Karşı Etkisinin İncelenmesi. *ISPEC Tarım Bilimleri Dergisi*, 8(3): 756-765. DOI: <https://doi.org/10.5281/zenodo.12788918>.
- Virtanen, E., Haggman, H., Degefu, Y., Valimaa, A., Seppanen, M. 2013. Effects of Production History and Gibberellic Acid on Seed Potatoes. *Journal of Agricultural Science*, 5(12):148-153.

**PATOJEN GIDA KONTAMİNANTLARI ÜZERİNE ENKAPSÜLE MİSK ADAÇAYI
YAĞININ ETKİSİ
EFFECT OF ENCAPSULATED CLARY SAGE OIL ON PATHOGENIC FOOD
CONTAMINANTS**

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ÖZET

Gıdalarda bulunan mikrobiyal patojenler, gıda zehirlenmeleri ve gıda kaynaklı hastalıkların başlıca etmenidir. Son yıllarda, gıda endüstrisinde, patojen mikroorganizmaların gelişimini durdurmak amacı ile yeni gıda koruyucuları olarak işlev görecektir doğal bileşiklerin incelenmesine yönelik çalışmalar oldukça popülerdir. Misk adaçayı (*Salvia sclarea*) *Lamiaceae* familyasına ait, anavatanı Akdeniz Bölgesi olan tıbbi değerli bir bitkidir. Bu çalışmadaki amacımız, misk adaçayı yağının antimikrobiyal aktivitesi üzerine enkapsülasyon teknolojisinin etkisini incelemektir. Enkapsülasyon işleminde dört polimer kullanılmıştır; maltodekstrin (MD), sodyum kazeinat (SK), gam arabik (GA) ve jelatin (J). Misk adaçayı yağı dört farklı kabuk materyalin üç farklı kombinasyonda (MD-SK, MD-SK-GA ve MD-SK-J) formüle edilmesi ile oluşan duvar materyallerinde enkapsüle edilmiş ve dondurarak kurutulmuştur. Duvar materyal formülasyonlarının enkapsülasyon etkinliği ve antimikrobiyal aktivite üzerine etkisi incelenmiştir. En yüksek enkapsülasyon etkinliği MD-SK (%80.78) formülasyonunda belirlenirken, bunu MD-SK-GA (%71.58) formülasyonu takip etmiştir. MD-SK-J (%68.12) kabuk formülasyonu ise en düşük enkapsülasyon etkinliği değerine sahip olmuştur. Serbest ve enkapsül formda misk adaçayı yağının antimikrobiyal aktivitesi broth mikrodilüsyon tekniği ile üç Gram negatif, üç Gram pozitif bakteri ve iki mayaya karşı test edilmiştir. *Bacillus cereus* (2.5 mg/mL Minimum İnhibitör Konsantrasyonu, MİK) hem serbest hem de enkapsüle misk adaçayı yağına karşı en hassas bakteri olarak belirlenmiştir. Test edilen Gram pozitif bakterilerin Gram negatif bakterilere kıyasla misk adaçayı yağına (serbest ve enkapsül formlarda) karşı daha dirençli oldukları belirlenmiştir. Misk adaçayı yağının her iki formda da test edilen mayalar üzerinde etki göstermediği gözlemlenmiştir. Ayrıca enkapsül formdaki misk adaçayı yağının serbest forma kıyasla test edilen tüm bakteriler üzerinde daha yüksek MİK değerlerine sahip olduğu belirlenmiştir.

Anahtar kelimeler: Misk adaçayı yağı, Enkapsülasyon, Antimikrobiyal aktivite, Gıda patojenleri

ABSTRACT

Microbial pathogens in foods are known to cause foodborne illnesses and food poisoning. In recent years, studies examining natural compounds as new food preservatives to prevent decay and the development of pathogenic microorganisms in the food industry have become very popular. Clary sage (*Salvia sclarea*) is a medicinally valuable plant belonging to the *Lamiaceae* family, native to the Mediterranean region. This study aimed to investigate the effect of encapsulation on antimicrobial activity of clary sage oil. Four polymers were used as wall materials in the encapsulation process; maltodextrin (MD), sodium caseinate (SC), gum arabic (GA) and Gelatin (G). Clary sage oil encapsulated with three different wall material formulations (MD-SC, MD-SC-GA and MD-SC-G) and obtained capsules were freeze-dried. The effect of wall material formulation on encapsulation efficiency and antimicrobial capacity were investigated. The highest encapsulation efficiency was determined in MD-SC formulation (%80.78), followed by MD-SC-GA capsule (%71.58). Whereas MD-SC-G capsule formulation was showed the lowest encapsulation efficiency (%68.12). Antimicrobial activities of free and encapsulated clary sage oil were investigated against three Gram positive bacteria, three Gram negative

bacteria and two yeasts with broth microdilution technique. *Bacillus cereus* (2.5 mg/mL Minimum Inhibitory Concentration, MIC) was determined most sensitive bacteria against both free clary sage oil and its encapsule. Tested Gram negative bacteria were more resistance against clary sage oil (free and encapsule forms) than tested Gram positive bacteria. It was observed that clary sage oil (free or encapsule forms) did not exhibit antifungal effects on yeasts. Also, encapsulated clary sage oil had higher MIC value than free clary sage oil for all tested bacteria

Keywords: Clary sage oil, Encapsulation, Antimicrobial activity, Food pathogens

GİRİŞ

Gıdalardaki mikrobiyal patojenler gıda kaynaklı hastalıklar ve gıda zehirlenmeleri etmeni olarak bilinmektedir. *Staphylococcus aureus*, *Enterococcus* spp. gibi çoklu ilaç direncine sahip süper bakterilerin ortaya çıkışı bahsi geçen gıda kaynaklı hastalıklara yakalanma insidansını arttırmıştır. Gıda güvenliğinden emin olmak adına tanımlanmış miktarlarda kimyasal koruyucular kullanılmaktadır. Ancak bu koruyucuların uzun dönem kullanımı insanlar için potansiyel sağlık sorunlarını da beraberinde getirmektedir. Gıda bozulma etmeni ya da patojen mikroorganizmaları inhibe etmek ya da inaktive etmek amacı ile kullanılan sentetik antimikrobiyal ajanlar ve kimyasal koruyucuların kullanımını azaltmak ve bunlara yeni alternatifler araştırmak öncelikli konular arasında yer almaktadır. Son yıllarda gıda endüstrisinde çürüme ve patojen mikroorganizma gelişimini engellemek amacı ile yeni gıda koruyucuları olarak doğal bileşiklerinceleyen çalışmalar oldukça popülerite kazanmıştır (da Silva vd., 2021).

Keskin aroma bileşenleri içeren baharatlar ve doğal bitkisel ürünler gıdalarda aroma arttırıcısı olarak yaygın kullanılmaktadır. Ayrıca baharat ekstraktları ve yağlarının gıda güvenliğini arttırmaya yardım ettiği görülmüştür. Yapılan çalışmalarda keskin kokuya sahip bitkilerin güçlü bir uçucu yağ kaynağı olduğu bildirilmiştir (Diniz do Nascimento vd., 2020). Esansiyel yağlar uçucu sekonder metabolitlerdir. Meyve, çiçek, çekirdek, yaprak, kök gibi bitkinin farklı kısımlarından elde edilebilir. Bitki özütlerinin %1 ile %17 gibi değişken oranını oluşturan uçucu yağlar biyolojik olarak aktif bileşikler olarak bilinmekle birlikte içerik olarak monoterpenler, fenolik asitler, alkaloidler, flavonoidler, karotenoidler ve aldehitler başta olmak üzere farklı kimyasal grupları içermektedirler (Li vd., 2022). Misk adaçayı (*Salvia sclarea*) *Lamiaceae* ailesine ait, anavatanı Akdeniz bölgesi olan bir bitkidir. Bitkinin içerdiği fitokimyasallar başta antimikrobiyal ve antioksidan etki olmak üzere birçok farmakolojik etki sergilemektedir (Cui vd., 2015).

Son yıllarda, uçucu yağlar meyve suyu, süt, peynir, tavuk, sosis ve balık gibi oldukça farklı çeşitte gıda ürünlerinde koruyucu olarak kullanılmaktadır. Ancak, düşük su çözünürlükleri, kararsız yapıları ve güçlü bir kokuya sahip olmaları nedeni ile gıda ürünlerinde uygulamaları ve koruyucu olarak değerlendirilmeleri oldukça sınırlıdır. Bu probleme farklı çözüm önerileri getirilmiş ve aralarında uygulamada en avantajlı olanın enkapsülasyon teknolojisi olduğuna karar verilmiştir (Lorenzo vd., 2014). Enkapsülasyon maskeleyme, stabilite probleminin giderilmesi ve doğru yerde doğru zamanda salınım gibi birden fazla amaç için kullanılan, tutuklama tekniğidir. Enkapsülasyon teknolojisinde tutuklanan maddeye merkez, çekirdek, öz, doğu, aktif madde gibi farklı terimler verilebiliyorken, tutuklayan maddeye ise kabuk, zar, taşıyıcı, duvar ya da matriks terimleri kullanılabilir (Zuidam ve Shimoni, 2010).

Bu çalışmada amacımız tıbbi değeri olan bitkilerden misk adaçayı yağının gıda patojen kontaminantlarına karşı antimikrobiyal aktivitesi üzerine enkapsülasyon işleminin etkisini belirlemektir.

MATERYAL VE METOT

Materyal

Bu çalışmada misk adaçayı (*Salvia Sclarea*) yağı ticari olarak Monoville (Aydın/Türkiye) firmasından satın alınmıştır. Misk adaçayı yağı kullanılıncaya kadar buzdolabında +4 C'de muhafaza edilmiştir. Kabuk materyal olarak Matodekstrin, sodyum kazeinat, gam arabik ve jelatin Sigma-Aldrich (Steinheim, Germany) den, Brain Hearth Infusion Broth (BHI), Sabouraud Dextrose Broth (SD), Mueller Hinton Broth (MH), Dimethyl Sulfoxide (DMSO), hekzan Merck (Darmstadt, Germany) firmasından temin edilmiştir.

Misk Adaçayı Yağının Enkapsülasyonu

Misk adaçayı yağının enkapsülasyonu Hee vd. (2015) önerdiği yöntemde hafif değişiklikler yapılarak gerçekleştirilmiştir. Duvar materyal formülasyonu Tablo 1'de verilen şekilde hazırlanmıştır. Kapsül üretiminde kullanılacak duvar materyallerinin tam çözünmesini sağlamak amacı ile Tablo 1'de önerilen

konsantrasyonda saf su ile çözeltiler hazırlanmış ve bir gece oda sıcaklığında manyetik karıştırıcı yardımı ile karıştırılmıştır. Emülgatör olarak Tween 80 kullanılmıştır. Toplam katı madde oranı (misk adaçayı yağı, duvar materyal ve emülgatör) %30 olacak şekilde enkapsülasyon karışımı hazırlanmıştır. Emülgatör içeren (%1) duvar materyal çözeltilisine merkez materyal (toplam katı madde oranının %40'ı olacak şekilde) eklendikten sonra yüksek hızda karıştırıcı (Ultra turax, T18, IKA-WERKE GmbH, Staufen, Germany) ile 15.500 rpm de 5 dk karıştırılmış ve dondurarak kurutucu ile (-40 °C, 24 saat, Buchi, Lyovapor L-200) toz forma dönüştürülmüştür.

Tablo 1. Misk adaçayı enkapsülasyonunda kullanılan duvar materyal formülasyonu

Formülasyon (%)	MD-SK	MD-SK-GA	MD-SK-J
Misk adaçayı yağı	12	12	12
Su	70	70	70
Maltodekstrin (MD)	13	10	10
Sodyum kazeinat (SK)	4	3.5	3.5
Gum arabik (GA)	-	3.5	-
Jelatin (J)	-	-	3.5
Tween 80	1	1	1

Enkapsülasyon Etkinliği

Enkapsüllerin yüzey yağ miktarını belirlemek için sokselet aparatı kullanılmıştır. Beş gram toz formdaki enkapsül sokselet kartuşuna tartıldıktan sonra 250 mL hekzan ile 3 saat sokselet düzeneğinde yıkanmıştır. Süre sonunda alınan hekzan rotary vacuum evaporatör ile uzaklaştırılmış, gravimetrik olarak yüzey yağ miktarı tartılmıştır. Toplam yağ miktarı Clevenger aparatı yardımı ile belirlenmiştir. Enkapsülasyon etkinliği toplam yağ ve yüzey yağ miktarlarının kullanıldığı aşağıda verilen formül yardımı ile hesaplanmıştır (Turasan vd., 2015).

$$\text{Enkapsülasyon etkinliği (\%)} = \frac{\text{Toplam yağ} - \text{Yüzey yağ}}{\text{Toplam yağ}} \times 100$$

Antimikrobiyal Aktivite Testi

Mikrobiyal suşlar ve büyüme ortamları

Misk adaçayı yağının serbest ve enkapsül formlarının antimikrobiyal aktivitesi en düşük inhibitor konsantrasyonu (MIC) testi temelinde değerlendirilmiştir. Testte üç Gram negatif bakteri, üç Gram pozitif bakteri ve iki maya kullanılmış, kullanılan suşlar Refik Saydam Hifzısıhha Merkezi (RS) ve Amerikan Tip Kültür Koleksiyonu (ATCC) dan temin edilmiştir. Antimikrobiyal denemede kullanılan test organizmaları; *Escherichia coli* (ATCC 25922), *Salmonella enterica subsp. enterica sv.* Enteritidis (ATCC 13076), *Shigella flexneri* (RS No 184), *Staphylococcus aureus* (RS No 1020/06008), *Bacillus cereus* (RS No 869), *Streptococcus mutans* (ATCC No 25175), *Saccharomyces cerevisiae* (RS No 08022) ve *Candida albicans* (ATCC No: 90028). Bakteriler Brain Heart Infusion Broth (BHI) da 37°C'de 24 saat süre ile aktifleştirilmiş, mayalar ise Sabouraud Dextrose broth (SDB) da 27°C'de 48 saat aktifleştirilmiştir. Antimikrobiyal denemelerde kullanılan test organizmalarının süspansiyon konsantrasyonları yaklaşık 1×10^6 koloni oluşturma birimi (kob)/mL olacak şekilde ayarlanmıştır.

Minimum İnhibitör Konsantrasyonu (MIK)

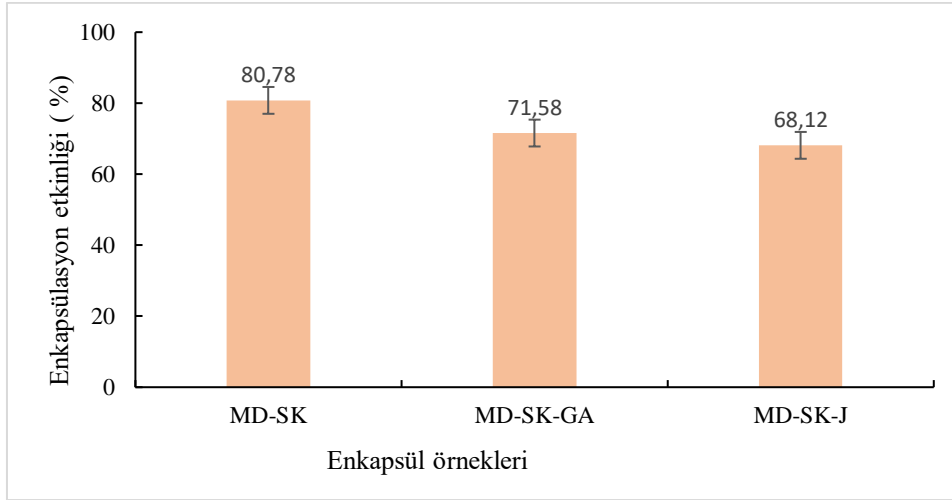
Mikrobiyal gelişimin olmadığı en düşük etken madde konsantrasyonu olan MIK testinde bakteriler için Mueller Hinton Broth, mayalar için SDB kullanılmış, testte kullanılacak misk adaçayı yağının test ortamına tam dağılımını sağlamak amacı ile dimethyl sulfoxide (DMSO) kullanılmıştır. Antimikrobiyal denemelerde kullanılan DMSO'nun test edilen mikroorganizmalar üzerinde toksik etki göstermediği doz (%10) ön denemelerde belirlenmiş ve bu doz testte kullanılmıştır. Taze aktifleştirilmiş organizma ve çalışılan organizmaya uygun besiyeri içeren test tüplerine serbest formda misk adaçayı yağı iki katı konsantrasyon olacak şekilde (1.25 mg/mL'dan 40 mg/mL'e) tartılmıştır. Etkinlik testi temelinde serbest misk adaçayı yağı ile aynı miktarlarda enkapsül içeren toz formda enkapsül örnekleri hesaplanmış, steril test tüplerine tartımlar alındıktan sonra test tüplerine besiyeri ve mikroorganizma eklenmiştir. Ayrıca çalışılan mikroorganizmanın dirençli bir organizma olmadığını belirlemek amacı ile

pozitif kontrol olarak standart antimikrobiyal ajanlar; Ampisilin ve Tetrasiklin ($\geq 99\%$, Sigma-Aldrich, Steinheim, Germany) kullanılmıştır. Negatif kontrol olarak ise DMSO içeren ve içermeyen içerisinde sadece mikroorganizma ve besiyerinin bulunduğu test tüpleri hazırlanmıştır. Tüm test tüpleri bakteriler için $37\text{ }^{\circ}\text{C}$ 'de 24 saat, mayalar için $27\text{ }^{\circ}\text{C}$ 'de 48 saat inkübasyona bırakıldıktan sonra test tüplerinde mikrobiyal faaliyeti gözlemek amacıyla indikatör kullanılmıştır. İndikatör olarak 0.2 mg/mL *p*-iodonitrotetrazolium violet (INT; Sigma-Aldrich) kullanılmış ve test tüplerindeki renk gelişimine bağlı olarak MİK konsantrasyonu belirlenmiştir (Eloff, 2001).

BULGULAR VE TARTIŞMA

Enkapsülasyon Etkinliği

Enkapsülasyon etkinliği değeri enkapsülasyon işleminin başarısını ölçmede önemli bir indekstir. Misk adaçayı yağının enkapsülasyon işleminde üç farklı kombinasyonda (MD-SK, MS-SK-GA ve MD-SK-J) duvar malzemesi formüle edilmiştir. Enkapsüller arasında en yüksek etkinlik değeri MD-SK (%80.78) formülasyonunda belirlenirken bunu MD-SK-GA (%71.58) takip etmiş, MD-SK-J (%68.12) formülasyonu ise test edilen formülasyonlar arasında en düşük etkinlik değerine sahip olmuştur. Misk adaçayı yağının maltodekstrin ve gam arabik ile enkapsüle edildiği bir çalışmada etkinlik değerleri sırası ile %94.1, 98.6 olarak bildirilmiştir (Aytemur, 2017). Literatürde benzer duvar malzemeleri ile yapılan enkapsüllerde duvar malzemesinin çözünürlüğü ve emülsifikasyon yeteneğinin doğrudan enkapsül etkinliğini belirlediği rapor edilmiştir (Hee vd., 2015). En düşük etkinliğin belirlendiği formülasyonun (MD-SK-J) bileşeni olan jelatinin bahsi geçen özellikleri taşıması nedeni ile enkapsülasyon başarısını olumsuz etkilediği düşünülmektedir. Hee vd. (2015) MD-SK duvar materyal formülasyonunun diğer duvar materyal kombinasyonlarına (MD, SK, GA, J, WPC) kıyasla daha yüksek enkapsülasyon etkinliği elde edildiğini bildirmişlerdir.



Şekil 1. Enkapsülasyon etkinlik değerleri

Antimikrobiyal Aktivite

Tıbbi değeri olan bitkiler başta antimikrobiyal aktivite olmak üzere pek çok fonksiyonel özelliğe sahiptir. Tablo 2'de görüldüğü gibi misk adaçayı yağı test edilen Gram pozitif bakteriler ($2.5\text{--}5\text{ mg/mL}$ MİK) üzerinde Gram negatif bakterilere ($10\text{--}40\text{ mg/mL}$ MİK) kıyasla daha yüksek etkinlik sergilemiştir. Bhatia vd. (2024) guar gam ve kalsiyum kazeinat ile misk adaçayı yağı kullanarak biyobozunur filmler hazırlamışlar ve elde ettikleri filmlerin *Pseudomonas aeruginosa*, *Staphylococcus aureus*'a karşı antimikrobiyal etkinliğini incelemişlerdir. Araştırmacılar %0.2 misk adaçayı yağı içeren filmlerin Gram negatif bakteriye kıyasla Gram pozitif bakteri üzerine daha yüksek aktivite sergilediğini bildirmişlerdir (Bhatia vd., 2024). Adaçayı yağının antimikrobiyal etkinliğini inceleyen bir başka çalışmada Gram pozitif bakterilerin (*B.cereus*; 2.94 mg/mL , *B.subtilis* 5.88 mg/mL), Gram negatif bakterilere (*E.coli* ; 11.75 mg/mL , *S.typhimurium*; 23.5 mg/mL) kıyasla adaçayı yağına daha yüksek hassasiyet gösterdiği rapor edilmiştir (Özçoban ve Gedikoğlu, 2024).

Bitkisel yağların antimikrobiyal potansiyeli kimyasal kompozisyonlarına bağlıdır, hatta bazen kimyasal bileşenler sinerjistik etki de sergileyebilir. Antimikrobiyal aktivite etken maddenin, kimyasal bileşimdeki reaktif fonksiyonel grupların mikroorganizmaya ulaşabilmesi esas teşkil etmektedir (Burt, 2004).

Yapılan çalışmalarda adaçayı yağının bileşiminin yarısından fazlasının linalyl acetat tan oluştuğu bildirilmiştir (Aytemur, 2017). Adaçayı yağının linalool ve linalyl acetat gibi monoterpenoid varlığı sergilediği antimikrobiyal aktivitenin öncelikli sebepleridir (Bhatia vd., 2024; Carson ve Riley, 1995). Söz konusu bileşiklerin hidrofobik doğası hücre membran lipidleri ile etkileşimi mümkün kılmakta ve membran permeabilitesinde değişiklikler sonucunda da hücre ölümü gerçekleşmektedir. Linalyl acetate hidrofobik etkileşimler sayesinde membran proteinlerini kullanarak mikrobiyal hücrelerden içeriye de girmektedir. Mikrobiyal hücrenin dış membranının disintegrasyonu ile membran permeabilitesi derin tahribata uğramakta ve lipopolisakkarit salınımı gerçekleşmektedir. Ayrıca yağ kimyasal bileşenleri ATP seviyelerinde değişime neden olmakta, bunun sonucunda stoplazmik pH düşmektedir. Tüm bu etkiler adaçayı yağının antimikrobiyal aksiyonuna katkıda bulunmaktadır (Bhatia vd., 2024).

Çalışma sonuçlarımızda hem Gram pozitif hem de Gram negatif bakteriler için misk adaçayı yağı serbest formda enkapsül forma kıyasla daha yüksek antimikrobiyal etki sergilemiştir. Literatür verileri değerlendirildiğinde, sonuçlarımızla uyumlu olarak, enkapsülasyon işlemi ile antimikrobiyal aktivitesi azalan (Radünz vd., 2019) ya da bizim sonuçlarımızın aksine enkapsülasyon işlemi ile antimikrobiyal aktivitesi artan (Mondéjar-López vd., 2022) çalışmalar bulunmaktadır. Serbest ve enkapsül form antimikrobiyal aktivite sonuçlarındaki bu farklılığın merkez ve duvar materyalleri arasındaki bağlanmanın kuvvetine, merkez ve duvar materyalinin karakteristik özelliklerine, enkapsül üretim prosesine, enkapsül partikül boyutuna bağlı olarak değiştiği bildirilmiştir (Radünz vd., 2019).

SONUÇ

Bu çalışmada misk adaçayı yağı üç farklı duvar materyal formülasyonu (MD-SK, MD-SK-GA ve MD-SK-J) ile enkapsüle edilmiş, dondurarak kurutulmuştur. Elde edilen enkapsüllerin etkinlik değerleri ile kapsülasyon başarısı belirlenmiştir. MD-SK (%80.78) en yüksek etkinlik değeri ile en başarılı formülasyon olarak belirlenmiştir. MD-SK-GA (%71.58) ve MD-SK-J (%68.12) daha düşük etkinlik değerleri sergilemiştir. Misk adaçayı yağının gıda patojen kontaminantlarına karşı antimikrobiyal aktivitesi toplamda sekiz mikroorganizmaya karşı test edilmiştir. Gram pozitif bakterilerin Gram negatif bakterilere kıyasla misk adaçayı yağına daha yüksek hassasiyet gösterdikleri gözlemlenirken, en hassas bakteri *B.cereus* (2.5 mg/mL MIK) olarak belirlenmiştir. Test edilen mayaların misk adaçayı yağının serbest ve enkapsül formundan etkilenmediği tespit edilmiştir. Misk adaçayı yağının antimikrobiyal aktivitesinde enkapsülasyon işlemi ile belirgin bir kayıp yaşandığı öne çıkan bir diğer sonuçtur.

Tablo 2. Serbest ve enkapsüle misk adaçayı yağının antimikrobiyal aktivite sonuçları

*: Gelişme var

Antimikrobiyal aktivite sonuçları (MIC, mg/mL)											
Mikroorganizma	Misk Adaçayı Yağı	Dolu Mikrokapsül		Boş Mikrokapsül		Pozitif kontrol, (µg/mL)		Negatif kontrol			
		MD-SK	MD-SK-GA	MD-SK-J	MD-SK	MD-SK-GA	MD-SK-J		Tetrasiklin	Ampisilin	
Gram negatif	<i>Escherichia coli</i>	10	20	>40	>40	>40	>40	>40	1.56	12.5	+*
	<i>Salmonella spp.</i>	20	40	>40	>40	>40	>40	>40	1.56	3.12	+
	<i>Shigella flexneri</i>	40	>40	>40	>40	>40	>40	>40	3,12	12.5	+
Gram pozitif	<i>Bacillus cereus</i>	2.5	5	20	>40	>40	>40	>40	1.56	3.12	+
	<i>Staphylococcus aureus</i>	5	10	20	>40	>40	>40	>40	1.56	3.12	+
	<i>Streptococcus mutants</i>	5	10	20	>40	>40	>40	>40	1,56	1.56	+
Maya	<i>Saccharomyces cerevisiae</i>	>40	>40	>40	>40	>40	>40	>40	Test edilmedi		+
	<i>Candida albicans</i>	>40	>40	>40	>40	>40	>40	>40	Test edilmedi		+

KAYNAKÇA

- Aytemur E. (2017). Adaçayı yağının püskürtmeli kurutucu ile enkapsülasyonuna taşıyıcı malzemelerin etkisi. İstanbul Teknik Üniversitesi Fen Bilimleri Enstitüsü Gıda Mühendisliği Anabilim dalı Yüksek Lisans Tezi, İstanbul, Türkiye, 51 s.
- Bhatia, S., Shah, Y. A., Al-Harrasi, A., Alhadhrani, A. S., ALHashmi, D. S. H., Jawad, M., Dıblan, S., Al Dawery, S. K. H., Esatbeyoglu, T., Anwer, M.K., Koca, E., & Aydemir, L. Y. (2024). Characterization of biodegradable films based on guar gum and calcium caseinate incorporated with clary sage oil: Rheological, physicochemical, antioxidant, and antimicrobial properties. *Journal of Agriculture and Food Research*, 15, 100948.
- Burt, S. (2004). Essential oils: their antibacterial properties and potential applications in foods—a review. *International journal of food microbiology*, 94(3), 223-253.
- Carson, C. F., & Riley, T. V. (1995). Antimicrobial activity of the major components of the essential oil of *Melaleuca alternifolia*. *Journal of applied bacteriology*, 78(3), 264-269.
- Cui, H., Zhang, X., Zhou, H., Zhao, C., & Lin, L. (2015). Antimicrobial activity and mechanisms of *Salvia sclarea* essential oil. *Botanical studies*, 56, 1-8.
- da Silva, D. A. M., Fernandes, M. S., Endo, E. H., Vital, A. C. P., Britta, E. A., Favero, M. E., Castro, J. C., Matumoto-Pintro, P. T., Dias Filho, B. P., Nakamura, C. V., Machinski Junior, M., mikcha, J. M. G., & de Abreu Filho B. A. (2021). Control of the growth of *Alicyclobacillus acidoterrestris* in industrialized orange juice using rosemary essential oil and nisin. *Letters in Applied Microbiology*, 72(1), 41-52.
- Diniz do Nascimento, L., Moraes, A. A. B., Costa, K. S. D., Pereira Galucio, J. M., Taube, P. S., Costa, C. M. L., Cruz, J. N., Andrade, E. H. A. A., & Faria, L. J. G. (2020). Bioactive natural compounds and antioxidant activity of essential oils from spice plants: New findings and potential applications. *Biomolecules*, 10(7), 988.
- Eloff, J. N. (2001). Antibacterial activity of Marula (*Sclerocarya birrea* (A. rich.) Hochst. subsp. *caffra* (Sond.) Kokwaro) (Anacardiaceae) bark and leaves. *Journal of ethnopharmacology*, 76(3), 305-308.
- Hee, Y.Y., Tan, C.P., Abdul Rahman, R., Adzahan, N.M., Lai W.T., & Chong, G.H. (2015). Influence of different wall materials on the microencapsulation of virgin coconut oil by spray drying. *International journal of food engineering*, 11(1), 61-69.

- Li, Y. X., Erhunmwunsee, F., Liu, M., Yang, K., Zheng, W., & Tian, J. (2022). Antimicrobial mechanisms of spice essential oils and application in food industry. *Food Chemistry*, 382, 132312.
- Lorenzo, J. M., Batlle, R., & Gómez, M. (2014). Extension of the shelf-life of foal meat with two antioxidant active packaging systems. *LWT-Food Science and Technology*, 59(1), 181–188.
- Mondéjar-López, M., López-Jimenez, A.J., García Martínez, J.C, Ahrazem, O., Gómez- Gómez, I., & Niza, E. (2022). Comparative evaluation of carvacrol and eugenol chitosan nanoparticles as eco-friendly preservative agents in cosmetics. *International Journal of Biological Macromolecules*, 206, 288-297.
- Özçoban, A., & Gedikoğlu, A. (2024). *Salvia officinalis* L. Esansiyel Yağının Antimikrobiyal ve Antioksidan Aktivite Potansiyelinin Değerlendirilmesi. *Adnan Menderes Üniversitesi Ziraat Fakültesi Dergisi*, 21(1), 89-94.
- Radünz, M., da Trindade, M. L. M., Camargo, T. M., Radünz, A. L., Borges, C. D., Gandra, E. A., & Helbig, E. (2019). Antimicrobial and antioxidant activity of unencapsulated and encapsulated clove (*Syzygium aromaticum*, L.) essential oil. *Food chemistry*, 276, 180-186.
- Turasan, H., Sahin, S., & Sumnu, G. (2015). Encapsulation of rosemary essential oil. *LWT-Food Science and Technology*, 64(1), 112-119.
- Zuidam, N.J., & Shimoni, E., (2010). Overview of Microencapsulates for Use in Food Products or Processes and Methods to Make Them, *Encapsulation Technologies for Active Food Ingredients and Food Processing* (Chapter 2, pp. 3-29).

ŞİZOFRENİ TANILI BİREYLERİN BİLİŞSEL DEĞERLENDİRMELERİ İLE ÖZGÜR İRADE VE BELİRLENİMCİLİKLERİ SOSYAL İŞLEVSELLİKLERİNİ NASIL ETKİLER ?

HOW DO COGNITIVE APPRAISALS, FREE WILL AND DETERMINISM AFFECT THE SOCIAL FUNCTIONING OF INDIVIDUALS WITH SCHIZOPHRENIA?

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ABSTRACT

Studies on how cognitive evaluation, specific will and determinism levels of individuals with mental illnesses such as schizophrenia may affect their social functioning levels are important. In schizophrenia, the negative impact of the social ability pattern has a significant impact on the disease process of the individual due to the fact that the disease course can be accurately predicted in the long process, which usually extends before the preliminary stages of the disease. Social ability in schizophrenia is affected by positive and negative findings, mental state, social behavior and environmental factors. Social behavior is determined by social perception and cognitive abilities. Social perception is the ability to comprehend the current conditions in any social event and markers such as the emotional feedback of others. In individuals with schizophrenia, problems have been found in the comprehension of social symptoms and in understanding the emotional reflection of the expressions on the faces of individuals; illusions in the perception of the outward reflection of emotion on the face have been associated with impaired social ability pattern. Social behavior is selected by social perception and cognitive abilities. Cognitive assessment of patients with schizophrenia is significantly impaired in areas such as verbal memory, attention, processing speed and executive function. It is thought that the levels of free will and determinism greatly affect the evaluation of schizophrenia patients. Whether individuals diagnosed with schizophrenia will approach the diagnosis of schizophrenia as a result of free will or determinism, which is a fatalistic approach, affects cognitive evaluation and social functioning. In order to increase the social functionality of schizophrenia patients, it is necessary to improve their cognitive evaluation skills. For this development, it is of great importance that the level of free will and determinism is fully understood in the individual. It is thought that it will be useful for psychiatric nurses to consider the cognitive level and the free will and determinism of individuals in the trainings they will apply to increase the social functionality of individuals diagnosed with schizophrenia in case management.

Keywords: Cognitive assessment, Free will, Social functioning, Schizophrenia, Psychiatric nursing.

ÖZET

Şizofreni gibi ruhsal hastalıkları olan bireylerin bilişsel değerlendirme, özgül irade ve belirlenimcilik düzeylerinin sosyal işlevsellik düzeylerinin nasıl etkileyebileceğine yönelik çalışmalar önem arz etmektedir. Sosyal yetenek örüntüsünün negatif etkilenmesi şizofrenide genellikle hastalık ön safhalarından öncesine uzanan ve uzun süreçte hastalığın seyrini kesin tahminlerin görülmesi nedeniyle bireyin hastalık sürecini önemli etkide etkilemektedir. Şizofrenide sosyal yetenek; olumlu ve olumsuz bulgular, ruhsal hal, sosyal davranış biçimi ve çevresel unsurlardan etkilenmektedir. Sosyal davranış biçimi, sosyal algılayış ve kognitif yetiler tarafından belirlenir. Sosyal algılayış, herhangi bir sosyal olayda, içinde bulunan mevcut koşulların ve diğerlerinin duygu yönünden geri dönüşü gibi belirteçlerin kavranabilmesidir. Şizofrenisi olan bireylerde sosyal belirtilerin kavramada ve bireylerin yüzlerindeki ifadeleri duygu yansımaları anlamada problemler bulunmuş; yüzdeki duygunun dışa yansımaları

algılanmasındaki yanılsamalar sosyal yetenek örüntüsünün bozulma ile bağdaştırılmıştır. Sosyal davranış biçimi, sosyal algılayış ve kognitif yetiler tarafından seçilir. Şizofreni hastaların bilişsel değerlendirmesi; sözel bellek, dikkat, işlem hızı ve yürütücü işlev gibi alanlarda özellikle önemli boyutta bozulmuş durumdadır. Şizofreni hastalarını değerlendirirken özgür irade ve belirlenimcilik düzeylerin değerlendirmeyi büyük ölçüde etkilediği düşünülmektedir. Şizofreni tanılı bireylerin şizofreni tanısına özgür irade sonucu mu yoksa kaderci bir yaklaşım olan belirlenimcilik şeklinde yaklaşım yaklaşmayacağı konusu bilişsel değerlendirme ve bununla birlikte sosyal işlevselliği de etkilemektedir. Şizofreni hastalarının sosyal işlevselliğini artırmak için bilişsel değerlendirme yetisinin geliştirmek gerekmektedir. Bu gelişim için özgür irade ve belirlenimcilik düzeyinin bireyde tam anlamı ile kavraması büyük önem taşımaktadır. Psikiyatri hemşiresi, şizofreni tanılı bireylerin vaka yönetiminde sosyal işlevselliklerini arttırmaya yönelik uygulayacağı eğitimlerde bilişsel düzeyi ve bireylerin özgür irade ve belirleyimciliklerini göz önünde tutmasının yararlı olacağı düşünülmektedir.

Anahtar Kelimeler: Bilişsel değerlendirme, Özgür irade, Sosyal işlevsellik, Şizofreni, Psikiyatri hemşireliği.

GİRİŞ

Şizofreni , algısal ve bilişsel bozulma, duygu, davranış ve düşünce bölümlerinde işlevsizlik gösterdiği ve bunun sonucunda sosyal ve mesleki aksaklıklara neden olan mühim bir beyin hastalığıdır(1,2).Şizofreni tanısına sahip bireyin hayatı boyunca kronik seyretmesi sonucu bireyin hayatında farklı zorluklara neden olmaktadır. Bu zorluklar, büyük ölçüde şizofreni tanısına sahip bireylerin psikososyal işlevselliklerindeki bozulmadan kaynaklanmaktadır. Hastalar işe girebilme ve işi sürdürme, sosyal ilişkiler kurabilme ve devam ettirebilme , sosyal desteği olmadan yaşama ve hatta şahsi günlük ihtiyaçlarını karşılama konusunda bile zorluklar yaşamaktadırlar(3).

Şizofreni tanılı bireyin sosyal işlevselliği konusunda gelişim sağlamanın en temel yollarından biriside bilişsel değerlendirme konusunda ki yeterli tespittir. Şizofrenide tanılı bireyler de bilişsel işlev bozuklukları, sosyal ve çalışma alandaki işlevsellik ve toplum içinde özgür yaşama gibi işlevlerde saptayıcı bir etken olarak karşımıza çıkmaktadır. Şizofreni tanılı bireyler de tespit edilen sözel kavrama ve bellek, kognitif işlevler ve vijilans gibi çeşitli bilişsel alanlardaki bozukluklar bireylerin çalışma, günlük aktiviteleri, sosyal problem çözme becerileri gibi farklı işlevsellik ölçütlerinin saptayıcısı olarak belirlenmiştir(3). Bilişsel değerlendirme şizofreni tanılı bireyler de ; sosyal yetenek , sosyal algılama , sosyal davranış açısından son derece önemlidir bireyin tedaviye başlaması , sürdürmesi ve sosyal yaşama adapte olması yani bireyi topluma kazandırma açısından son derece önemli olduğunu aktarmaktadır. Şizofreni tanılı bireyin toplum da işlevselliğini kazandırmak için bireyin bu hastalığa bakış açısının nasıl olduğunu kavraması son derece önemlidir. Fiziksel ve mental belli bir olgunluğa gelmiş çoğu insan kimsenin emri ile hareket etmeden hür bir şekilde karar vermeyi, kendi rotasını kendisi çizmek ister ve bu insanlara biz ; özgür iradesi yüksek olan bir bireyler olarak ifade ederiz(4). Genellikle özgür iradenin zıddı olarak bilinen belirlenimcilik, determinizm olarak da ifade edilir. Sebebi ise belirlenimcilik te olayların önceden belirli olan nedenleri vardır bu nedenle özgür iradenin var oluşundan söz edilemez. Özgür irade, bireyin bir şeyi gerçekleştirip gerçekleştirilmeme konusunda verdiği kararı ortaya koyarken ; belirlenimcilik ise hadisenin öncesinde var olan durumların sonucu olduğunu savunarak daha çok kaderci bir yaklaşım benimsemektedir(4). Bu noktada bireyin hayatta başına gelebilecek her duruma yaklaşımını belirlemektedir. Şizofreni tanısına birey ; kaderci tutum mu yoksa verilen kararlar sonucu mu oluştuğu algısının oturması son derece önemlidir çünkü birey de iç gözü kavramının oluşması , tedaviye yanıtı ,sosyal davranışlara , sosyal yaşantıya adaptasyonunu büyük ölçüde etkilemektedir. SZ'li bireyler, SZ'li bireylere kıyasla önemli ölçüde daha yüksek yalnızlık düzeyleri bildirmektedir. Sosyal bozulma şizofreninin temel bir özelliğidir. Daha küçük sosyal ağ boyutu, sosyal aktivitede azalma ve yalnızlık, hastalığın başlangıcından önce oldukça yaygındır ve hastaneye yatışta artış ve daha düşük yaşam kalitesi dahil olmak üzere daha kötü sonuçlara katkıda bulunur. Sosyal beceri eksiklikleri, sosyal bilişsel bozukluk ve negatif semptomlar (örn. motivasyonsuzluk) sosyal işlev bozukluğuna birincil katkıda bulunan faktörlerdir(5).

Şizofreni (ŞZ) hastaları birden fazla konuda zorluklar yaşarlar. SZ'de hastalık seyri boyunca sosyal bozulmanın göreceli istikrarı göz önüne alındığında, sosyal işlev bozukluğunun iyileştirilmesine ihtiyaç vardır. Sosyal beceri eksiklikleri, sosyal biliş bozuklukları, yalnızlık, sosyal ağ boyutunun azalması, sosyal motivasyon bozuklukları ve yüksek özellikli sosyal anhedoni dahil olmak üzere sosyal işlevsellik

alanları(5)(6). Şizofreni tanısı konulan bireylerdeki sosyal anhedoni ye neden olan en önemli faktör stigma dır. Damgalama alanında yapılan son arařtırmalar, şizofreni hastalarının %40'ından fazlasının yüksek oranda damgalanmış hissettiğini ve hatta damgalanmayı “ikinci bir hastalık” olarak deneyimlediğini göstermiştir. Algılanan/deneyimlenen damgalanmanın semptomlar ve benlik saygısı, yaşam kalitesi, güçlenme, ruh sađlığı bakımı arama ve buna bađlı kalma ve intihar eğilimi üzerinde olumsuz sonuçları tanımlanmıştır (7).

Toplum, şizofreni tanılı bireyleri sadece damgalamakla kalmayıp sosyal ilişkilerde de hasta ile iletişimi koparmaktadır. Hastalar stigma korkusu ile tanılarını gizlemeye çalışırken bu durum hastaların sosyal izolasyona sebebiyet vermektedir. Hastalığın tedavi sürecinde hastalık semptomlarını en aza indirmek amacıyla yapılan farmakolojik tedaviden ziyade hastaların işlevsellik düzeylerinin de korunması önem teşkil etmektedir . İşlevselliđi korumaya yönelik olarak da günümüzde ruhsal toplumsal tedavi yaklaşımlarına büyük önem verilmektedir.(8)

Şizofreni hastalarına hastalığın erken tanı ve tedavisine yönelik uygulanacak hemşirelik girişimleri ile hastalığın ilk dönemlerde saptanması sađlanabilir. Psikiyatri hemşiresine bu noktada büyük sorumluluk düşmektedir bireyin hastalık seyri boyunca hastalığa karşı tutum ve davranışı, bilişsel deđerlendirmeleri, sosyal becerilerini tanımlama açısında iyi bir gözlem ile bireye uygun tedavi ve yöntemi saptayıcı kiři olarak yer almaktadır. Psikiyatri hemşiresi bireyin şizofreni hastalığını kabullenışı ve tedaviye uyumu kolaylařtırıcı etkisini ortaya koyarak bireyde ki farkındalıđı artmasına neden olmaktadır. Bunun sonucunda bireyin stigma ya maruz kalma oranının azaltarak bireyi sosyal yaşantıya adaptasyonunu kolaylařtırmış olmaktadır. Bunun sonucunda hasta ve ailesinin etiketlenme endişesine müdahale etme şansı elde edilmiş olur ve tedavi süreci kısaltılabilir (8)

SONUÇ

Şizofreninin belirgin özellikleri yürütücü işlevler, dikkat, hafıza ve işlem hızındaki bilişsel eksikliđidir. Bu nedenle şizofreni tanısı alan bireylerin bilişsel deđerlendirmeleri yapılırken ki hassasiyet son derece önemli olmaktadır çünkü bireyin kognitif işlevleri bireyin gündelik yaşam fonksiyonlarını etkilemektedir . Bilişsel deđerlendirme bireyin ; sosyal yetenek , sosyal davranış ,sosyal yaşantı yani sosyal işlevsellik alanlarına da büyük ölçüde yansıma yapmaktadır. Bu yansımaları olumlu yönde ilerletmek bireyin tanıyı kabul edip tedaviye uyumunu ve aynı zamanda stigma ve nüks gibi durumlardan da en az hasar ile atlatmasına destek sađlamaktadır. Kabul noktasında ise bireyin özgür irade ve belirlenimcilik düzeyini tespit etmek aynı şekilde tedavinin seyrini etkileyen ve bireyin günlük yaşantı anlayışını şekillendirmesi açısından önemli bir noktadır. Psikiyatri hemşirelerinin tanı alan bireylerin durumu nasıl analiz ettiđine yani özgür irade ve belirlenimcilik düzeyi ve bilişsel deđerlendirme ve sosyal işlevsellik alanında bireyin düzeylerini belirleyerek en iyi şekilde vaka yönetimi sađlamak amacıyla ve eksik olan yönlerini güçlendirerek topluma daha sađlıklı birey kazandıran meslek grubudur.

KAYNAKÇA;

- 1) Erdil, N. (2008). *Şizofrenide zihin teorisi, empati ve içgörü yeteneklerinin klinik deđişkenlerle ilişkisi* (Master's thesis, Dokuz Eylül Üniversitesi (Turkey)).
- 2) Arslan, M., YAZICI, A., YILMAZ, T., COŞKUN, S., & KURT, E. (2015). Rehabilitasyon programının şizofreni hastalarının kliniđi, sosyal işlevselliđi ve yaşam kalitesi üzerindeki uzun dönem etkileri: İzleme çalışması. *Anatolian Journal of Psychiatry/Anadolu Psikiyatri Dergisi*, 16(4).
- 3) Özak, N. (2019). *Şizofreni Hastalarında Bilişsel Bozukluk Düzeyini Deđerlendiren Şizofreni Bilişsel Deđerlendirme Ölçeđinin Türkçe Geçerlilik ve Güvenilirlik Çalışması* (Master's thesis, Dokuz Eylül Üniversitesi (Turkey)).
- 4) Aydın, R. Ş., Sarıçam, H., & Yıldırım, B. HAYATA NASIL BAKIYORUZ: ÖZGÜR İRADE VE SPİRİTÜEL İYİ OLMA. *Avrasya Uluslararası Arařtırmalar Dergisi*, 12(39), 216-241.

- 5) Fulford, D., Mote, J., Gonzalez, R., Abplanalp, S., Zhang, Y., Luckenbaugh, J., ... & Gard, D. E. (2021). Smartphone sensing of social interactions in people with and without schizophrenia. *Journal of Psychiatric Research*, 137, 613-620.
- 6) Mote, J., & Fulford, D. (2020). Ecological momentary assessment of everyday social experiences of people with schizophrenia: a systematic review. *Schizophrenia research*, 216, 56-68.
- 7) Valery, K. M., & Prouteau, A. (2020). Schizophrenia stigma in mental health professionals and associated factors: A systematic review. *Psychiatry research*, 290, 113068.
- 8) Sevinik, H., & Taş Arslan, F. (2020). Şizofreni hastalarında içselleştirilmiş damgalanma ve sosyal işlevsellik düzeyinin belirlenmesi. *Psikiyatri Hemşireliği Dergisi*, 11(3), 173-180.

GLOBALIZATION OF ECONOMIES AND THE SUSTAINABLE DEVELOPMENT OF THREE SELECTED EURO-DOLLAR COUNTRIES

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ABSTRACT

As a strict term, globalization means the myriad economic and social transformation of mankind at present, on an extensive and integrating scale and generated by the impact of transcontinental monetary financial flows on the characteristics of social interactions. Sustainable development, on the other hand is conceived as a new development path that sustains human progress for the entire planet and for a long future. Globalisation is an inevitable phenomenon in human history that's been bringing the world closer through the exchange of goods and products, information, knowledge and culture. The purpose of this study was to find out the influence of globalisation of economies and sustainable development on the selected three Euro-dollar countries, viz- France, Spain and Germany between (1980 -2018). The researcher therefore reviewed the existing literature on the implication of globalization on the economic sustainability of these countries. Thus the concept of globalisation and sustainable development as well as some components of the selected Euro-dollar countries and the impact of globalisation on the world economy are critically examined. The study undertook a conceptual approach based on the effects of globalization on sustainable economic development of the selected Euro-dollar countries under review during the period: 1980 to 2018. The study thus established that there is a positive relation between globalisation and sustainable economic growth and development. This made the researcher come to the conclusion that the economies of these three selected Euro-dollar countries (France, Spain and Germany) is gaining from globalisation, mainly due to Foreign Direct investment (FDI) and trade openness. Since these Euro-dollar countries has opened up to international trade and foreign investment, they have achieved a better economic growth.

Key Words: Globalization, Sustainable Economic Development, Economies, Foreign Direct Investment, International Trade and Openness, Gross Domestic Product (GDP), IMF, World Bank

1.0 INTRODUCTION

1.1 Background of the Study

With the advent of globalisation and especially since the end of World War II, the World has become a much smaller place where interaction between different countries has led to a situation where a country's economy and development are not only in the hands of the ruling Government but is highly influenced by international organizations and international trade where international rules and legislations reign.

Although the term 'globalisation' has already become a cliché, the concept itself is not new. Its origins are found in the writings of scholars in the late 19th century and early 20th century. However, the term has gained only academic acceptance in the late 1960s, today the concept found its expression in all languages of the world. It reflects a wide perception of the fact that the world is rapidly transforming into a shared social sphere under the influence of technological and economic forces, and that development in any region of the world can have profound consequences on the individuals and communities in the other side of the globe.

At the same time, many people associate globalisation with a sense of political fatalism and chronic insecurity. This is due to the contemporary social and economic changes which seem to overcome the possibility of the national governments, or citizens to control, challenge or impose the change.

Economic globalisation refers to the increasing interdependence of world economies as a result of international capital and wide and rapid spread of technologies. It reflects the continuing expansion and mutual integration of market frontiers, and is an irreversible trend for economic development in the whole world at the turn of the millennium. The rapid growing significance of information in all types of productive activities and marketization are the key major driving forces for economic globalisation. In other words, the fast globalisation of the world's economies in recent years which is largely based on

the rapid development of science and technologies, has resulted from the environment in which market economic system has been fast spreading throughout the world, and has developed on the basis of increasing cross-border division of labour that has been penetrating down to the level of production chains within enterprises of different countries.

The advancement of science and technologies, has greatly reduced the cost of transportation and communication, making economic globalisation possible. Today's ocean shipping cost is only half of that in the year 1950, the current airfreight 1/6 and telecommunication cost 1%. The price level of computers in 1990 was only about 1/125 of that in 1960, and this price level in 1998 reduced again by about 80%. This kind of 'time and space compression effect' of technological advancement greatly reduced the cost of international trade and investment, thus, making it possible to organize and coordinate global production. For example, Ford's Lyman car is designed in Germany, its gearing system produced in Korea, pump in USA, and engine in Australia. It is exactly the technological advancement that has made this type of global production possible. Moreover, the development of the networking-based economy has given birth to a large group of shadow enterprises, making the concept of national boundaries and distance for certain economic activities meaningless.

If technological advancement and information technology (IT) development were assumed as the technological driving forces for economic globalisation, then the market-oriented reform carried out throughout the world should be regarded as the institutional driving force for this trend. Under the framework of General Agreement on Tariff and Trade (GATT) and World Trade Organization (WTO), many countries have gradually cut down their tariff and non-tariff barriers, more and more countries open up their current accounts and capital accounts. All of these greatly stimulated the development of trade and investment. Moreover, the transition of the former centralized planned economies to market economies has made it truly possible for the world's economies to integrate into a whole.

Multinational corporations (MNCs) have become the main carriers of economic globalisation. They are globally organizing production allocating resources according to the principle of profit maximization, and their global expansions are reshaping macroeconomic mechanisms of the operation of the world's economies. In 1996, there were altogether only more than 44,000 MNCs in the whole world, which had 280,000 overseas subsidiaries and branch offices. In 1997, the volume of the trade of only the top 100 MNCs already came up to 1/3 of the world's total and that between their parent companies and their subsidiaries took up another 1/3. In the US, of the \$3,000 billion balance of foreign direct investment at the end of 1996, MNCs owned over 80%. Furthermore, about 70% of international technological transfers were conducted among MNCs. This type of cross-border economic activities within same enterprises has posed a challenge for the traditional international trade and investment theories.

Globalisation was defined by Giddans (2010) as the intensification of worldwide social relations which shrink distant localities in such a way that local happenings are shaped by events occurring miles away and vice versa. This definition embodies some interrelated ideas, of 'accelerating interdependence' (Ohmae, 2019), of action at a distance'' (Giddens, 1990) and of 'time-space compression'' (Harvey, 2009). 'Accelerating interdependence'' is understood to be the growing intensity of international enmeshment among national economies and societies, such that development in the country impacts directly on another country. 'Time space compression'' refers to the manner in which globalisation appears to shrink geographical distance and time.

In a world of near instantaneous communication, distance and time no longer seem to be the major constraints on patterns of human organization and interaction (Held, McGraw, Goldbar and Perratton, 2009). Globalisation is leading to homogenization and convergence in organizations' strategies, structures and processes and in consumer choice, along with a new global division of labour that widens the income gap between the 'haves' and 'have nots' both within and between societies.

Today's world is organized by accelerating globalisation, which is strengthening the dominance of a world capitalist economic system, supplanting the primacy of the nation state with transnational corporations and organizations, and eroding local cultures and traditions through a global culture (Kelhen, 2019). The emergent global economy and culture can be described as a 'network society' which is grounded in new communications and information technology (Castell, 2016, 2007, 2018). Some view globalisation as the continuation of modernization and a force of progress, wealth, freedom, democracy and happiness. Others view it as another form of imposition. Its critiques view globalization as harmful and perceive it as a force that brings about underdeveloped countries. They feel that it widens the gap between the 'haves' and the 'have nots' (Castell, 2016). From the social theory perspective,

globalisation involves the flows of commodities, capital, technology, ideas, forms of culture and people across national boundaries via a global networked society (Castells, 2016, 2007, 2018). The consumptions of technology and capital work together to create a new globalized and interconnected world (Castell, 1998). A technological revolution involving the creation of computerized network of communication, transportation and exchange is the presupposition of a globalized economy, along with the spheres of production, exchange and consumption.

The technological revolution presupposes global computerized networks and the free movement of goods, information and people across national boundaries. Hence, the internet and global computer networks make globalization possible, by producing a technological infrastructure for the global economy. Globalization has an effect on employment patterns worldwide. It has contributed to a great deal of outsourcing which is one of the greatest organizational and industry structure shifts that changes the way business operates (Drucker, 1998). Globalization is also seen as changing organizational structures where expenses can move up or down as business climate dictates (Garr, 2000). For employees the trend toward outsourcing has been thought to result in a loss of fixed employment opportunities as a consequence of firms seeking to use cheap labour from countries like China, Mexico and even Africa. The globalized economies have also had their effect on reward systems, migration, and on job security.

Globalisation is the integration of national economies through trade and financial interaction. A sub-set of globalisation which has become very pervasive and in some cases, destabilizing is financial markets integration across the globe. The rapid flow of goods, services and capital, especially the later, has made national controls on these aggregates less effective without consideration for countervailing measures that other nations could impose in the absence of continued responses (CBN Economic & Financial Review, Vol. 38 No. 2).

The rapid advance of technology and telecommunication has reduced the cost associated with foreign portfolio and foreign direct investment (FDI). Without moving from one location to another, a foreign investor could deploy funds across the globe with the aid of telecommunication facilities. The ease with which capital can be re-deployed to take advantage of better returns has often proved adverse for economies experiencing the outflow. Reductions in transport and communication costs, capital account opening, financial market deregulation and privatization of state enterprises have combined to create a favourable environment for increased capital mobility (Fischer, 2018: 164). The globalisation of financial markets has proved complex to understand because the phenomenon encompasses both product and capital markets, the effectiveness of macroeconomic policies in recent times, as depicted by the financial crisis in South East Asia in 1997. The rapid advance in globalization, especially after the end of the Cold War has tended to re-enact the laissez-faire doctrine that was prevalent before the ideological polarization of the world. The fact that globalization could mean many things to different people, depending on where they fit into in the current dispensation, makes it imperative to explore the implications of the phenomenon for domestic macroeconomic management. The extent to which the effectiveness of domestic economic policy can be compromised if adequate consideration is not given to countervailing responses of other nation is a major area of inquiry of this paper. This is more important as the interdependence between nations is an indication that growth could be undermined if nations build protective walls around their economies. Stabilizations of finance and financial risk have been attributed to an increase in the technical capabilities for engaging in precision finance, the integration of activities of the markets they engage in and the emergence of the global bank and the developments in global finance. In the first place, traditional banking institutions have revolved into financial services firms with new accounts. Additionally, non-bank financial institutions now actively compete with banks both on asset and liabilities sides of the balance sheet thereby blurring the distinction between banks and non-bank financial institutions. Also, the rapid growth in the share of other earning assets or total assets and relative growth in off-balance sheet items have been unprecedented (IMF, 2018: 180-192) CBN Economic and Financial Review, Vol. 38 No. 2.

Although globalisation and internationalization are used in the same context, there are some major differences.

- Globalisation is a much larger process and often includes the assimilation of the markets as a whole. Moreover, when we talk about globalization, we take up the cultural context as well.

- Globalization is an intensified process of internationalizing a business in general terms, global companies are larger and more widespread than the low-lying international business organizations.
- Globalization means the intensification of cross-country political, cultural, social, economic, and technological interactions that result in the formation of transnational business organization. It also refers to the assimilation of economic, political, and social initiatives on a global scale.
- Globalization also refers to the costless cross-border transition of goods and services, capital, knowledge and labour.

There are many factors related to the change of technology, international policies, and cultural assimilation that initiated the process of globalization. The following are the most important factors that helped globalization take shape and spread it drastically.

a) **The Reduction and Removal of Trade Barriers:**

After World War II, the General Agreement on Tariffs and Trade (GATT) and the World Trade Organization (WTO) have reduced tariffs and various non-tariff barriers to trade. It enabled more countries to explore their comparative advantage. This had a direct impact on globalization.

b) **Trade Negotiations:**

The Uruguay Round of Negotiations (1986-94) can be considered as the real boon for globalization. It is considerably a large set of measures which was agreed upon exclusively for liberalized trade. As a result, the world trade volume increased by 50% in the following 6 years of the Uruguay Round of Negotiations, paving the way for businesses to span their offerings at an international level.

c) **Transport Costs:**

Over the last 35 years, sea transport costs have plunged 70%, and the airfreight costs have nosedived 3-4% annually. The result is a boost in international and multinational trade flows that led to Globalization.

d) **Growth of Multinational Corporations:**

Multinational Corporations (MNCs) have characterized the global interdependence. They encompass a number of countries. Their sales, profits, and the flow of production is reliant on several countries at once.

e) **The Development of Trading Blocs:**

The Regional Trade Agreement (RTA) abolished internal barriers in trade and replaced them with a common external tariff against non-members. Trading blocs actually promote globalization and interdependence of economies via trade creation.

1.2 Statement of the Problem

Globalisation essentially is a marriage among unequal partners (Ogboru, 2020). It involves a relationship between developed and developing nations in which the former is a stronger partner benefiting from this relation at the expense of the latter being weaker. A review of the effect of globalization on the economic sustainability of the selected three Euro-dollar countries viz- France, Spain and Germany reveal that they have seriously benefited from world globalisation which is viewed as a phenomenon which has a positive influence especially in developed countries just as the ones under review. In this paper, we will focus on how globalization has impacted on domestic sustainable economic development of these selected Euro-dollar countries (France, Italy and Germany) and how its impact have affected their economy either positively or negatively.

1.3 Research Objectives

The purpose of this study is to:

- i. investigate the impact globalization has had on the economies of these Euro-dollar countries under review, viz-France, Spain and Germany;
- ii. determine the role of the identified Euro-dollar countries on a global stage;
- iii. identify how these Euro-dollar countries under review can achieve higher sustainable and economic development in today's rapidly globalizing world.

2.0 LITERATURE REVIEW

2.1 Conceptual Review

We will start this section with the literature review of key terms and their relationship with each other.

2.1.1 What is Globalization?

In this section, we will give a short explanation of what globalization is, its roots, and why it is important for economic development. We will then define globalization, by giving definitions of different authors. We will equally consider the concepts of globalization and sustainable economic development. The last part will deal with views on globalization in regard to advantages and disadvantages.

2.1.2 Brief History of Globalization

Globalization is not a new concept. The interaction between people in different parts of the world has been taking place for thousands of years. A very good example of this interaction is a Silk Road which connected Asia, Africa and Europe. Philosophy, religion, language, the arts and other aspects of culture spread and mixed as nations exchanged products and ideas.

In the 15th and 16th centuries the Europeans made important discoveries such as transatlantic travel and the discovery of the New World-America. This shows that globalization has existed in times past, though the speed of globalization has increased phenomenally in the last decades. This increase has been facilitated by improved technology in areas of transportation and communication.

2.1.3 Definitions of Globalization

There have been numerous attempts by different authors to define the term globalization. Often one particular dimension acts as a key to each of the definition – for instance, a politically-centred definition may underscore the decline of the nation-state and the territorially-bounded societies that formed the grounding unit of analysis of modern political science, sociology and international relations; while economically-centred definitions may underscore capitalism and the expansion of the free-market system as key mover of globalizing processes. For some, globalization is best understood as a legitimate cover or ideology, a set of ideas that distorts reality so as to serve particular interests (Barrett, 2021). Thus Schirato and Webb (2013: 199) view globalization as a discursive regime, a kind of machine that eats up anyone and anything in its path. They suggest that globalization functions as a set of texts, ideas, goals, values, narratives, dispositions and prohibitions, a veritable template for ordering and evaluating activities, which is ‘‘filled in’’ or infected with the interests of whoever can access it (Schirato and Webb, 2013: 200). For others, globalization is a much-more material reality in the contemporary world. Sometimes, as mentioned, this reality is viewed as, for instance, in the following definition from production of different areas.

The Social Science Encyclopaedia (Kuper and Kuper, 2016: 234) which privileges economics: The development of the world economy has a long history, dating from at least the sixteenth century and is associated with the economic and imperial expansionism of the great powers. By globalization we refer to a more advanced stage of this process of development. Langhome (2011: 2) meanwhile accents the proliferation of technology. Globalization is the latest stage in a long accumulation of technological advance which has given human beings the ability to conduct their affairs across the world without reference to nationality, government authority, time of the day or physical environment.

For others, a more general definition of globalization is in order. The Dictionary of Social Sciences (Calhoun, 2012: 192) offers the following conceptualization: globalization is a catch-all term for the expansion of diverse forms of economic, political and cultural activity beyond national boundaries. According to Hewlett & Ramesh (2016, p. 175), it is often used to explain the development of economically underdeveloped countries because it is assumed to help economic growth’’ (Wolmuth, 2011, p. 20). However, this last statement is not always true as Wolmuth (2011) himself explains in his book that weaker States are often hindered in their growth because of the effects of globalization. . By using the above definition we can see that globalization is a network of organizations across nations, therefore, accentuating the importance of international relations. It has often been seen as a purely economic aspect, however, globalization also comprises cultural, political and ideological relations. Although globalization is often used to explain the development of under developed countries, the effects of this concept are not always as positive as may seem (Gelilov, Gylch, Waziri, Fadimatu, Isik, Abdurahman, 2016).

2.1.4 Concepts of Globalization and Sustainable Economic Development

2.1.4.1 Concepts of Globalization:

According to Odia (2016: 12), globalization is the term used to describe the growing worldwide integration of the people and countries. It is the process of integrating economic decision-making such as consumption, investment and saving all across the world. This means that part of globalization is a process of creating global market place in which increasingly, all nations are made to participate.

Nkem (2012) opines that the features that characterize globalization include interconnection of sovereign countries through trade and capital flow, harmonization of the economic roles that govern the interaction or relationship between these sovereign nations; create structures to support and facilitate dependence and interconnection; and creation of a global market place. However, globalization brings about advancement in information technology, harmonization of different cultures and belief and harmonization of the political systems of different countries of the world.

To Nwankwo (2018), globalization has led to the intensification of the world social relations which link distant localities in such a way that local happenings are shaped by events occurring many kilometres away and vice versa. The components of globalization include:

- Movement of people, goods and services across the world.
- Interdependence of economic transaction.
- Belief in the efficacy of the market.
- Public and private sector of development.

Kankwinda (2014) stated that, ‘the belief on the effectiveness of the market presuppose an adherence to economic fundamentalism, the Washington consensus or a form of dogmatism in the extreme in which there is a strong belief that markets can handle any and everything’. More important is the fact that the principles and mission statement of globalization are constantly reviewed and sustained by multinational corporations (MNCs), the International Monetary Fund (IMF), World Bank (WB), World Trade Organization and the industrialized countries of Europe and North America (Kankwinda, 2014).

Since globalization largely depends on technological effectiveness, massive industrialization and solid infrastructural base to triumph, it automatically means that countries that are lagging behind in development, with micro-economic inconsistency will be enveloped and be manipulated by those that have been developed. This could lead to inequality in the global economy.

2.1.4.2 Concept of Sustainable Economic Development:

Mabogunje (1980) opined that, ‘development is a term that is used to describe quantitative and qualitative growth-taking in an area or environment. Growth is concerned with the measure of quantitative changes that has taken place over a period of time, which could be negative or positive’. The word development has been defined in different ways by different authors. Development is defined as a process that seeks to recognize space and society with a view to reducing spatial integration and diffusion of idea (Mabogunje, 1980). Therefore, development should aim not only to achieve socio-economic formation of a society but also seek to transform space since space is part of the socio-economic formation. He further explained that development brings about fundamental change in the life of any society; change which will extend into political, social and economic spheres of human life. Development takes place when infrastructural constructions, which makes life meaningful, are brought under focus, and when the human mind has acquired more skills for solving contemporary problems. Development depicts modernization in the way man lives his life, uses his material resources and plans his immediate activities.

Seers (2019) defined development as a term that involves economic growth and the conditions of adequacy in food supply, employment, as well as reduction of the gap between the poor in developing rural area and the rich in the urban area. According to Falodun et al., (2017), there are economic, political and cultural developments. Economic development is the attainment of ideas of modernization such as the rise of productivity, social and economic equity, improved institutions and values. That is, economic development is the process of evolving an acceptable political behaviour that facilitates the achievement of the national objectives such as a free and democratic society. There is the development of civilized and refined political culture that corresponds with the objectives of each country. Cultural development, on the other hand, involves a process of improving the culture of the society. Since culture is dynamic, it is expected that the culture of the society should reflect the socio-economic requirement of the people from time to time.

2.1.5 The Goals of Globalization

Globalization has brought about shrinkage of the world into global village, revolution in information technology, the collapse of boundaries between different worlds, expanding connectivity of all forms of interactions. Scholte (2017) suggests that globalization facilitates the removal of barriers among nations of the world, thereby giving social relations unhindered access. The unique characteristics of globalization often includes increased capital mobility, decline in costs of transportation, computing and communications. Other goals of globalization from the economic perspective according to Mrak (2010) includes:

- Internationalization of production accompanied by changes in the structure of production.
- Expansion of International trade and services.
- Widening and deepening of international capital flows.

However, the major goal of globalization is the diffusion of the cultures, commerce and communication of countries of the world in order to bring about homogenization. Globalization reveals the interconnectedness within and across regions of the world due to the growing social, economic, political networks, education, information, and communication technology of different groups of people. It suggests the extent to which the action of one group of people exerts either positive or negative impact on others.

2.1.5.1 Advantages of Globalization

A key point summary of the advantages of globalization includes the following:

- i. resources of different countries are used for producing goods and services they are able to produce most efficiently;
- ii. consumers to get much wider variety of products to choose;
- iii. consumers get the product they want at more competitive prices;
- iv. companies are able to procure more goods and services required at most competitive prices;
- v. companies get access to much wider market;
- vi. promotes understanding and goodwill among different countries;
- vii. businesses and investors get much wider opportunities for investment;
- viii. adverse impact of fluctuations in agricultural productions in one area can be reduced by pooling of production of different areas.

2.1.5.2 Disadvantages of Globalization

A key point summary of the disadvantages of globalization includes the following:

- i. developed countries can stifle development of undeveloped and under-developed countries;
- ii. economic depression in one country can trigger adverse reaction across the globe;
- iii. it can increase spread of communicable diseases;
- iv. companies face much greater competition. This can put smaller companies at a disadvantage as they do not have resources to compete at global scale.

3.0 GLOBALISATION IN THE SELECTED EURO-DOLLAR COUNTRIES (FRANCE, SPAIN AND GERMANY-THE CASE STUDY)

In this section, we shall briefly review the growth and impact of globalization on the sustainable economic developments of the three selected Euro-dollar countries between 1980-2018 to highlight whether globalization has actually been a curse or blessing to them. We shall consider these countries one apiece.

3.1 Effect of Globalization on Sustainable Economic Development in France:

France is one of the major economic powers of the world ranking along with such countries as the United States, Japan, Germany, Italy and the United Kingdom. Its financial position reflects an extended period of unprecedented growth that lasted for much of the post-war period until the mid-1970s, frequently this period was referred to as the ‘trente glorieuses’ (‘thirty years of glory’). Between 1960 and 1973 alone, the increase in gross domestic product (GDP) averaged nearly 6% each year. In the aftermath of the oil crisis of the 1970s, growth rates moderated considerably and unemployment rose substantially. By the end of the 1980s, however, strong expansion was again evident. This trend continued although at a more modest rate into the 21st century.

One of the single most important factors that have sustained the economy of France since the 1980s till date is reputed to be adoption of globalization into its economic activities. In spite of its mercantilist past, France has reluctantly converted to market liberalism and made liberalization, both as the

unintended by-product of European integration and as a conscious effort by policy-makers. As a result, we should expect France to break from the traditionally protectionist demands of special interests and instead promote a more open international trade agenda.

The emergence of this new, ‘‘global’’ protectionism illustrates one unappreciated consequence of economic globalization, its potential for reshaping national politics. Globalization alters fundamental features of a country’s political identity, such as the relationship between the state and the individual, the exercise of democratic control, and the boundaries of sovereignty. As a result, globalization is also likely to affect the structural organization of interest representation, the relative weight between different political forces, and the individual definition of national identity.

France is a particularly interesting case for observing how globalization reshapes national cleavages and domestic politics. First, France has proclaimed itself the worldwide leader in the combat against globalization. Second, France possesses certain cultural and political characteristics that make it prone to identifying the negative side-effects of globalization and as a result, to rejecting globalization sooner than most other countries. Finally, as a member of the European Union (EU), France has been exposed to partial globalization through European integration – thus making the consequences of globalization apparent and triggering a political debate earlier than in non-EU countries.

3.1.1 Paradigm Shift in Trade Politics in France from Special Protectionism to Global Protectionism in the 1980s:

The traditional cleavage in French trade politics has long been like in most countries, between free trade and protectionism, between consumers and producers, between efficient industries and declining sectors. Politically, this means that free trade (with the exception of the agricultural sector was advocated by mainstream, centrist parties, while protectionism was defended by extremist parties on the far left and the far right). However, in the 1980s, French trade politics seems to be moving away from the traditional free trade versus protectionism cleavage, pitching dynamic and educated elites on one side against special interests and victims of trade openness on the other. Instead, the new cleavage centres around the concept of globalization – that is, the increased flow of goods, services, capital, persons and information across borders. This new cleavage reflects, in turn, a broader paradigm shift in trade politics from special protectionism in the name of a few, to ‘‘global protectionism’’ in the name of the nation as a whole, if not humankind. This ‘‘global protectionism’’ has proven so appealing to French public opinion since the summer of 1999 that the theme of anti-globalization has gained mainstream legitimacy and politicians have rallied its cause en-masse.

3.1.2 Globalization and the ‘‘New French Protectionism in the 1990s:

Central to the political debate in today’s France is the issue of how much control the French nation should retain on what comes in and what goes out of the country. In a way, the discourse against globalization is not novel in France. This debate is the direct heir of the breach opened in French politics in the 1980s by the far-right Front National party (FNP) and the exacerbated discourse its leader, Jean Marie Le Pen, about ‘borders’ (Berger, 1995). The appeal of Le Pen’s message came primarily from his linkage of domestic economic insecurities to threats coming from outside France. His central claim was that high unemployment was the result of the ‘invasion’ of France by immigrants, which in turn threatened national identity. From the immigrants to the free flow of goods, labour and capital as the main causes of France’s economic woes, there was only one step that FNP supporters easily took when the debate turned to European integration and later to globalisation. Indeed, Le Pen himself switched from integration to trade globalization as the central theme of his electoral campaign for the June 1999 elections to the European Parliament.

The identification of external borders as the new cleavage in French politics was further accentuated by the 1992 referendum on the Maastricht Treaty on European Union. President Mitterand had originally called the referendum for strictly Machiavellian domestic, political reasons since opinion polls had shown the French to be in overwhelming majority ‘in favour of’ European integration, he expected to receive a plebiscitary show of support while weakening the Right, which was divided on the Europe issue. An unexpected consequence of the referendum campaign, however, was to trigger the first real public debate in France on the question of European integration (Meunier and Ross, 2013). The face support for European integration had come mainly out of ignorance of the real issues at stake (Percheron, 2011). The Maastricht campaign provided the first opportunity for a public debate about the potential consequences of increasing capital investments, shifting power from states to markets, and loss of democratic control. Even if the culprit being blamed then was not called globalization but

Europeanization, the reasons for discontent were the same: the over-the-board liberalization of trade and capital was rendering the French economy more dependent on the outside world, and therefore more vulnerable, while at the same time citizens saw their democratic prerogatives eroded in favour of supranational and corporate actors. Consequently, as the campaign days went by, opposition to European integration mounted, led not only by the Front National Party and the Communists, but also by mainstream leaders such as Jean Pierre Chevenement on the left and Phillips Seguin on the right. In September, 1992, a 51% majority barely approved the referendum, thereby enabling the European Union to move forward with monetary union. The Maastricht referendum campaign served as a lesson for French politicians. Subsequent EU reforms, such as the 1997 Treaty of Amsterdam were not submitted to popular ratification, since the openness of the French economy and the replacement of national sovereignty to Europeanization had come to be viewed as new evils threatening the welfare of French citizens and, more generally, the greatness of France.

The conclusion of the Uruguay Round in 1994 and the subsequent creation of the World Trade Organization (WTO) provided another opportunity for opponents of globalization to articulate their views against the increasing power of corporations and the shift in power from elected national officials to non-elected trade bureaucrats and international officials. The 1992-93 crisis about agriculture, by which France endangered the whole multilateral round in the name of preserving its rural way-of-life, was followed by an equally firm French position on the so-called ‘cultural exception,’ according to which cultural goods should be exempted from the rule of free trade. Although there was no real domestic political debate, these issues were featured prominently in the media for two years.

A less publicized, but equally defining moment in the French combat against globalization was the negotiation on the OECD Multilateral Agreement on Investment (MAI) which collapsed in 1998. The primary objective of this agreement was to facilitate international investment by ensuring that the host governments treat foreign and domestic firms similarly (Kobrin, 2018). The secret negotiations were taking place in Paris until 1997 when a draft agreement was leaked to a US-based consumer organization and denounced as a threat to democracy, sovereignty, human rights, economic development, and the environment. The main fear was that this agreement would limit the ability of national governments to regulate the protection of their environment, natural resources and health, as well as to end the protection of their citizens from foreign investors. After a coalition of extremely diverse non-governmental organizations in different OECD countries put pressure on their respective governments, the negotiations were halted. In the fall of 1998, the French government decided to walk away from the negotiations and the agreement eventually failed.

Finally, the debate about globalization appeared in the French headlines in the spring of 1999 as a result of two rulings of the WTO against Europe. In the banana dispute, the WTO concluded that the existing EU preference for bananas from African and Caribbean states with whom the EU had preferential trading arrangements under the Lome Convention was discriminatory. Therefore, the WTO allowed the US to impose retaliatory trade sanctions against European goods, such as Louis Vuitton handbags and Italian Pecorino cheese, so long as the EU banana regime was not in compliance with world trade rules. In the beef dispute, the WTO ruled that in the absence of scientific evidence attesting to the dangers of hormone-treated beef, the current EU ban was indeed a trade-distorting protectionist measure. Once again, the WTO allowed the US to impose trade retaliatory sanctions on European products, such as Dijon mustard and Roquefort cheese. Both rulings infuriated French public opinion and raised front – page concerns about the legitimacy and democratic accountability of globalization.

Who were the WTO judges to rule that the American cattle lobby could force-feed potential harmful ‘hormone-treated beef’ down the throats of European children? The WTO rulings were presented in France as the clear evidence that globalization put business interests above all competing social concerns, such as consumer health and safety.

3.1.3 Globalization and France in the Year 2000s – Amalgamation between trade, culture and politics:

Globalization has also been vilified in France because it threatens the very foundation of French greatness: its unique culture. A clash between French and American cultures was bound to happen since both claim a universalist vocation. The question of trade and culture was at the top of the foreign trade agenda towards the end of the Uruguay Round when the US and the EU debated the issue of ‘cultural exception’.’ At the time, however, the debate was limited to cultural goods per se, such as movies, music and television programming. What has changed in recent years is the realization that the threat to French

culture comes not only from trade in cultural goods, but more broadly from trade in general. The WTO has been portrayed in France as the Trojan horse of the unification of the world around the American way-of-life – that is, a ‘low’ culture made up of fast food, bad clothing and dumb sitcoms. By opposition, the French cultural model is portrayed as a ‘high culture, made of universal philosophers, fine paintings, and intellectual movies.

The most direct consequence of globalization on French domestic politics has been to accelerate the implosion and re-composition of the Rights. Globalization also has had the potential of contributing to an ideological renewal and reshaping of the Left. The Socialist Party has adopted both European integration and globalization, albeit in a harnessed, controlled incarnation. Other components of the Left have not been so eager to embrace these themes.

Another consequence of globalization in France is as regards European institutions. Increased support for European integration does not mean, however, increased support for supra-nationalism. On the contrary, one could expect the discourse on democratic deficit and loss of sovereignty to increase pressures for an inter-governmental Europe. This comes at a crucial time for European institutions. The EU is now embarking on a new Inter-Governmental Conference (IGC) designed to reform its institutions in view of the near enlargement in countries from Central and Eastern Europe.

The emergence of a central debate on globalization in French politics and the appeal of ‘global protectionism’ in French society will certainly impact the content of EU trade policy –and as a result the substance of any trade agreement negotiated between the EU and the US. The EU has adopted some of the French discourse against globalization as was made clear by its position in the Seattle meeting supposed to inaugurate a new round of multilateral trade talks. Some of the pet themes of Europe were the ‘multi-functionality’ of agriculture, the inclusion of international regulations on competition and the guaranteeing of food safety. Indeed, even though the EU has emerged in recent years as a champion of open markets and multilateral trade rules, the 15-member entry is now trying to actively develop a ‘harnessed’ and ‘managed’ alternative to globalization.

Finally, it is worth asking whether the current French debate on globalization may have a ‘contagion effect’ on the domestic politics of other countries. The coalition of opponents to globalization was successful in both the MAI and the Seattle cases precisely because it was a coalition of diverse interests, of diverse political affiliations, of diverse countries. The French opponents of globalization are finding solace and support in the birth of an anti-globalization movement worldwide. The appeal of ‘global protectionism’ goes beyond the borders of nations and states.

France is unique in the fight against globalization because its political and cultural identity combine all the elements that are threatened by globalization: a universalist culture, a language with international aspirations, a ‘superior’ food, an older practice of democracy, a sensitive view of national sovereignty, a central role of the state; a need for a world role; a sense of duty towards the more disadvantaged nations; and, most of all, a deep-rooted anti-Americanism.

3.2 The Effect of Globalization on the Economic Sustainability of Spain

Spain is a clear case of economic success. This has been frequently attributed to the benefits from its membership into the European Union and the Euro, but to a large extent, it all began a long time ago, in the late 1950s, when Spain began to take advantage of all the benefits of commercial and financial integration that today, we sometimes call the process of globalization. The key year was in 1959 in which it was implemented in orthodox Stabilization and Reform Plan under the auspices of the IMF. Before that year, and for more than two decades, the successive Franco’s governments had developed an economic policy based on anarchy and import substitution. These anarchic policies were a failure, with inflation problems and with a stagnant economy, in which the level of per capita income that had prevailed in 1935 was not achieved until 1952, with foreign trade staying at one third of the level registered in 1931.

3.2.1 Effects of Globalization and Sustainable Economic Development on Spain in the 1980s:

Accession to the EEC on January 1, 1986 initiated Spain’s most important liberalization episode since 1959. Tariffs have been reduced to zero for goods coming from European Union countries and the common external tariff was fully adapted for goods coming from the rest of the world. Besides, the integration of the Spanish Peseta into the European Monetary System in 1989 and the accession to the Euro in 1999, for reasons which will be presented later, have all contributed to Spain being one of the most open countries (globalized economy) presently in the world.

The openness ratio went up by 37.5% in 1986 to the present 59% in 2017 (an important increase of almost 23 points in only 20 years). After all the process of Commercial Integration and Globalisation of the Spanish economy, Spain is nowadays the 15th exporter and the 14th importer of the world. It imports mainly from the EU (72% of all exports), but also to Asia (8%), Latin America (5%) and the USA (4%). As quite correctly, Eduardo Aninat, Deputy Managing Director of the IMF, remarked in Aninat (2011), Spain is a star performer. As may be seen in Table 0, Spain is the second country, only after Japan that multiplied its income per capita by 9 times), to increase its income per capita by more in the last 50 years (Spain has multiplied its income per capita by a factor of six). Table 0 also shows the economic history of Spain, since the 1930's, presenting data for GDP and GDP per capita.

Table 0
The Spanish Economy since the Great Depression

Year	GDP (1950 = 100)	GDP per cap. (1990 US\$)
1930	99.24	2,595
1935	100.83	2,499
1938	72.95	1,738
1945	92.00	2,115
1950	100.00	2,196
1952	118.56	2,573
1959	154.96	3,168
1969	330.51	6,057
1979	538.39	8,904
1986	629.40	9,969
1999	997.74	15,149
2007	1,313.47	18,012

Source: Carreras and Tafunell (2010)

The contention of this paper is that a great part of this increase has been explained by the huge increase in the openness of the Spanish economy. The openness ratio of the Spanish economy starting from 1959 has been presented above, and it can be seen, for the last four decades, in Table 1.

Table 1
Spain: The Last Four Decade

Year	Openness	GDP (1995 = 100)	Wages (1995 = 100)
1971	28.0%	51.5	3.3
1975	31.0%	63.7	8.6
1980	33.8%	69.6	28.8
1986	37.5%	77.5	55.0
1994	44.5%	97.4	95.0
1999	55.8%	114.2	115.5
2007	59.0%	151.8	156.3

Source: IMF, International Financial Statistics Yearbook, 2008

Much has been written, recently, in connection with the effects and consequences of globalization. In particular, a lot of attention has been paid to the effects of globalization regarding the convergence between rich and poor countries and the distribution of income among and within countries. According to work done by Dollar and Krray (2011), Bhalla (2012), and IMF (2017) as well as others stated that productivity, wages, and incomes in poor countries seem to be catching up with those obtained by individuals in the rich world. Spain is a clear case that confirms all the above. The growth of its per capita income has been impressive, and, regarding wages, as it can be seen in Table 1, also its growth has been quite remarkable, from a low level of 3.8 in 1971 to the present level of 156.3 in 2007.

3.2.2 The Effects of Globalization on Sustainable Economic Development in Spain in the 1990s:

Spain in the 1990s has reached the highest degree of financial and monetary integration within the project of European unification. Spain doesn't have any more a local currency. It has now a global currency: the Euro. But it wasn't easy to reach the Euro. Let's see the Maastricht Convergence Criteria that Spain had to fulfil in 1998 in order to belong and launch the Euro in 1999.

- Price Stability: The annual inflation rate couldn't exceed by more than 1.5 percentage points, that of, at most, the three best performing Member-States.
- Interest rate convergence: The 10 year government bond yield could not exceed by more than 2 percentage points that of, at most, the three most price-stable Member States.
- Two conditions for Sustainability of the Government Financial Position:
 - a) The Fiscal Deficit to GDP ratio couldn't exceed 3%.
 - b) The Public Debt to GDP ratio couldn't be less than 60%, unless diminishing and approaching 60%.
 - c) Exchange Rate Stability: Observance of normal Exchange Rate Mechanism fluctuation margin for at least two years, without devaluation.

Spain made great efforts in the 1990s to achieve needed convergence on inflation. Following the joining of the Spanish Peseta of the European Monetary System in 1989, Spain's Monetary Policy was tight in the '90s and, together with the contractionary fiscal policy of the late '90s, the inflation target was achieved in 1998.

From a fiscal point of view, this lowering of interest rates has very beneficial for the Spanish budget as the cost of servicing the public debt has decreased as a consequence of lower interest rates. In addition to promoting financial integration, greater price stability and lower interest rates, Spanish accession to the Euro has contributed even more to the trade integration of Spain with the countries of the Eurozone. The argument ids that Spain could achieve even more significant savings in transaction costs that could lead to further increases in trade and investment between countries of the European Union that is already integrated in a substantial degree.

3.2.3 Effects of Globalization on Sustainable Economic Development of Spain in the Year 2000s:

There were pros and cons of Spain joining the Euro when it was inaugurated in 1999. The first and obvious benefit is that of avoiding currency and severe balance of payment crisis, like the one of 1992. Without the domestic currency, the possibility of a devaluation has disappeared and sudden capital outflows motivated by fear of devaluations are ruled out. Another clear advantage has been that of aligning Spanish inflation and interest rates with those of the rest of the countries of the Eurozone, particularly with Germany an anchor of the previous European Monetary System and of the present Euro system. In the following table, it can be seen the important process of convergence in inflation and interest rates that took place in the Spanish economy with Germany in the Eurozone.

Table 2
Globalization and Spain's Economy in the 1980s to 2000s

Spain	1980	1985	1990	1995	2000	2007
Interest	15.96	13.37	14.68	11.04	5.36	4.31
Inflation (++)	66.2	80.1	85.7	100.0	107.0	122.3
Germany	1980	1985	1990	1995	2000	2007
Interest Rates (+)	8.50	6.87	8.88	6.50	5.24	4.22
Inflation (++)	66.2	80.1	85.7	100.0	107.0	122.3

(+) *Government Bond Yields*

(++) *Consumer Price Index (1995 = 100)*

Source: International Financial Statistics Yearbook, 2008

So, although Spain's country risk could still be a little higher than in other Eurozone countries (a mere 0.09% in 2007), the elimination of a currency's risks has been crucial for the lowering of interest rates and the consequent boost in investment and growth.

3.3 The Effects of Globalization on Sustainable Economic Development of Germany

3.3.1 Effects of Globalization in the 1980s in Germany:

Germany remains one of the largest and most competitive economies in the world thanks in part to globalization. Germany has benefited from free movement and higher flows of goods and services, investment, capital, people and ideas. Germany is deeply tied into the global economy and is in a strong position to seize the opportunities presented by globalization. Through greater integration with the global economy, Germany's trade flows have remained strong and been redirected towards consumption-oriented, rapidly developing nations. Foreign direct investment flows to and from Germany are robust. Financial globalization - the near 24/7 movement of global capital - has provided needed funds to promote investment and growth at home. The global earnings of corporate Germany have soared over the past half-decade, generating investment, creating employment and boosting the income of millions of German workers. Globalization, in general, has helped raise Germany's real economic growth and maintain the nation's status as one of the most prosperous nations on earth.

Due to globalization, the degree of trade openness of many countries has increased significantly (as measured by total exports and imports of goods and services at a ratio of GDP). In the German's case, the relevant figure amounts to roughly 75% in 2008 compared with just over 60% in 1990. The German economy is the world's fifth largest, measured by purchasing power parity, and of the five is the most tightly tied to the global economy - more than the US, China, India or Japan.

3.3.2 The Effects of Globalization on Sustainable Economic Development of Germany in the 1990s:

Germany is the only large European country that continues to maintain a strong and persistent presence in high and medium high-technology manufacturing. German industry accounts for 87% of Germany's trade. Germany's trade has shifted to developing countries, but German investment remains focused overwhelmingly on developed countries. Nine of the ten fastest growing export markets for Germany since 1990 have been developing nations. Germany exports to the latter increased by nearly 10% annually since 1990, versus a comparable rate of 5.8% to non-EU-15 developed nations. More than two-thirds of Germany's outward investment stock, however, is in developed nations.

German companies are often front-runners in both Europeanization and globalization. They are taking advantage of the larger European Single Market to integrate new EU member states into their manufacturing production processes. 87% of the German offshored jobs stay in Europe. Germany is offshoring manufactured jobs within Europe and service jobs to Asia. The investment of German companies in the initial ten central and east European accession countries to the EU rose from \$350 million in 1990 to \$41.4 billion in 2004 and the number of people of these countries employed by German companies during the period jumped 25 times - from 31,000 in 1990 to 75,000 in 2004. Europeanization has its limits, however - in relation to the 2008 global financial crisis. German leaders refused to participate in any Europe-wide plan that would potentially draw on German taxpayer-funds to rescue banks in neighbouring countries. Despite the euro, the EU's financial sector is still more fragmented than united. This is inefficient and makes it hard for Europe to craft a coordinated and effective response in times of crisis.

Germany is shrinking, aging, and losing ground in the battle for global talent. Every year 300,000 fewer children are being born than needed to keep German's population stable. An older German work force is exacerbating skill shortages and exposing mismatches between available jobs and relevant skills. Globalization is not responsible for these demographic pressures, but it exposes the demographic challenges starkly. Immigration is essential to Germany's future prosperity, and Germany remains a top destination to migrants. But Germany is a magnet for the unskilled and recent efforts to facilitate the inflow of skilled migrants have yet to demonstrate success. Domestic reforms and new approaches are urgently needed.

Despite key strengths, German innovation is uneven and its education system is failing to meet the challenge. Germany ranks high in key cutting-edge economic sectors, boasts vibrant regional clusters, and invests considerably in innovation at home and abroad. Yet Germany ranks 8th among 16 advanced innovation economies and risks being squeezed between the high technology challenge posed by the U.S. and Japan and the catch-up challenge posed by rapidly developing countries.

3.3.3 Effects of Globalization on Sustainable Economic Development on Germany in the Year 2000s:

Before 2004 and mid-2008 Germany's economy rebounded from its sluggish performance during the previous decade and a half. Growth picked up, order books filled, unemployment declined. Germany seemed on course for an across-the-board revival that would re-establish itself as Europe's economic dynamo. But that was before the series of shocks that hit global financial and commodity markets suddenly in 2007 and most dramatically in 2008.

The financial crisis of 2008 has put to rest any doubt about how interconnected the global economy has become over the past few decades. As the crisis began, the prevalent feeling of Germany and Europe was that American financial problems, triggered by the U.S. subprime meltdown, were just that – America's problems. There was much talk of global decoupling – the capacity of Europe and the emerging markets to go their merry way despite a weakened United States. Such was the level of confidence in Europe that the European Central Bank opted to raise interest rates in early summer 2008, a signal that growth in the Eurozone was adequate and that the real challenge was inflation, not growth. This all changed in the early fall of 2008 when Europe, including Germany, found itself in the throes of a financial crisis and an economic recession courtesy of the financial tsunami whipped up by the United States. Such are the ties of globalization and the depth of transatlantic ties that a problem in the United States quickly translates into a problem for Europe and its largest economy, Germany.

Globalization cuts both ways – in good times, it bestows multiple benefits on those nations most open and receptive to unfettered cross-border flows of capital, goods, ideas and people. In bad times, there is no place to hide – and Germany is a prime example. Notwithstanding the nation's conservative banking sector and the fact that its real estate market experienced neither boom nor bust, Germany was enveloped in one of the worst global crises since the Great Depression. The epicentre of the global financial crisis is the United States, but Germany has not been spared the pain triggered by the financial tsunami. The country's robust recovery has been ambushed by the global financial crisis and attendant credit squeeze, and now faces an economic downturn that may last for many months and perhaps for years.

What role do Germany's 16 federal states play in global trade? Germany's leading trading state, not surprisingly, is the most populous state of North-Rhine Westphalia, the country's industrial heartland in the Ruhr valley. The two rich large southern states of Baden Wurttemberg and Bavaria are also major global exporters. Germany ranks as the third largest foreign investor in the EU in terms of FDI outward stock, trailing the United Kingdom and France. However, Germany is a pauper when it comes to FDI inward stock, accounting for just 7.8% of the EU's total inward stock in 2005. France's level of inward FDI stock was 56% larger than that of Germany in 2006. Germany's inward FDI stock accounted for only 8.3% of gross fixed capital formation in Germany in 2007. That's well below the EU average (nearly 23%), and underscores the potential for more inward foreign direct investment in Germany with attendant benefits for all stakeholders.

4.1 Theoretical Review

The theory of globalization today is a field of intensive and multidisciplinary debate. Attendees are numerous, and often opposing views of the mentioned phenomena. The theory of globalization is a very wide area of research and composed of contributions from many authors. Therefore, it is necessary to systematize understandings of globalization. This multidimensional phenomenon is being differentiated into three courses of analysis:

1. Hyper-globalist
2. Transformationalists
3. Skeptics

By hyper-globalists, globalization is viewed as a legitimate and irrepressible historical process, which leads to a world order based on the market and supranational institutions. Globalization presents a new era of development of civilization, without precedent on the course of human history. This process is referred to as progressive and socially desirable. It is also stressed that the intensity and dynamics of current changes in the economy lead to changes in core framework of social action (Held, McGraw, 2007, p. 5).

Guided by the self-reforming growth of global markets and technological progress, globalization inexorably destroys all previously established hierarchical structures. The role of the nation-state in this context is also significantly diminishing. Multinational corporations concentrate vast resources and become the main carriers of economic activity on a global level. This creates a global civilization in

which the market is integrated on the world level, multinational companies are becoming major actors in the economic process and international institutions substitute the role of national states. Multinational companies have fundamental influence on the economy and represent natural response to the ‘borderless’ economy that is characterized by homogeneous consumer tastes. These companies crowd out national models of economy as relevant units of economic activity (Ohmae, 2010).

Hyper-globalists conceive globalization as a process which has the internal logic and predictable outcome, the global society based on a fully integrated market. In other words, all the variety of heterogeneous cultures withdraws from in front of the unique social pattern, based on markets and institutions derived from the radically liberal cultural framework. In this sense, a well-known assumption about the end of history is generated which implies that the modern, global capitalism with liberal democracy as a political framework, represents the last word of socio-economic evolution (Fukuyama, 2012).

Transformationalists (Giddens, Scholte, Castells, Westheim (2012) are more moderate in terms of emphasis of ubiquity and linearity of the globalization process, as well as assessing of progressivism of its effects. But they do not accept skeptic thesis about globalization either. For them, changes in the organization of society that globalization brings are the growing overall integration and acceleration of socio-economic dynamics through ‘compression of space and time’. However, their approach is multidimensional, taking into account mechanisms of globalization other than economic ones. In this sense, a sociologist of modernism, Anthony Giddens, considers globalization as a phenomenon shaped by forces of ‘modern’ capitalism, politics, military power and industrialism (Giddens, 2010). These forces are the sources of dimensions of globalization. Four basic dimensions of globalization are: world capitalist economy, system of national state, world military order and international division of labour. The specified dimensions of modernity have enabled western countries to become the leading force in the world. Spreading dimensions of modernity, according to Giddens, to all countries in the world is identified as the process of globalization. However, another sociologist of modernity, Beck (2012) believes that the unintended effects of modernity forces are global risk and the new global threat. In order to overcome the risks, as important dimension of reality, it is necessary to create institutions of democracy and cosmopolitan confidence. Without it, globalization represents only a façade for the game of imperialist powers. There are also opinions that the liberal economic policy, which is inseparable from globalization creates political backlash by groups whose interests are negatively affected.

The third group of theoreticians, who expressed scepticism with regard to ubiquity of the process of globalization, is also characterized by the criticism towards globalization. In that sense they emphasize that the level of integration and openness of today’s economy is unprecedented international trade and capital flows were more important relative to GDP in the pre-1914 period (the first wave of globalization than in the contemporary economy (Hist, Thompson, 2000). Also, instead of a destructible character of globalization in relation to the hierarchy and the nation-state, they emphasize the significant role of national economies in pursuing economic liberalization and promotion of cross-border activity. The creation of regional blocs as the essential characteristic of the world economy offers argumentation that the world economy is less integrated than it was in the late nineteenth century (Held, McGraw, 2007, p. 5). Within this direction of thought, assessments of the non-sustainability of the current unification of the world are also present, because it raises radical resistance within individual cultures, which in the end can lead to a conflict of civilizations (Huntington, 2019). In short, scepticism is expressed both in terms of impacts of globalization and its ubiquity as well as in terms of sustainability of unification influences which it produces. Another classification of globalization theories is that of structural, conjunctural and social-constructivist.

4.2 Theoretical Framework

The concept of globalization has a very sound theoretical framework. The promotion of global trade was first started by the mercantilists in early 16th century. They were engaged mainly in commercial activities in order to attain favourable balance of trade. Looking at the present developments in the world economies, it has been proven that it is impossible for countries to separate or isolate themselves in a rapidly integrating world. Globalization has come to stay. Trade theory as well as close and open economy macroeconomic theories has explained a great deal of the phenomenon that has overwhelmed the world.

Over the past decade, globalization has been a pervasive trend in almost all economies. The world economy is becoming increasingly interdependent, deepening and intensifying international linkages,

most notably in trade. The trade theorist advanced the thesis that trade was essential for the growth of nations. The argument of this school does not favour autarky, where an economy is closed with little relations with the rest of the world. They believed that an economy should be opened. Global industrial restructuring in the 1990s was characterized by increasing specialization of firms and their extensive outsourcing and networking strategies. Heightened global competition, growing technological complexities and evolving markets and consumer tastes are driving restructuring of firms of all sizes. The trends towards downsizing and focusing on core competencies is accompanied by growing alliances, mergers and other types of business networks with foreign partners.

5.0 METHODOLOGY

5.1 Research Methodology

This paper is a conceptual work based on literature review, which employed the use of secondary sources of data collection. Secondary data was obtained from various publications in learned academic journals, publications of international and global development agencies like the United Nations Organization (UNO), the World Bank (WB), the International Monetary Fund (IMF), books, magazines, Newspapers and journals, internets, public records and statistics of the selected Euro-dollar countries under review.

6.0 CONCLUSION AND RECOMMENDATIONS

6.1 Conclusion

This study examined globalization of economies and the sustainable development of three Euro-dollar economies during (1980-2018). Given the extent of Foreign Direct Investment and trade openness, the study showed that these Euro-dollar countries under review viz- France, Spain and Germany are gaining from globalization. This is shown by high GDP growth. The study equally highlighted the negative as well as the positive effects of globalization on the world economy with particular reference to the selected Euro-dollar countries under review.

In this work, we have looked at the globalization and its effect on the sustainable economic development of the three selected Euro-dollar countries within the period: 1980-2018. The advantages of globalization for these Euro-dollar countries lies in the capacity for wealth creation through export-led growth and the gains of expanded international trade of goods, services and access to new products. Despite the fact that globalization provided opportunities for development and growth, there are associated serious problems that can be managed using appropriate fiscal policies.

6.2 Recommendations

In this research paper, the author suggests that globalization is good and should be handled in such a way as to improve the life of every inhabitant of global neighbourhood including the Euro-dollar countries under review. For globalization to succeed, the inequality between the poor and the rich economies should be minimized. The global economy should be regulated and should not be dominated by organizations that recognize money as the way of life.

References

- Aguado, S. (2011)**, ‘Argunos Malentendidos Frecuentes sobre la Glonalization Economica’ (available at <http://www2.uuh.es/saguado>)
- Aninat, E. (2011)**, ‘Reflections on Globalization, Spain and the IMF’ (speech available at <http://www.imf.org/external/np/speeches/2001/062901.htm>)
- Ball, L. and N. G. Mankiw (2016)**, ‘What Do Budget Deficits Do?’, in Federal Reserve Bank of Kansas City, Budget Deficits and Debt: Issues and Options, 1996.
- Balmaseda, M. and Sebastian, M. (2013)**, ‘Spain in the EU: Fifteen Years May Not Be Enough’ in Royo, S. and P. C. Manuel (eds), Spain and Portugal in the European Union, Frank Cass, 2013.
- Bergsten, C. F. (2019)**, ‘Dollarization in Emerging Market-Economies and its Policies Implications for the United States’, Institute for International Economics: Statement (April, 2019) (Available in <http://www.iie.com/TESTIMONY/dollariz.htm>)
- Bhalla, S. (2012)**, ‘Imagine There’s No Country: Poverty, Inequality, and Growth in the Era Of Globalization, Washington D.C; Institute for International Economics, 2002.
- Burtless, G. R; Lawrence, R. Litan and R. Shapiro (2018)**, ‘Globophobia: Confronting Fear About Open Trade. The Bookings Institution, 2018.
- Carreras, A. and X. Tafunell (2010)**, ‘Historia Economica de la Espana Contemporanea

- (1789-2009), Ed. Critica, 2010.
- C.B.N. (2018),** "Foreign Private Investment in Nigeria (2018), Economic and Financial Review 38, No. 579.
- De La Dehesa, G. (2011),** "Spain: Trade Liberalization after 1959" in Shepherd, G. and C. Langoni (eds.), Trade Reform: Lessons from Eight Countries, ICS Press, 2011.
- De La Dehesa, G. (2010),** "Comprender la Globalization, Alianza Editorial , 2011.
- Dollar, D. and Kraay, A. (2011), "Trade, Growth and Poverty", World Bank Policy Research Department Working Paper No. 2615, Washington, 2011.
- Dornbusch, R. (2019),** "The Euro: Implications for Latin America", (March, 2019). (Available in <http://www.mit.edu/rudi>)
- Dornbusch, R. (2010),** "Keys to Prosperity: Free Markets, Sound Money and a Bit of Luck. The MIT Press, 2010.
- Hamilton, D. S. and Quinian, J. P. (2018),** "Globalization and Europe: Prosperity in the New World Order, Washington D.C. Center for Transatlantic Relations, 2018).
- IMF (2017):** World Economic Outlook: Globalization and Inequality, October, 2017.
- IMF (2018):** International Financial Statistics Yearbook, 2018.
- International Monetary Fund, World Economic Outlook, April, 2017,** Dieter Braeuniger," Globalization and Distribution – Industrial Countries Also Face the Challenge", Deutsche Bank Research; Current Issues, November, 2017.
- Kankwenda, M. (2014),** "Globalization and the need for Development Leadership in Africa in Globalization and African Development, CIDJAP, Enugu.
- Mabogunje, A. L. (1980),** "The Development process: A Spatial Perspective, London, Hutchinson University library.
- Mrak, M. (2010),** "Globalization: Trends, Challenges and Opportunities for Countries in Transaction, Vienna UNIDO.
- Nicola, F. S. Dirk, K. and Sommer, M. (2018),** "Inequality Trends for Germany in the Last Two Decades: A Tale of Two Countries," September, 2008.
- Salimono, A. (2019),** "Globalization and Challenges: International Summit on Globalization As Problem of Development in Harana Cuba, Jan 18-22.
- Scholtre, J. (2017),** "The Globalization of World Policies", in Steve Smith and John Baylis (eds.). The Globalization of World Policies, Oxford University Press.
- Seers, D. (2017),** "The New Meaning of Development in Mabogunje, A. L. (1980), The Development Process; A Spatial process Perspective", London, Hutchinson University Library.
- Shenkar, O. and LUO, Y. (2014),** "International Business", New York:/John Willey and sons.
- Spitaller, E. and Galy, M. (2012),** "Spain: Landmarks in Economic Development, 1959-92", IMF Working Paper 78, 2012.

THE EFFECTS OF STRATEGIC INTELLIGENCE ON COMPETITIVE ADVANTAGE IN THE NIGERIAN FOOD AND BEVERAGE MANUFACTURING INDUSTRY

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ABSTRACT

This study aimed to verify the effects of strategic intelligence on the competitive advantage in the Nigerian Food and Beverage Manufacturing Industry. To achieve the aims of the study, a descriptive analytical method was used. The study was conducted on a sample consisting of (231) managers in these companies. To measure strategic intelligence, a scale of five dimensions was used: foresight, system thinking, vision, motivation and partnership. To measure the competitive advantage, the researcher used a four-dimensional scale: quality, cost, flexibility and delivery. The study found that there were medium levels for all dimensions of strategic intelligence, while the levels of dimensions of competitive advantage were all high. It was also found that there was a significant effect of all dimensions of strategic intelligence except for system thinking and that there was a significant effect of strategic intelligence on all dimensions of competitive advantage. The food and beverage manufacturing industry has been used as an example for demonstrating the given model's capabilities to create standard algorithms for making anticipatory decisions in difficult situations. This paper also defines the role of strategic intelligence in the era of digital transformations and the transformation of organizations into self-learning ones.

Key Words: Strategic intelligence, Competitive advantage, Food and Beverage Manufacturing Industry, Nigeria.

1. INTRODUCTION

There is a lot of literature that talked about competitive advantage, and how organizations work and focus on factors, whether internal or external in order to reach a higher level of competitors in the same field, where some view that competitive advantage is a powerful stimulus that drives organizations to do more.

From the continuous effort at all levels, there is the necessity to ensure the continuity of the market for the longest possible period, through achieving the desire of customers and achieving the goals of the organization (Kafi, 2017, 181). The meaning of competitive advantage dates back to the beginning of the eighties (1980s) in the last century, and many scholars believe that Porter is one of the first to have spoken and written on competitive matters, and his book "Competitive Strategy" published in (1985) is a major reference in this field (Al-Sarhan, 2005, 91).

The increased competition between organizations and different philosophies in how to deal with conditions and changes in the business environment at various levels globally and locally, the emergence of globalization and its impact on all organizations and ease of communication and great openness between peoples and countries until the world became like a single village, this is what forced the organizations to predict their future and follow scientific and administrative methods for adapting to developments and changes that occur in the internal and external environment of these organizations. At the same time, these organizations are looking for human resources and capabilities that have sufficient flexibility to deal with these conditions and changes, and have the ability to envision the future and develop appropriate visions for them, all in order to achieve success and excellence in markets where competition has become stronger and remain in it for those who search about the competitive advantage.

The developments in the business environment as well as the accelerating changes have led the organizations to search for a competitive advantage, not in option for them, but a duty for them to survive, excel, continue, and reach the stage of excellence, and that they gain the loyalty of their customers as well as maintaining sustainability between competitors and the characteristics of the competitive advantage, which is represented in strategies that competitors do not apply, and it is difficult for others to imitate them, as well as to reduce costs in products, at the same time difficult to imitate or

use another alternative. To achieve a competitive advantage there must be something of strategic intelligence to reach the competitive advantage that most organizations seek to reach at a time when competition among organizations is intensifying on a large scale, and competition is increasing day by day (Mnjula, 2014).

Strategic intelligence is a form of development in management thought, in which all organizations work to achieve their goals and reach their goal through obtaining appropriate information in order to use them to predict the future, an integrated view of the administrative system, innovation of new ideas, and creativity in business to counter changes in the surrounding environment and adapt to it. All institutions try to maintain the competitive position they seek through a set of procedures and changes that they undertake in order to achieve the goals of the organization.

1.1 STUDY PROBLEM

It is not clear to anyone the intensity of competition between business organization in order to obtain a greater market share and reach a greater number of clients, as the organizations seek to focus on excellence and to continue to achieve progress not only at the local level but also at the global level at other times. Achieving competitive advantage, survival and success, and achieving current and future goals alike, had to be practical solutions to face this great momentum in intense competition and expansion of markets and the spread of modern means and the abundance of local and global economic crisis, all of which pushed this this direction and research, studies and ideas emerged on the side strategic intelligence in order to use it to find solutions and access to excellence, development and continuity of organizations.

1.2 Study Objectives

The main objective of this study is to investigate strategic intelligence: a quintessential requirement for organizational growth and development. The specific objectives were:

- i) To identify the relative importance of strategic intelligence in Food and beverage manufacturing industry in Nigeria.
- ii) To highlight the relative importance of the level of competitive advantage in the Food and beverage manufacturing industry in Nigeria.
- iii) To evaluate the effects of strategic intelligence on the competitive advantage in the Food and beverage manufacturing industry in Nigeria.

2. THEORETICAL BACKGROUND

2.1 BASIC CONCEPTS, AND TERMINOLOGY

Strategic intelligence is a systematic and continuous process of exploring trends and the market environment with the use of powerful analytical systems that ensure the generation of knowledge and digital tools for making long-term decisions and the organization's preparedness for the unpredictable challenges of the future. With regard to management, strategic intelligence performs the function of detecting, identifying, and solving problems that go beyond the past experience, and which the organization is going to face in the future. Strategic intelligence is a form of development in management thought, in which all organizations work to achieve their goals and reach their goal through obtaining appropriate information in order to use them to predict the future, an integrated view of the administrative system, innovation of new ideas, and creativity in business to counter changes in the surrounding environment and adapt to it.

All institutions or organizations try to maintain the competitive position they seek through a set of procedures and changes that they undertake in order to achieve the goals of the organization from reaching the competitive advantage that they seek as well as achieving profits and this requires continuous improvement in all production and service operation and the stages it goes through from the design of the product to the stage of distribution (Al-Jubouri, 2008, 254).

The concept of strategic intelligence lies in an attempt of individuals to control problem solving in the environment in which the organization works and the ability of individuals to use their experience in order to create concepts in theory and practice in order to define the relationship, whether it is apparent or hidden (Al-Ghanudi, 2017). Others argue that strategic intelligence relates to focusing on products today and in the near future, in order to provide information to stakeholders in the planning process to take them into account with regard to existing products to make appropriate change and take these changes into the organization's strategies (Duczynski & Knight, 2016).

Intelligence is defined as the sum of the mental abilities that an individual uses to confront new situations, or the ability to understand and perceive the truth, and it can also be defined as the behaviour through which problems are solved and adaptation to the surrounding environment, and the ability to form and develop mental concepts (Rouach & Santi, 2001). Strategic intelligence is more than a process that aims to search for information, then analyse it in order to be available to everyone at the time it needs it, in order to make the appropriate decision for the situation in which this decision must be made at the right time (Clar, Acheson, Haimer, Saunter, Buczek & Allan, 2008, 173).

Strategic intelligence is what is what the organization needs to know in the current business environment in order to determine what operations and procedures it should do today and what changes it wants to make in the future (Tham & Kim, 2002, 2). Strategic intelligence is also seen as consisting of four basic elements that are knowledge management, as well as foresight, in addition to reference comparison, and finally economic intelligence and all of the above contribute to strategic decision-making in organizations working in the business sector (Muhammad, Al-Tayyib & Abdali, 2012). Strategic intelligence is seen as the ability to form an image in which to view the environment in which the organization operates remotely, by looking at the information and data available on this environment (Alnoukari & Hanano, 2017). Hollensen (2010, 142) believes that the strategic intelligence directs the organization towards looking to the future, whether it is far or near, and helps it in making important decisions that are based on knowledge, and at the same time is concerned with the future conditions of the organization (Knosch, 2015).

One of the main reasons behind the importance of organizational transformation is to increase the intelligence of the organization. Organizational intelligence refers to a set of rules with aided value derived from the intangible assets of the organization, which together represent the knowledge that consists of employees, management, stakeholders, and clients.

To increase the intelligence in the organization, you must first build a hierarchy of components that contribute to the intelligence in the organization. Benefits that can be obtained from the organization's use of intangible assets, which have been mentioned previously, show a new type of intelligence that helps the organization in the process of organizational transformation of the continuity of its presence within the markets, where intelligence can be classified according to the view (Liebowitz (2016, 13) into several types with the emergence of developments in modern technology and the use of technologies to do business instead of the human element. For the purpose of conducting this study, the five main dimensions were approved namely:

- **Foresight:** Foresight is an important component of strategic intelligence as it shows the ability of senior management to see what others do not see (Maccoby, Michael, Scudder & Tim, 2011). The presence of technology is a major addition in the formation of strategic intelligence among organizations through the use of accurate information provided by modern technology, which thus serves the process of foresight (Rotolo, Rafols, Hopkins & Leydesdorff, 2017). The rapid change and significant development that is taking place urges organizations to work hard to develop the outlook process, and this requires changing the traditional methods of workers in this field as well as the need for continuous training for achievement (Palacios, 2018). The prospect for the future can be seen by having people in the organization from senior leadership with special ability and skill in the outlook process (David & Barnes, 2010). The prospecting process requires the ability to map what will happen in the future (Ravetz & Miles, 2016).
- **System Thinking:** Systematic thinking can be viewed by knowing the relationship between the internal and external entities of the organization and the nature of the relationships between them, and how they work towards creating a complete unity for the organization (Mohamed, Mohamed and Fadel, 2018). Some researchers argue that systematic thinking relates to the holistic view of the organization, by knowing the relationships and forces that relate to the production process (Al-Murshid, 2019). The process of systematic thinking is at present considered one of the secrets of the organization success regardless of the nature of their work, as it is based on grouping efforts and dividing them within the organization so that everyone works in an integrated, coordinated, efficient and effective manner (Yousfi, 2019, 37). The competitiveness of the organization requires it to work between its departments and units in an organized and coordinated manner in order to reach its goals, and to achieve the maximum degree of competition (Alnoukari & Hanano, 2017). Organizations seeking success must link

their internal components with each other in order to do business as required of them, and therefore must work in concert with each other (Qasim, 2018; Alnoukari & Hanano, 2017).

- **Vision:** The future vision indicates the perceptions and expectations of what the organization should be, and it represents the outlook for the future and the expectations that can be obtained in the long run (Ai-Ashkar, 2012, 67).

All organizations are working to reach the future that they seek to achieve their goals, and this requires setting a vision to reach them, because the vision is the image that is formed in the minds of the future that you want to reach for the organization (Wheelen & Hunger, 2012, 9). The vision is seen as the long term goal that the organization is heading towards and that is an image of the organization in the future as it achieves competitive advantage and achieving its goals (Dess, Lumpkin, Eisner & Mcnamara, 2014). The vision can be seen as a way to urge the organization to pursue its goals through a process of motivating workers to make the utmost efforts to reach the desired goals (Qasim, 2018). There are those who say that the vision relates to the ability of senior management to look to the future, and how the organization will be in the future (Muhammad et al., 2018).

- **Motivation:** Motivation is based on motivating individuals and bringing them together on a specific goal in order to achieve the vision that the organization seeks to reach (Al-Nuaimi, 2008, 173). There is a strong relationship between the ability of workers to perform their duties within organization, than they have the flexibility to perform their tasks, their ability to perform more than one task at times, which can be entrusted to them, and the internal motivation that they have to accomplish these actions (Tuan, 2016). Managers move individuals within the organization through the process of motivation in order to achieve the organization's vision, by identifying what drives and encourages motivation among workers and which drives them to work and achieving the goals of the organization (Al-Hamiri and Abdul Mahdi, 2019). Some researchers believe that motivation differs from one person to another, so the leader must have the ability to distinguish between individuals and what drives them to work and give in order to achieve the vision that the organization seek to reach (Abuzaid, 2017). The task of pushing the workers to do their jobs to the fullest extent lies in the distribution of responsibilities to them, in addition to that the benefit is taken from the good relations between the workers (Al-Sheikhly and Obaid, 2015).
- **Partnership:** The partnership process will be through the organization's ability to forge alliance and strategic cooperation with other organizations (Sheikh and Mumir, 2016). Partnership represents the ability of a leader who has strategic intelligence to be able to establish strategic alliances, and to have a vision of partnership, alliance and integration with other organizations (Amran, 2015). A leader who can make partnerships and has the ability to benefit from it whether at the organizational level or at the external level through alliances with other organizations, is a characteristic of the intelligence that the leader has (Baie, Ahmadi, Shariff, Malafeh & Bae, 2017). Through its strategic plan, organizations seek partnerships with organizations that work at the same field, or in businesses that have a relationship with other organizations (Shujahat, Huaaain, Javed, Malik, Thurassamy & Ali, 2017). The partnership process plays an important role in the organization's internal strategy in providing information from the organizations' workers (Walsh, 2017).

2.1 Competitive Advantage

The concept of competitive advantage is due to profitability as a long-term concept, that is, there is continuity in achieving profits, and the performance of the organization is above average in the industry to which it belongs, and this is sufficient to be evidence of its superiority and sustainability, therefore the concept of sustainability and excellence is always linked to long term, as for time, its indication of sustainability and competitive advantage, so if the organization seeks to maintain its position and multiply efforts to continue to excel and progress, it maintains its competitive advantage among organizations in the same sector (Al-Alaq, 2016, 257). Some writers believe that the progress and failure of some organizations depends on competition, and by setting the competitive strategies of the organization that lead it to dominate the market, as it works diligently to increase its market share (Clar et al., 2008, 175).

When developing the organization's strategic plan, the organization's strengths and weaknesses are studied and the external and internal environment is defined. During the development of the plan, a competitive advantage is established as a goal that the organization seeks to reach by implementing the strategy through the focus strategy, which is relied upon to achieve competitive advantage (Diderrich, 2019, 8).

Fain and Nair (2009) defines competitive advantage as a kind of distinction that gives the organization something of positive progress and distinction over workers in the same sector or in the same industry, and this does not mean continuity for a specific period but rather the continuation to an indefinite period of time and the goal of the organization is to continue and repeat the preservation. It must, and if the organization does not do so, it will be a major retreat for the organization and will not have any competitive advantage.

There are those who believe that the competitive advantage depends on the exploitation of resources through adopting rapid movement strategies through rapid learning and dealing with the rapid and lasting changes that take place in the environment in which the organization operates (Liu, 2013). Achieving competitive advantage is due to several important factors, one of which is the use of technology in its various forms. It helps the organization to analyse accurately and quickly communicate, in addition to linking it with the outside world in which it influences, deals with, and influences (Vivek, 2017, 199). From the point of view of Al-Ali (2009, 40), the basic idea of competitive advantage is based on the ability of the organization to fulfil the desires and needs that the customer seeks to obtain, or in another way the value that he tries and hopes to reach from the product, and this is what gives a competitive advantage to that organization on the other, and thus makes the customer returns to deal with this organization and not permanently.

Others believe that a competitive advantage can be defined as the organization's ability to work out strategies and create mechanisms that enable it to reach better positions compared to organizations, working in the same sector and to exercise the same actions and make them ahead (Haider, 2002, 8). There are those who explain the competitive advantage as a type of competence that the organization performs in order to distinguish them from other organizations, which leads to providing a new addition to customers in a way that leads to a difference from others or competing organizations in the same sector and this leads to access to excellence in these markets (Shafiq, 2010). For the purpose of conducting this study, four main dimensions were approved namely:

- **Quality:** Quality is one of the main factors that organizations use to confront competitors, through the process of choosing new ways to do business and using new communication methods, modern and advanced technologies, attracting people with expertise, and using modern methods such as advanced software and new methods in dealing with customers (Al-Awawdeh, 2019). These are those who see quality as a process of improvement and development in the capabilities of the organization, and the process of continuing and maintaining the achievement of the requirements of the beneficiary of the organization, and that at all stages of work and performance starting from knowing the needs of the beneficiaries and ending with knowing how satisfied they are with the products provided to them (Al-Hamidi, Salama & Kafy, 2016, 230). On the other hand, quality can also be seen as the state of satisfaction, which customers want to continuously reach (Robbins & Coulter, 2003, 128).
- **Cost:** Cost is an important factor in achieving competitive advantage for organizations as it always seeks to reduce costs to the extent that does not affect the nature of the product and the goal of its production (Aghajani, & London, 2012, 135). There are those who believe that organizations should work to reduce costs in order to obtain a competitive share in the market, by reducing production costs, as well as marketing costs (Al-Tawil and Ismail, 2009, 12). Another concept of cost is the organization's ability to produce and markets products whose cost is lower than competitors, which increases the organization's market share (Morsi, 1998, 83). There are those who consider that costs are very important in determining the competitive advantage, but not at the expense of quality and in this case the cost and quality must be taken into consideration at the same time (Al-Zubi, 2014).
- **Flexibility:** flexibility is seen as the ability of the organization to respond to the desires and needs of customers through its ability to change the procedures and processes it has, as well as the commitment to achieve the desires and requests of customers by making changes that require and warrant to be made as well as providing the best products, whether goods or services, with

appropriate quality and cost (Lami, 2008, 25). Others see that flexibility is based on the ability that the organization has to provide more than one product in a broad and large way, due to the large volume of customers who have different tastes and opinions as it works to meet these needs of these customers (Chase, Jacobes & Aquillano, 2004, 26).

- **Delivery:** time is very important to customers, as it is considered an important component of the competitive advantage that all organizations are trying to reach, so it is drawn into the strategic policies of organizations by reducing the time period from the customer's request to the delivery time, and that is as quickly as possible and that requires reducing the product's life cycle to the lowest degree possible while maintaining the characteristics of the product and its performance (Salaq, 2016, 286). In addition, it can be used to reduce storage operations and various production procedures to reduce the time period for delivery (Ibn Jarwa & Nur-Alden, 2017). Speed is very important in achieving the competitive advantage (Al-Ali, 2000, 51), and it is based on rapid work in carrying out the basic functions in the organization, such as working to improve and develop the product, and performing customer requests as quickly as possible, and after-sales service procedures (Jabreen, 2006, 37). There are those who see great importance to the factor of time, delivery and speed in production and delivery of the product to the markets before competitors, and this plays a very important role in achieving competitive advantage and affects the organization and its position in the market and achieving profitability (Al-Lami, 2008, 26).

3. Empirical Review

The study carried out by Al-Awawdeh (2009) in order to identify the impact of strategic information systems on competitive advantage. The study found a positive effect of the elements of strategic information systems on the competitive advantage. As for Badri (2019), he tries to explain the role of a proposed strategy to activate the impact of organizational learning in achieving competitive advantage. The results of the study showed that there is an association between the proposed strategy to activate the role of organizational education and achieve competitive advantage, and that there is a complete weakness in achieving competitive advantage. Latif and Abd (2019) tries to get acquainted with the role of the logistics department in enhancing competitive advantage, but that there is a weakness in the information system within organizations, and the study demonstrated the existence of two logistic management divisions, namely administrative logistic, which is part of the supply chain, and production logistic related to the supply of raw materials to the company. Hamed and Kamel (2019) focused on knowing the impact of dynamic capabilities on competitive advantage. They came out with many results, the most important of which was the direct impact of the dynamic capabilities on competitive advantage. As for Al-Hunaity and Al-Aqeed (2019), their study sought to know the effect of organizational structures on achieving competitive advantage. The results of the study indicated an effect of organizational structures on achieving competitive advantage. In another study conducted by Khazzal and

Dhiab (2019), to see the effect of green innovation on production and processes in innovation and sustainable competitive advantage. The company has achieved a competitive advantage by reducing production costs as well as by providing high-quality products that are competitive in the markets. Al-Zawawy (2018) sought to know the role of technological innovation in gaining sustainable competitive advantage. Its results have demonstrated a correlation between technological innovation and the acquisition of sustainable competitive advantage. As for Al-Mardini and Al-Mawsili (2017), they examined the effect of continuous improvement in the competitive advantage, and the elements of continuous improvement have had a major impact in achieving the competitive advantage. Ade, Akanbi and Tubosun (2017) were interested in knowing the impact of marketing intelligence on competitive advantage in the business sector. The results of the study showed a significant impact of marketing intelligence on the competitive advantage and the study also showed that information and data on competitors, opportunities, threats and risks from competitors, has a significant and positive impact in achieving the competitive advantage, and that this information may lead to achieving a better performance than competitors.

In another study by Erdizadeh, Salehzadeh and Esfahani (2017) to demonstrate the role of business intelligence and knowledge exchange and organizational innovation in gaining competitive advantage. The results of the study showed that business intelligence and knowledge exchange and organizational

innovation have a positive and significant impact on competitive advantage through knowledge sharing and organizational innovation, and that knowledge sharing achieves a competitive advantage in a positive and significant way, and finally that of innovation. The organizer has a significant and positive impact on obtaining competitive advantage and preference among companies in the same field of competition.

4. Hypotheses

H1: There is no effect of strategic intelligence on competitive advantage in the Food and beverage manufacturing companies in Nigeria.

H2: There is no significant effect of strategic intelligence in quality in the Food and beverage manufacturing companies in Nigeria.

H3: There is no significant effect on costs in the Food and beverage manufacturing companies in Nigeria.

H4: There is no significant effect of strategic intelligence on flexibility in the Food and beverage manufacturing companies in Nigeria.

H5: There is no significant effect of strategic intelligence on delivery on the Food and beverage manufacturing companies in Nigeria.

5. Procedures

5.1 Sample

The population of this study is represented by the managers in the Nigerian Food and Beverage Manufacturing Companies, who number (736) managers. To collect the necessary data for the study from the managers, the researcher selected the random, proportional sample from the managers in these companies, whose number was (254) managers. The questionnaire was distributed to them through direct visits to companies by the researcher. After completing the distribution process, (231) questionnaires valid for statistical analysis was retrieved.

5.2 Measurement

To measure the dimensions of the study, the researcher relied on the approved measures used in many previous studies that dealt with strategic intelligence and competitive advantage. To measure strategic intelligence (independent variable), five-dimensional scale was used: foresight, System Thinking, vision, innovation and partnership, used in many previous studies (Maccoby, 2001; Purity, Ifeoma & Anigbogu, 2017). To measure the competitive advantage (dependent variable). The five-dimensional measure was utilized: cost, quality, innovation, flexibility and delivery that are widely used by researchers in previous studies (Ade, Akanbi & Tubosun, 2015; Eidizadeh, Salehzadeh & Esfahange, 2015; Liu, 2013).

The reliability test for the two variables of the study was through the reliability factor of Cronbach Alpha where it was found that all dimensions exceeded the (0.70) ratio accepted for statistical analysis purposes (Al-Najjar, Al-Najjar & Al-Zoubi, 2017, 109). Alpha coefficient ranged between (0.838 - 0.915) as shown in Table (1).

6. Statistical Analysis

Table (1) indicates the number of dimensions items for each variable on this study and reliability coefficients of these items, it's all greater than the statistically acceptable percentage (0.70) (Sekaren & Bougie, 2010). The highest value in mean was for cost items with this value (4.105) and the lowest value in mean it was for Motivation items with this value (3.484).

Table 1: Descriptive statistics and reliability

Variables	Items	Alpha	Mean	Std. Dev.
Foresight	5	0.872	3.527	0.941
System Thinking	5	0.907	3.648	1.104
Vision	5	0.836	3.629	0.829
Motivation	5	0.897	3.484	0.795
Partnership	5	0.859	3.581	0.781
Quality	6	0.828	3.831	1.108
Cost	6	0.873	4.105	1.022
Flexibility	6	0.915	3.794	0.749
Delivery	6	0.855	3.846	0.667

H1: There is no significant effect of strategic intelligence on competitive advantage in the Nigerian Food and Beverage Manufacturing Companies

Table 2: Impact of strategic intelligence on competitive advantage

model	Dimensions	b	t	Sig.	r2	f	Sig.
1	Partnership	0.571	35.058	0.000	0.618	67.721	0.000
2	Partnership	0.491	32.947	0.000	0.684	54.937	0.000
	Foresight	0.463	29.004	0.000			
3	Partnership	0.418	26.227	0.000	0.732	43.619	0.000
	Foresight	0.374	22.736	0.000			
	Vision	0.347	18.592	0.000			

Table (2) indicates the results of the stepwise regression coefficient of the effect of strategic intelligence on competitive advantage. In the first model, it was found that partnership was the first dimension affecting the competitive advantage, where the value of t (0.618), and the value of f (67.721) and the level of significance (0.000), this means that partnership explained the ratio (61.8%) in the variation in the competitive advantage. In the second model, after entering the foresight with the partnership, the value of r (0.684), with the value of f (54.937) and with a significant level (0.000), this means that the partnership and foresight together explained a percentage (68.4%) in the variation in the competitive advantage. In the third model, after adding the vision for partnership and foresight, the value of r increased to (0.732) and the value of f (43.619) and at a significant level (0.000), meaning that the vision raised the effect on the competitive advantage to (73.2%). In the fourth model. After adding motivation, the value of r increased to (0.759), at the value of f (36.728), and at a significant level (0.000), meaning that the four dimensions were explained (75.9%) of the variance in the competitive advantage. While it is noted from the results of the analysis, there is no significant effect of system thinking on competitive advantage.

Table 3: Effect of strategic intelligence on quality

r2	b	f	Sig.
0.294	0.372	83.562	0.000

Table (3) shows the results of a linear simple regression analysis for the effect of strategic intelligence on quality, it showed that there is a significant effect of strategic intelligence on quality, where the value of r2 reached (0.294), this means that strategic intelligence explains (29.4%) of the variance in quality, and the value of b (0.372), while the value of f (83.561) with a significant level (0,000). The results of regression analysis indicate to rejection of the second study hypothesis.

H3: There is no significant effect of strategic intelligence on cost in the Nigerian Food and Beverage Manufacturing Companies.

Table 4: Effect of strategic intelligence on cost

r2	b	f	Sig.
0.628	0.247	69.131	0.000

Table (4) indicates the results of a linear simple regression analysis for the effect of strategic intelligence on cost, where the value of r2 reached (0.628), this means that strategic intelligence explains (62.8%) of the variance in cost, and the value of b (0.247), while the value of (69.131) with a significant level (0,000). The results of regression analysis indicate to reject of the third study hypothesis.

H4: There is no significant effect of strategic intelligence on flexibility in the Nigerian Food and Beverage Manufacturing Companies.

Table 5: Effect of strategic intelligence on flexibility

r2	b	f	Sig.
0.842	0.431	91.629	0.000

Table (5) shows the results of a linear simple regression analysis for the effect of strategic intelligence on flexibility, where the value of r^2 reached (0.842), and the value of b (0.431), while the value of f (91.629) with a significant level (0.000). The results of regression analysis indicate to reject the fourth study hypothesis.

H5: There is no significant effect of strategic intelligence on delivery in the Nigerian Food and Beverage Manufacturing Companies.

Table 6: Effect of strategic intelligence on delivery

r²	b	f	Sig.
0.176	0.190	51.742	0.000

Table (6) indicates the results of a linear simple regression analysis for the effect of strategic intelligence on delivery, where the value of r^2 reached (0.176), and the value of b (0.190), while the value of f (51.742) with a significant level (0.000). The results of regression analysis indicate to reject the fifth study hypothesis.

7. Discussion

In this study, the researcher tried to test the effect of strategic intelligence on achieving the competitive advantage in the Nigerian Food and Beverage Manufacturing Companies. The results of the study indicated that there are medium levels of the strategic intelligence dimension of employees in these companies. The management of companies is unable to push its employees to provide more achievements to achieve its vision, and this may be due to the lack of incentives that they provide to them, which is reflected negatively on their weak thinking about the future of their companies, and the prediction of opportunities that the future can bring, and which is reflected negatively in their desire to think by developing long-term strategies. On the other hand, the results of the study indicated that the companies under study were distinguished by their competitive advantage, especially in the field of costs and quality, as they are able to provide products with low cost compared to competitors while maintaining the quality of their products. Companies benefit clearly from the application of global guidelines, in addition to applying a robust system for quality control, and they also use accurate accounting systems to control cost elements. The results of the study also indicated that there is a clear impact of the strategic intelligence dimension on companies achieving the competitive advantage except for the system thinking that did not have a significant effect on the competitive advantage. Strategic thinking receives the company, forecasting and anticipating opportunities building a clear vision for the company, persuading its employees, and making decisions consistent with this vision and using incentives to reward hard working employees, in addition to entering into partnerships with companies in the same industry to take advantage of their scarce resources all of which helps companies reduce their product costs and use modern methods in delivery of their products and rapid response to the change in demand for their products.

8. Recommendations

1. The management of Nigerian Food and Beverage Manufacturing companies needs to increase the motivation of its employees to increase the focus of their interest in thinking about the future of their organizations and not only to think about the completion of their daily work. Employees should be concerned with thinking about how to implement the organization's vision. This can be achieved by providing incentives based on their achievements and working on the basis of work teams in addition to using the flexible benefits system.
2. The management of these companies should encourage their employees to think about their future and anticipate the changes that will happen in the competitive environment and predict the future through exploring the current events to diagnose the opportunities that may appear in the future and prepare for their investment.
3. Corporate managements should increase their interest in entering into partnerships with companies working in the same industry to obtain scarce resources and increase their ability to face competition conditions, as well as help them to face the crisis that they may face, as well as increase their ability to invest their resources.
4. Increase the awareness of employees in their companies by seeing them by clarifying them to see the employees in them, so that they can unify their efforts in addition to persuading

employees to see the company to transform it into a practicable reality if the company's strategies are commensurate with the changes in the external environment, and there is harmony between management decisions and vision.

References

- 1) Abuzaid, A. (2017). Exploring the impact of strategic intelligence on entrepreneurial orientation: a practical study on Jordanian diversified financial services companies. *International Management Review*, 131 (1), 72 – 84.
- 2) Chase, Richard, B., Jacobes, F. (2004). *Operations management for competitive advantage*, (10th ed.), McGraw Hill Co. Inc.
- 3) David, R., & Burnes, Alan (2018). Mandel, geopolitical forecasting skill strategic intelligence. *Journal of Behavioural Decision Making*, (31), 127 – 131.
- 4) Dess, G., Lumpkin, G., Eisner, A., & Mcnamara, G. (2014). *Strategic management: Text and cases (7th Ed.)*, USA, New York: McGraw Hill Education.
- 5) Diderrich, Claude (2019). *Design thinking for strategy: Innovating towards competitive advantage*. Ebook, <http://doi.org/10.10077978-3-030-258075-7>.
- 6) Haider, Mbali Fahny (2002). *Information system: An introduction to achieving competitive advantage*. Egypt, Cairo: University House for Publishing and Distribution.
- 7) Kassem, Maysa Yahya (2018). Strategic intelligence and its relationship to problem solving for students of private colleges. *Journal of Educational and Social Sciences*, 5(1), 494 – 517.
- 8) Kiyobi, Kibeshi, & Isaga, Nsubili (2019). Strategic entrepreneurship, advantage and SMEs performance in the welding industry in Tanzania. *Journal of Global Entrepreneurship Research*, 62 (9), 1 – 23.
- 9) Knosch, Muhammed (2015). The role of strategic intelligence in achieving and enhancing the organization's sustainable competitive advantage. *North African Economics Journal*, (13), 91 – 116.
- 10) Purity Ndubuisi-Okolo, Ifeoma, Anekwe Rita & Anigbogu, Theresa (2017). The effect of strategic intelligence on business in selected commercial banks in south-east Nigeria. *International Journal of Trend in Scientific Research and Development*, 1(6), 87 – 98.
- 11) Robbins, S. P., & Coulter, M. (2013). *Management (7th ed.)*. Upper Saddle River: New Jersey, Prentice Hall.
- 12) Wheelen, Thomas L., & Hunger, J. David (2002). *Strategic management and business policy (12th ed.)*. New York, Prentice Hall.
- 13) Yousfi, Aladdin (2019). *Organizational development and organizational change management mechanisms*. Jordan, Amman: Dar Al-Hamid for Publishing and Distribution.

**MODERATING EFFECT OF GOVERNMENT SUPPORT ON THE RELATIONSHIP
BETWEEN LOCAL BUSINESS ENVIRONMENT AND SMEs PERFORMANCE IN
ADAMAWA STATE, NIGERIA**

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Abstract

The purpose of this study is to investigate the moderating effect of government support on the relationship between local business environment and SME's performance in North East Geo-political Zone, Nigeria. The study test these hypotheses in a survey data from 34 manufacturing and service SMEs locating in three Adamawa state senatorial Zone 2024. 215 owners and employees of SMEs were used for the study. Structured questionnaire was used to collect data from respondents. Multiple regression analysis was used to analyze the data collected using SPSS Version 29. The empirical results of the study reveal that local business environment (preferential treatment, firm promotion policy, local labour force, speed money, insecurity have significant effect on SMEs' performance. Similarly, the results revealed that government support moderating effect on the relationship between local business environments on SME's performance. The study therefore recommends that the SMEs should improve their strategies towards local environment and changes and consistently adapt, and SMEs should unite as a union and seek government support to over local business challenges.

Keywords: local business environment, government support, SMEs performance

Introduction

Small and medium enterprises (SMEs) have played and continue to play significant roles in the growth, development and industrialization of many economies the world over. In the case of Nigeria, SMEs have performed below expectation due to a combination of problems which ranges from attitude and habits of SMEs themselves through environmental related factors, instability of governments and frequent government policy changes and somersaults

Similarly, the role of the business environment in firms' operations is supported by most previous studies, although their findings are mixed. Previous studies have provided empirical evidence that the specific local business environment in which a SMEs is embedded can make a significant contribution to its performance (Neneh & Vanzyl, 2012; 2014; Ng & Kee, 2012; Tu, 2012; Chittithaworn, Islam, Keawchana, & Yusuf, 2011; Kennerley & Neely, 2003; Tan, 1996; Tan & Litschert, 1994; Okoroafo, 1993). Other studies have found that these factors have an inverse relationship (e.g., De Jong, et al., 2012; Chittithaworn et al., 2011; Luo, 1999; Ward, et al., 1995).

These mixed results may implicitly suggest that the effect of the local business environment on SMEs performance may vary by national or regional economic context (Ng & Kee, 2012; Alexandrova, 2004). In particular, SMEs in developed countries are clearly better off when their local business environment is certain. The effect may not even be the same in different transition economies. Therefore, we argue that the findings of previous studies addressing the effects of local business environment on SMEs in others countries continue as an ongoing debate and may not be applicable to Nigeria especially Admawa state in particular. Such topics in this region are under-explored. Thus, this research is intended to examine the effects of local business environment on SMEs performance in Adamawa State.

Literature Review

Business environment

The concept of business environment could be looked at from internal and external environmental elements that affect the operation of business firms. Business environment refers to those factors that are related to a business which affects enterprise decision and business performance. Cherunilam (2018) emphasized that a business's existence and success is determined by its inherent strength (the resources at its disposal, such as physical resources, financial resources, human resources, skill, and organization) and its ability to adapt to the environment. In industrialized countries, a link has been discovered between the operating environment and corporate growth. According to Okpara (2011), insufficient financial assistance, corruption, poor management, inadequate infrastructure, weak managerial skills, and low demand for products and services are among the factors that cause low performance in the SME sector

Preferential treatment

Transition economies have moved from their previously centrally planned economies, in which most firms were owned by the state and the private sector was not encouraged to develop, towards more market-oriented economies, in which development of the private sector has been considered the crucial catalyst of economic growth. However, state-owned companies continue to be preferred by the government over private ones, including SMEs (Maunganidze, 2013).

Promotion policy

Historical evidence has shown that the increasing promotion of private enterprises has led to an impressive growth of SMEs. Private firm promotion policies include credit and tax incentives and are associated with, for example, a reduction in complexity of paperwork, reduction of private firms' uncertainties about regulation and technology, and management enhancement for SMEs (Neneh & Vanzyl, 2012). Moreover, it has been reported that the relationship between Chinese firms and their various environmental components is highly complex, heterogeneous, and particularistic, particularly when information is not codified and regulations are not made explicit (Maunganidze, 2013; Boisot & Child, 1988; Child & Lu, 1990).

Local labour force

Environmental munificence represents the level of resources available to firms from various sources in the environment and is the extent to which an environment supports growth of organisations within it (for example, Tan & Liu, 2014; Tan, 1996; Okoroafo, 1993). Thus, when investigating 319 manufacturing firms in Singapore, Ward et al. (1995) included quality labour availability as one of three scales that are conceptually related to environmental munificence. The results showed that the responses of low performers to concerns about environmental munificence such as labour availability are quite different from those of high performers

Speed money (Bribery)

Svensson (2005) defined corruption as the misuse of public office for private gain. Corruption defined thusly would capture, for example, the sale of government property by government officials, kickbacks in public procurement, bribery and embezzlement of government funds. In addition, corruption is an outcome—a reflection of a country's legal, economic, cultural and political institutions. Corruption can be a response to either beneficial or harmful rules.

Insecurity

Security is the course of action allied with the eradication of any sort of threat to man and his values (Adegoke, 2014). The concept of security is embedded in the freedom from threat and the society's aptitude to retain an independent distinctiveness as well as their functional integrity coupled with forces of change (Ode, et al., 2018). The deficiency in adequate and proficient security brings about the notion of insecurity. Nwagbosa (2012) asserts that insecurity signifies different meanings such as: anxiety, fear, instability, uncertainty; danger; hazard; absence of safety; and lack of protection.

SMEs Performance

SMEs Performance has been defined as the resultant of efforts in form of activities of the business enterprise which includes its strategy and operational activities, management of all segments of business enterprise such as the human resources, finance, production, marketing (Leitner, 2000). Business performance is the effort expended by an enterprise so as to reach and achieve its stated

objectives which could include: its employee's satisfaction, its customer's satisfaction, the societal satisfaction, its survival, sales growth, and return on investment, employment, and ultimately profitability. This means SMEs performance is actual output as against expected output (Mark & Nwaiwu, 2015).

Theoretical Framework

This study underpinned on contingency theory. The contingency theory was propounded by Edward Fiedler in 1964. The theory asserts that no one best way exists to successfully manage business organizations, rather success is dependent on the leader's ability to manage and adapt to environmental situations. It proposes that organizational effectiveness results from fitting characteristics of the organization such as its structure to contingencies that reflect the prevailing situation within the organisation (Lamb, 2013). Contingencies here include; the environment, organizational size and organizational strategy (Chandler, 2013). Thus, the theory contains the concept of a fit that affects performance and impels adaptive organizational change.

Methodology

Survey research design was used for study. Questionnaire was used to collect data from 215 employees of SMEs in Adamawa state. The study test these hypotheses in a survey data from 34 manufacturing and service SMEs locating in three Adamawa state senatorial Zone 2024. 215 owners and employees of SMEs were used for the study. Structured questionnaire was used to collect data from respondents. Multiple regression analysis was used to analyze the data collected using SPSS Version 29.

Result

Based on the findings of the study,

- i. Preferential treatment has significant positive effect on SMEs performance in Adamawa State.
- ii. Promotion policy has significant positive effect on SMEs performance in Adamawa State.
- iii. Local labour force has significant positive effect on SMEs performance in Adamawa State.
- iv. Speed money (Bribery has significant positive effect on SMEs performance in Adamawa State.
- v. Insecurity has significant positive effect on SMEs performance in Adamawa State.
- vi. Government support moderates the relationship between local business environment and SMEs performance in Adamawa State.

Conclusion

Based on the objectives of this study the model is designed as SMEs performance development framework for developing entrepreneurial skills in Adamawa state and originally intended for application in real world contexts. Research questions two and three involved empirical assessment of external business environment and SMEs performance measures for Taxation police and Government/Institutional support initiative using data acquired by way of a survey instrument to which a sample of 2015 SMEs respondents participated. Hypotheses were developed for testing based on four local business environment clusters which emerged as relevant from the local business environment and SMEs performance model. The results provided responses to the research questions and led to the development of a conceptual model, the Local business environment and performance on SMEs in the state.

References

- Abraham E.E (2021). The effect of external factors on industry performance: the case of Lalibela City micro and small enterprises, *Ethopia. Journal of Innovation and Entrepreneurship*, 10(10), 1-14.
- Adeeko, A.E. (2017). *External business environment and entrepreneurial performance of Small and Medium Enterprises (SMEs) In Lagos State, Nigeria*. A Dissertation submitted to the Department of Business Administration and Marketing, School of Management Sciences, Babcock University, Ilishan Remo, Ogun State.

- Adegoke, N. (2013). Kidnapping, security challenges and socio-economic implications to the Niger Delta Region of Nigeria. *Central Point Journal: A Journal of Intellectual Scientific and Cultural Interest*, 16 (2), 205-216.
- Adegoke, N. (2014). The Nigeria police and the challenges of security in Nigeria. *Review of Public Administration and Management*, 3(6), 21-35
- Adeoye, A.O. & Elegunde, A.F. (2012). Impacts of external business environment on organisation al performance in the food and beverage industry in Nigeria. *British Journal of Arts and Social Sciences*, 6(2), 2-13.
- Adu, E. A. (2016). *The Impact of External Business Environment Factors on Performance of Small & Medium Sized Enterprises in the Pharmaceutical Industry in Kumasi Metropolis*. A thesis submitted to Department of Marketing and Corporate Strategy Kwame Nkrumah University of Science and Technology School of Business.
- Ahsan, A.S. (2018). Political Factors Affect Business Environment.
- Ali. L.; Awal. S & Abdulsalam. D (2020). Factors affecting the performance of small small scale construction firms in Nigeria. *Nigerian Journal of Technology*, 39(4), 981-991.
- Arsalan, H.; Arfan, S. & Rohail, H. (2020). .Organizational and environmental factors with the mediating role of e-commerce and SMEs performance. *Journal of Open Innovation Technology Market and Complexity*, 6(196), 1- 21.
- Cherunilam, F. (2018). *Business environment*. Himalaya Publishing House Pvt. Ltd.
- Dollar, D.; Mary, H.D. & Taye, M. (2005). Investment Climate and Firm Performance in Developing Economies. *Economic Development and Cultural Change* 54(1), 1-31.
- Dut, V. V (2015). The effects of local business environments on smes' performance: empirical evidence from the Mekong Delta. *Asian Academy of Management Journal*, 20(1), 101–122.
- Fernandes, A. (2008). Firm-Level Productivity in Bangladesh Manufacturing Industries. *World Development*, 36(10), 1725-1744.
- Gloria, O. E. (2015). Impact of Business Environment on Organization Performance in Nigeria: A Study of Union Bank of Nigeria. *European Scientific Journal*, 4(1), 478-494.
- Idris A. A & Farrah M. M (2019). The influence of environmental challenges on small scale businesses in Bauchi Central Market. *International Journal of Research and Review*, 6(8), 550-559.
- Li, W. (2007). The impact of economic reforms on the performance of Chinese state-owned enterprises. *Journal of Political Economy*, 105(2), 1080-1106.
- Mark, J. & Nwaiwu, J. N. (2015). Importance of political environment on business performance of multinational companies in Nigeria. *African Research Review*, 9(3), 1-10.
- Mohammed, S. K. A. & Abdalla, H. A. (2017). Impact of Internal Environment on Performance Excellence in Jordanian Public Universities from Faculty Points of View. *International Journal of Business and Social Science*, 8(1), 45-57.
- Ndife, C.F. (2014a). Business Environment and Survival of the Tourism Industry. *IOSR Journal of Business and Management (IOSR-JBM)*, 16(10), 78-83.
- Ndife, C.F. (2014b). Impact of business environment on business performance. *IOSR Journal of Business and Management (IOSR-JBM)*, 16(10), 78-83.
- Njoroge, J.K.; Ongeti, W.J.; Kinuu, D. & Kasomi, F.M. (2016). Does External Environment Influence Organizational Performance? The Case of Kenyan State Corporations. *Management and Organizational Studies*, 3(3), 41-51
- Nur, N.; Haris, M.; Nurdin, B. & Jusni (2017). The Effects of Business Environment, Market Orientation, Strategy, and Product Innovation on Business Performance in the Real Estate in Makassar City. *Scientific Research Journal (SCIRJ)*, 5(10), 51-57.
- Obiwuru, T. C.; Oluwalaiye, O. B. & Okwu, A. T. (2011). External and internal environment of businesses in Nigeria: An appraisal. *International Bulletin of Business Administration*, 12.
- Okonkwo, N.O. & Obidike, C. P. (2016). Small and medium scale enterprises financing in Nigeria: Problems and prospects. *International journal of innovative sciences and Humanities Research* 4(1), 77-86.
- Okpara, J. O. (2011). Factors constraining the growth and survival of small and medium enterprises in Nigeria: implication for poverty alleviation. *Management Research Review*, 34(2), 156-171.

- Ozoh. I.; Okeke. M. & Jacobs, D. (2020). Influence of environment on organizational performance: a study of selected small and medium enterprises in Anambra State, Nigeria. *International of Management and Marketing Systems*, 13(8), 32-44.
- Salisu. Y.; Momoh. I. & Uba, H. (2019). Analysis of environmental factors affecting manufacturing small and medium size enterprises in Kogi State, Nigeria. *Journal of Social Economics Research*, 6(2), 85-96

**“ALLAH’IN KELAMI” İSİMLİ MEALİN KIRAAT FARKLILIKLARI VE MUCİZE
OLGUSU AÇISINDAN TAHLİLİ
ANALYSIS OF THE WORK NAMED “THE WORD OF ALLAH” IN TERMS OF READING
DIFFERENCES AND THE PHENOMENON OF MIRACLE**

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Abstract

Translations are studies carried out by translating Quranic verses into Turkish, especially by those who do not know Arabic, in order to make the Quran understood. Recently, many translations have been written for this purpose. One of these is Mehmet Türk's translation, Allah's Word, Qur'an and Translation. Mehmet Türk designed his work as a translation-interpretation and wrote it accordingly. He paid attention to including the Arabic text of the Quran in the translation he prepared and briefly explained the verses with footnotes in the sections he deemed necessary. Some words in the Quran have been the subject of different recitations. While recitation differences sometimes directly affect the meaning, sometimes they are merely pronunciation differences without any effect on the meaning. Including recitation differences that cause changes in meaning and the variety of meanings resulting from these in translations is an element that allows the verses in question to be conveyed more comprehensively. Miracles are the creation of extraordinary events that cannot be seen in the current order by Allah's power based on various wisdoms. It has been observed that the verses that are the subject of miracles in recently compiled translations have been translated in various ways. In this study, the relevant translation has been examined from two perspectives. One of these is to what extent the variety of meanings resulting from differences in recitation is included, and the second is from what perspective the phenomenon of miracles, which is the subject of very different approaches in translations, is approached. The analysis method was used in the study. According to the results obtained, it has been determined that the recitation differences and the variety of meanings resulting from these are mostly not included in the translation in question. Examples of these are the verses Al-Baqarah 2/106, 219 and Al-Maidah 5/112, Yunus 10/30. It has been observed that the generally accepted understanding of miracles is adopted in the translation, and that no place is given to the attitude that makes miracles ordinary by interpreting them in various ways. The incident of some people being transformed into monkeys, which is mentioned in different places in the Quran, can be mentioned as an example of this. It has been determined that the author has taken the opinion of the public into consideration in the translation or explanation of verses that have been subject to different interpretations.

Keywords: Tafsir, Quran, Recitation, Translation, Miracle

Özet

Meâller, Kur'ân âyetlerinin Türkçeye aktarılması suretiyle özellikle Arapça bilmeyen kesim tarafından Kur'ân'ın anlaşılması adına yapılan çalışmaların son dönemlerde bu gayeye yönelik olarak pek çok meâl telif edilmiştir. Bunlardan biri Mehmet Türk'ün meâli olan Allah'ın Kelâmı Kur'ân-ı Kerim ve Meâli isimli eseridir. Mehmet Türk eserini, bir meâl-tefsir olarak tasarlamış ve buna göre telif etmiştir. Hazırlanmış olduğu meâlde Kur'ân'ın Arapça metninin de yer almasına dikkat etmiş ve âyetleri gerek gördüğü bölümlerde düştüğü dipnotlarla kısaca açıklamıştır. Kur'ân'da bazı lafızlar farklı kıraatlere konu olmuştur. Kıraat farklılıkları bazen anlamı doğrudan etkilerken bazen anlama herhangi bir etkisi olmaksızın sadece telâffuz farklılığından ibaret kalmıştır. Meâllerde özellikle anlam değişikliğine sebep olan kıraat farklılıklarına ve bunlardan kaynaklanan anlam çeşitliliğine yer verilmesi söz konusu âyetlerin daha kapsamlı bir şekilde aktarılmasını sağlayan unsurdur. Mucize ise çeşitli hikmetlere binaen Allah'ın kudretiyle mevcut düzende görülemeyen sıradışı hadiseler yaratmasıdır. Son

zamanlarda telif edilen meâllerde mucizelere konu olan âyetlerin muhtelif şekillerde çevrildiği gözlemlenmektedir. Bu çalışmada ilgili meâl iki açıdan incelenmiştir. Bunlardan biri kıraat farklılıklarından kaynaklanan anlam çeşitliliğine ne derece yer verildiği ikincisi ise meâllerde çok farklı yaklaşımlara konu olan mucize olgusuna hangi açıdan yaklaşıldığıdır. Çalışmada analiz yöntemi kullanılmıştır. Ulaşılan sonuçlara göre söz konusu meâlde kıraat farklılıklarına ve bunlardan kaynaklanan anlam çeşitliliğine çoğunlukla yer verilmediği tespit edilmiştir. Bunlara örnek olarak Bakara 2/106, 219 ve Mâide 5/112, Yûnus 10/30, âyetleri verilebilir. Meâlde mucizeyle ilgili genel kabul görmüş anlayışın benimsendiği, mucizeleri çeşitli şekillerde tevil ederek sıradanlaştıran tavra yer verilmediği görülmüştür. Buna örnek olarak Kur'ân'ın farklı yerlerinde geçen bazı insanların maymuna dönüştürülmesi hadisesi zikredilebilir. Müellifin farklı yorumlara konu olan âyetlerin çevirisinde yahut bunların açıklanmasında cumhurun görüşüne riayet edildiği tespit edilmiştir.

Anahtar kelimeler: Tefsir, Kur'ân, Kıraat, Meâl, Mucize

Giriş

Kur'ân meâlleri âyetlerin sadece Türkçeye aktarılmasından ibaret bir çeviri eseri olarak görülmemelidir. İlâhî mahiyeti ve eşsiz belagati sebebiyle Kur'ân'ın çevirisi tabiri caizse oldukça külfetli bir faaliyettir. Zira Kur'ân meâli hazırlamak farklı alanlarda ihtisas sahibi olmayı gerektirmektedir. Bunların başında Kur'ân ilimleri ve tefsir gelmektedir. Meal yazarının ayrıca kıraat, belagat, hadis, fıkıh ve kelâm gibi ilimlerde de belli bir seviyeye ulaşmış olması gerekir. Çeviri faaliyetinin odak noktasını dil oluşturduğundan meâl yazarının gerek Arapçanın gerekse Türkçenin dil incelikleri konusunda vukûfiyet sahibi olması şarttır. Günümüzde telif edilen meâllerin niceliksel açıdan oldukça iyi durumda olduğu söylenebilir olsa da niteliksel açıdan aynı hükmü vermek pek mümkün görünmemektedir. Bununla birlikte her bir meâl çalışmasının niteliksel olarak daha iyi meâllerin hazırlanmasına bir şekilde zemin hazırladığı söylenebilir. Meâllerin niteliksel açıdan iyileşmesine katkı sunacak faaliyetlerden biri hazırlanan meâllerin incelenmesine yönelik yapılan değerlendirme çalışmalarıdır. Bu bildiride de böylesi bir gaye takip edilmektedir. Çalışmanın konusunu Mehmet Türk'ün hazırladığı “Allah'ın Kelamı” isimli eser oluşturmaktadır. Bir meâli tüm yönleriyle incelemek daha geniş bir çalışmayı gerektirdiğinden bu bildiride söz konusu meâlde kıraat ve mucize olgularının durumu incelenecektir.

1. Kavramsal Çerçeve

Kıraat lafzı sözlükte bir masdar olarak “okumak, telaffuz etmek ve toplamak” anlamına gelmektedir (İbn Manzûr, 1993, s.128-129). Bir ilim olarak ise Kur'ân'ı nakledenlerin ittifaklarının veya ihtilaflarının kendisiyle bilindiği ilim olarak tarif edilir. İhtilaf noktalarını ise hazf, ispat, tahrik, teskin, fasl, vasl gibi hususlar oluşturmaktadır (el-Bennâ, 2006, s.6). Diğer bir tarife göre Kıraat, Kur'ân lafızlarının eda ediliş keyfiyetini inceleyen ilim olarak tarif edilmektedir (İbnü'l-Cezerî, 1999, s.9). Kıraat farklılığından kaynaklanan anlam çeşitliliğine örnek olarak Tevbe 9/12. âyeti zikredebiliriz. İlgili âyetteki اِيْمَانٌ lafzı, اِيْمَانٌ şeklinde de okunmuştur. اِيْمَانٌ lafzı “yeminler”, اِيْمَانٌ lafzı ise dilimize de yerleşmiş bir kavram olarak iman (inanç) anlamına gelmektedir. Bu durumda âyetin ilgili bölümünün iki farklı anlamı olmaktadır. Bunlardan birincisi “onların yeminleri yoktur” şeklindeyken ikincisi “onların imanı yoktur” şeklindedir (İbnü'l-Cezerî, 2009, s.278).

Mucize ise “âciz bıraktı, âciz buldu” anlamındaki اَعْجَزَ kökünden türetilmiş bir lafız olup, Peygamberlerin mucizelerini ifade sadedinde “aciz bırakan” manasına gelmektedir (el-Cevherî, 1978, s.883-884). Mucizenin terim anlamı konusunda ihtilaflar olsa da bu kavram genel olarak “peygamberin elinde ortaya çıkan ve benzeri öğrenim yoluyla meydana getirilemeyen olay” diye tanımlanır (Bulut, 2020, s.348). Kur'ân'da pek çok peygamberin mucizelerine yer verilir. Bu mucizeler anlatılırken “beyyine veya âyet/âyât” gibi lafızlar kullanılmaktadır. (A'râf 7/206). Hz. Mûsâ'nın asâsı ve elinin parlaması (el-A'râf 7/106-108; Hûd 11/96), Hz. İsâ'nın ölülere diriltmesi ve diğer mucizeleri (Âli İmran 3/49) bunlardan bazılarıdır.

2. Allah'ın Kelamı İsimli Meâlde Kıraat Olgusu

Mehmet Türk'ün meâlinde kıraat farklılıklarına ne oranda dikkat edildiği, bunu meâllere yansıtılıp yansıtılmadığı aşağıdaki kıraat farklılığına konu olan bazı âyetler üzerinden incelenecektir.

2.1. Fatıha suresi 1/4. Âyet

Ödül ve ceza gününün tek hakimi - مَالِكِ يَوْمِ الدِّينِ

Bu âyetin Mehmet Türk tarafından hazırlanan Allah'ın Kelamı isimli meâldeki çevirisi şöyledir: “Din gününün tek sahibi” (Türk, 2011, s.99).

Âyetteki mâlik lafzı, melik şeklinde farklı bir kıraate konu olmuştur (İbn Mücâhid, 1980, s.104). Mâlik lafzı sahiplik ifade ederken, melik lafzı kral anlamına gelmekte bununla bağlantılı olarak egemenlik ve yöneticilik anlamını barındırmaktadır. (Râzî, 1999, s.204-206). Türk, kıraat farklılıklarını âyetin çevirisine yansıtmamış olsa da düştüğü dipnotta söz konusu anlam çeşitliliğini aktarır. Buna göre meliklik her şey hakkında tedbir, emir ve yasaklama yetkisi demektir, bunun içine akıllı varlıklar da girmektedir. Maliklik ise, mal hükmünde olan şeyler ve bunlara dair yönetim ve tasarruf yetkisi anlamına gelir. Bunların tamamı "Alemlerin Rabbi Allah'a" aittir. (Türk, 2011, s.99-101).

Görüldüğü üzere müellif bu âyetteki kıraat farklılığından kaynaklanan anlam çeşitliliğine düştüğü dipnotta yer vermiştir.

2.2. Bakara Sûresi 106. Âyet

مَا نُنسَخُ مِنْ آيَةٍ أَوْ نُنسِئُهَا نَأْتِ بِخَيْرٍ مِنْهَا أَوْ مِثْلَهَا أَلَمْ نَعْلَمْ أَنَّ اللَّهَ عَلَى كُلِّ شَيْءٍ قَدِيرٌ

“Biz bir âyetin hükmünü yürürlükten kaldırır veya onu unutturursak, mutlaka daha iyisini veya benzerini getiririz. Bilmez misin ki Allah her şeye kâdirdir”

İlgili âyetin *Allah'ın Kelamı* isimli meâldeki çevirisi şöyledir:

“Biz herhangi bir ayetin daha hayırlısını veya benzerini getirmediğçe, onu asla yürürlükten kaldırmaz ve de unutturmaz. Sen, Allah'ın gücünün her şeye yettiğini hiç bilmez misin?” (Türk, 2011, s.389).

Bu âyette kıraat farklılığına konu olan نُنسِئُهَا lafzıdır. Bazı kıraat imamları bu lafzıdaki nun harfini fethalayıp ve hemzeli olarak نُنسَأُهَا şeklinde okumuştur (İbn Mücâhid, 1980, s.168), (ed-Dânî, 1984, s.76). نُنسَأُهَا kıraatine göre anlam, “onu ertelersek” şeklinde, نُنسِئُهَا kıraatine göre ise “onu unutturursak” şeklinde olmaktadır (et-Taberî, (2001), s. 394).

İncelenen meâlde âyete dipnot düşülmüş ancak bu dipnotta kıraat farklılıklarından kaynaklanan anlam zenginliğine değinilmeden sadece nesh konusuna ilgili açıklamalar yapılmıştır (Türk, 2011, s.389). Bu durum meâlde kıraat farklılıklarının dikkat edilen temel unsurlardan olmadığını söylemeye imkan vermektedir.

2.3. Bakara Sûresi 219. Âyet

يَسْأَلُونَكَ عَنِ الْخَمْرِ وَالْمَيْسِرِ قُلْ فِيهِمَا إِثْمٌ كَبِيرٌ

“Sana içkiyi ve kumarı soruyorlar. De ki: Bu ikisinde insanlar için büyük zarar vardır...”

Bu âyetin ilgili bölümünün meâli incelenen eserde şöyledir:

“Ey Muhammed!) Sana, içki ve kumar hakkında soruyorlar. Sen, onlara: "Onların her ikisinde de bir kısım faydalarıyla birlikte büyük günah vardır...” (Türk, 2011, s.405).

Bu âyetteki كَبِيرٌ lafzıyla ilgili kıraat farklılığına konu olmuştur. Bazı kıraatlerde “be” harfi “se” olarak كَثِيرٌ şeklinde, bazılarında ise كَبِيرٌ biçiminde okunmuştur (İbn Mücâhid, 1980, s.182), (İbnü'l-Cezerî, 2009, 2/227). كَبِيرٌ lafzı “büyük” anlamına, كَثِيرٌ lafzı ise “çok” manasına gelmektedir (el-Cevherî, 1978, s.801-803). Bu durumda âyet “onların her ikisinde bir kısım faydalarla birlikte büyük günah vardır” ve “onların her ikisinde bir kısım faydalarla birlikte pek çok günah vardır” şeklinde iki anlamı olmaktadır. İncelenen eserde ilgili âyete dipnot düşülmüş olsa da bu dipnotta kıraat farklılıklarından kaynaklanan anlam zenginliğine yer verilmemiştir (Türk, 2011, s.405).

2.4. el-Mâide 5/112. Âyet

إِذْ قَالَ الْحَوَارِيُّونَ يَا عِيسَى ابْنَ مَرْيَمَ هَلْ يَسْتَطِيعُ رَبُّكَ أَنْ يُنَزِّلَ عَلَيْنَا مَائِدَةً مِنَ السَّمَاءِ قَالَ أَتَقْوُونَ اللَّهَ إِنْ كُنْتُمْ مُؤْمِنِينَ

Havârilere “Ey Meryem oğlu İsa! Rabbin bize gökten bir sofrayı indirebilir mi?” diye sormuşlardı. O şöyle cevap verdi: “Eğer iman etmiş kimseler iseniz Allah’a saygılı olun.”

Bu ayet incelenen meâlde Mehmet Türk tarafından şu şekilde çevrilmiştir:

“Havârilere bir de: 'Ey Meryem'in oğlu İsa, Rabbin, bize gökten bir sofrayı indirebilir mi?' demişler, İsa da: 'inanıyorsanız Allah'tan hakkıyla sakının' demişti.” (Türk, 2011, s.578).

Bu âyetteki يَسْتَطِيعُ lafzı, kelimenin başında ye harfi “te” harfinin fethalı haliyle okunarak farklı bir kıraate konu olmuştur. Ayrıca ilgili lafız değişikliği gereğince رَبُّكَ lafzı da fethalı olarak رَبُّكَ biçiminde okunmuştur (İbn Mücâhid, 1980, s.249). Bu durumda âyetin ilgili bölümü, “Rabbinden isteyebilir misin?” anlamına gelmektedir.

İncelenen meâlde bu âyetteki kıraat farklılığından kaynaklanan anlam farklılığına yer verilmemektedir (Türk, 2011, s.578). Farklı kıraatlerden kaynaklanan diğer anlamama yer vermemek, Mehmet Türk'e has bir tutum değildir. Hazırlanan meâllerin pek çoğunda bu hususa dikkat edilmediği görülmektedir. Kanaatimizce burada bir dipnotla dahi olsa farklı anlama yer verilmesi âyetin kapsamlı çevirisi adına önem arz etmektedir. Nitekim İzmir İsmail Hakkı meâlinde düştüğü dipnotla söz konusu farklı anlamı

aktarmıştır (Hakkı, ts., 127). Bu ise önceki bölümlerde ifade edildiği üzere âyetin çevirilerinde kıraat farklılıklarının temel unsur olarak değerlendirilmediğini göstermektedir.

2.5. Yunus 10/30. Âyet

هٰذَا لِكُلِّ نَفْسٍ مَّا أَسْأَلَتْ وَرُدُّوا إِلَى اللَّهِ مَوْلَاهُمْ الْحَقَّ وَضَلَّ عَنْهُمْ مَا كَانُوا يَفْتَرُونَ

“İşte o gün her şahıs, dünyada yaptığının karşılığını görecektir, gerçek mevlâları olan Allah’ın huzuruna götürülecekler ve uydurup yakıştırdıkları putlar da onları yüzüstü bırakıp kaybolacaklardır.”

Bu âyetin çevirisi ilgili meâlde şu şekildedir:

“İşte (âhirette) herkes, dünyada yapmış olduğuyla hesaba çekilir ve gerçek sahipleri olan Allah’a döndürülür. (Dünyada) uydurdukları şeyler¹ de kendilerini terk eder.” (Türk, 2011, s.160).

İlgili âyette kıraat farklılığına konu olan lafız تَلُّوْ سözcüğüdür. Bu lafız bir başka kıraatte تَلُّو şeklinde okunmuştur ki bu kıraate göre âyetin anlamı “o gün her şahıs, dünyada yaptığını takip eder” veya “o gün her şahıs, dünyada yaptığını (amel defterini) okur” şeklinde olmaktadır (Mâtürîdî, 2005, s.37).

Bu ayette de diğer bölümlerde olduğu gibi kıraat farklılığından kaynaklanan anlam çeşitliliğine meâlin kendisinde veya düşülen notlarda yer verilmediği görülmektedir.

3. Allah’ın Kelamı İsimli Meâlde Mucize Olgusu

Mehmet Türk’ün hazırlamış olduğu meâlde mucize olgusunun ne şekilde alındığını görmek adına bazı örnek âyetler incelenecektir.

3.1. Bakara 2/65. Âyet

وَلَقَدْ عَلِمْتُمُ الَّذِينَ اعْتَدَوْا مِنْكُمْ فِي السَّبْتِ فَقُلْنَا لَهُمْ كُونُوا قِرَدَةً خَاسِئِينَ

“İçinizden cumartesi günü hakkındaki hükmü çiğneyenleri elbette bilirsiniz. Bu yüzden onlara, “Aşağılık maymunlar olun!” demiştik.”

Bu âyet ilgili meâlde şu şekilde yer alır:

(Ey İsrail oğulları!) içinizden cumartesi yasağını çiğneyenleri, Bizim onlara: "Birer aşağılık maymunlar olun!" dediğimizi biliyorsunuz.

Âyete düşülen dipnotta müfessirlerin bazılarının âyette geçen “maymun olun” ifadesini “maymun karakterli olun” şeklinde yorumladıkları aktarılır ancak genel kabul görmüş anlam kabul edilir. Nitekim müellif buradaki dönüşümün hakiki oluşunu âyetin zahirinden ve müfessirlerin ekseriyetinin bu görüşte olması üzerinden gerekçelendirir. (Türk, 2011, s.383).

Bu âyetle ilgili olarak bilhassa son yüzyılda rağbet gören “kendilerinin bizatihi maymuna dönüşmelerinden ziyade karakterlerinin değiştirildiği” şeklindeki yoruma rağmen (Karaman, vd. 2017, s.139) burada geçmişten bu yana genel kabul görmüş yorumun tercih edilmesi mucizeler konusunda genel çizgiye uyulduğunu göstermektedir.

3.2. Şuara 26/63. Âyet

فَأَوْحَيْنَا إِلَىٰ مُوسَىٰ أَنْ اضْرِبْ بِعَصَاكَ الْبَحْرَ فَانْفَلَقَ فَكَانَ كُلُّ فِرْقٍ كَالطَّوْدِ الْعَظِيمِ

“Bunun üzerine Mûsâ’ya, “Asân ile denize vur!” diye vahyettik. Deniz derhal yarıldı, her parça koca bir dağ gibi oldu.”

Bu âyet ilgili meâlde şöyle çevrilmiştir:

“Bunun üzerine Biz, Mûsâ’ya: “Âsân ile denize vur!” diye vahyettik. (O da âsâsını vurunca) deniz hemen yarıldı ve her parçası, kocaman bir dağ gibi oldu.”

Müellif âyete düştüğü dipnotta söz konusu mucizeyi gel-git (med-cezir) olarak yorumlayanlar sert bir üslupla eleştirir. Müellife göre bu kimseler ya gel-git hadisesini bilmemektedir veya ne dediklerinin farkında değildirler (Türk, 2011, s.116). Bu mucizeyi bir nevi med-cezir olarak yorumlayanlardan biri Muhammed Esed’dir. Kendisi bu olayın nasıl gerçekleşmiş olabileceğini Şuara 26/66. ayete düştüğü dipnotta kısaca açıklar (Esed, 2015, s.902).

3.2. Kamer 54/1. Âyet

إِقْتَرَبَتِ السَّاعَةُ وَانْتَشَقَّ الْقَمَرُ

Bu âyetin incelenen meâldeki çevirisi şöyledir: Kıyamet(in vakti) yaklaştı ve ay yarıldı.

Müellif bu çeviriye düştüğü notta Ay’ın yarılmasının Hz. Peygamber’in (s.a.v.) en büyük mucizelerinden biri olduğunu aktarır. Müfessirlerin çoğunluğunun bu görüşte olduğunu belirten müellif farklı yorumların gerekçelerini özetle çürütmeye çalışır. Ona göre inşikâk-ı kamerin kıyamette gerçekleşecek bir hadise olarak yorumlanması doğru değildir. Çünkü bu anlam sonraki âyetlerle uyuşmamaktadır. Ayrıca bu görüşler inkâra hevesli olanları memnun edecek yorumlardır (Türk, 2011, s.35).

İncelenen örneklerde de görüldüğü üzere *Allah’ın Kelamı* isimli meâli hazırlayan Mehmet Türk, mucize olgusuyla ilgili geçmişten bu yana ulemânın kâhîr ekseriyetinin ittifak ettiği anlayışı doğru

bulmakta ve bunu savunmaktadır. Dolayısıyla ilgili meâlde mucize olgusunun geçmişte nasıl anlaşılıyorsa o şekilde anlaşıldığı ve bilinen mucize anlayışının devam ettirildiği söylenebilir.

SONUÇ

Bu bildiride “Allah’ın Kelamı (Nüzul Sıralı) Kur’an-ı Kerim ve Meâli” isimli eser kıraat ve mucize olmak üzere iki açıdan incelenmiştir. Müellifin kıraat farklılıklarından kaynaklanan anlam çeşitliliğine çoğunlukla yer vermediği görülmüştür. Bunun muhtemel sebebinin meâl hazırlarken kıraat farklılıklarının esasa etki etmeyen unsurlar olarak görülmesi olduğu söylenebilir. Kanaatimizce meâlde bu hususa yeterince yer verilmemesi anlam çeşitliliğini gösterememesi sebebiyle bir eksiklik olarak yorumlanabilir. Müellifin mucize konusunda ise çoğunluğu teşkil eden ve Ehl-i sünnet olarak bilinen ana omurganın mucize anlayışını benimsediği, bunun korunması gerektiği düşüncesinde olduğu anlaşılmıştır. Müellifin bu konudaki net ve kararlı tavrı, söz konusu anlayışa aykırı yorumları sert bir üslupla eleştirdiği bölümlerde daha görünür olmaktadır.

KAYNAKÇA

- Bennâ, Ahmed b. Muhammed. (2006). *İthâfû fuzalâ ‘i’l-beşer. Dâru’l-Kutubu’l-İlmiyye.*
- Bulut, Halil İbrahim. (2020). Mûcize. *TDV İslâm Ansiklopedisi.* (c.30. s.348) içinde. TDV Yayınları.
- Cevherî, el-Farabî Ebu Nasr İsmâil. (1978). *es-Sihâh Tâcü’l-Luga ve Sihahü’l-Arabiyye.* (cilt 3). Dârü’l-İlm.
- Dânî, Ebû Amr. (1984). *et-Teysîr fî Kiraati’s-Seb’.* Dârü’l-Kütübu’l-Arabî.
- Esed, Muhammed. (2015). *Kur’ân Mesajı.* İşaret Yayınları.
- Hakkı, İzmirli İsmail. (t.s.) *Kur’an-ı Kerim ve Türkçe Anlamı.* Eren Yayınları.
- İbnü’l-Cezerî, Muhammed. (2009). *en-Neşru fi’l-Kıraâti’l-’Aşr.* (c.2. s.227) içinde. el-Matba’atü’t-ticâriyyeti’l-kübrâ.
- İbnü’l-Cezerî, Muhammed. (1999). *Müncidü’l-mukriîn ve müřşidü’t-talibîn.* Dârü’l- Kütübi’l-ilmiiyye.
- İbn Manzûr, Cemâluddîn. (1994). *Lisânü’l- Arab.* Beyrut: Dâru Sâdir.
- İbn Mücâhid, Ahmed b. Mûsa. (1980). *es-Seb’atü fi’l-kirâât.* Dârü’l-Me’arif.
- Karaman, Hayreddin vd. (2017), *Kur’ân Yolu Türkçe meâl ve Tefsir.* (c.1. s.139) içinde. Diyanet İşleri Başkanlığı Yayınları.
- Mâtürîdî, Ebû Mansûr. (2005). *Te’vilâtü’l-Kur’ân.* (c.6 s.37) içinde. Dâru’l-Kütübu’l İlmiyye,
- Râzî, Fahreddin. (1999). *Mefâtihu’l-gayb.* (c.1. s.204-206) içinde. Dâru İhyâi’t-Turâsi’l-Arabi.
- Taberî, Muhammed b. Cerîr. (2001). *Câmi’u’l-beyân.* (cilt 2). Dâru Hicr li’t-Tibâati ve’n-Neşr.
- Türk, Mehmet. (2011). *Allah’ın Kelamı (Nüzul Sıralı) Kur’ân-ı Kerim Meâli.* Kitap Dünyası Yayınları.

TEFSİRLERDE HZ. YUNUS KISSASININ EVRENSEL YORUMU
THE UNIVERSAL INTERPRETATION OF THE STORY OF PROPHET YUNUS IN
COMMENTARIES

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Abstract

One of the prophets whose story is told in the Quran is Hz. Yunus. Hz. Yunus invited his people to monotheism for a long time, but when his people insisted on denying it, he left them without asking permission from God. As a result of the events that happened to him during his sea voyage, he fell into the sea and was swallowed by a fish. Realizing his mistake, Hz. Yunus prayed to God while he was in the belly of the fish and was miraculously saved. Returning to his people and inviting them to monotheism again, Hz. Yunus received a positive response to this invitation and his people believed in him. The stories in the Quran are not just about narrating a historical event. There are many wisdoms behind the Quran's inclusion of stories, such as giving a message to the addressees of the period of revelation and proving the prophethood of the Prophet. One of these is that the addressees learn from them and take lessons from them. When the stories in the Quran are carefully examined, it is seen that the events narrated include sociological, psychological, moral and theological messages. The story of Hz. Yunus is one of these. Since the past, Islamic scholars in general and commentators in particular have tried to determine the universal messages, in other words, the lessons to be learned from this story. However, since the early period commentaries were mostly based on narration, it was attempted to include details of the subject in the interpretation of the verses. It has been observed that in the works compiled later, attempts were made to determine the lessons to be learned from the story as well. In this study, an attempt was made to determine the universal messages in the story of Hz. Yunus. The study used the analysis and comparison method. Accordingly, it was determined that the story of Hz. Yunus has aspects that appeal to people of every period. Examples of these are; Behavioral principles can be stated such as that a person should not insist on his mistakes and should turn back from his mistakes, that responsible people should be more emotionally resilient, that people should avoid attitudes such as being offended by their duties based on their wrong behaviors. Apart from these, it has been observed that the story also contains religious and personal lessons that people of all ages can benefit from.

Keywords: Tafsir, Quran, Story, Prophet Yunus

Özet

Kur'ân'da kıssası anlatılan peygamberlerden biri Hz. Yunus'tur. Hz. Yunus uzun süre kavmini tevhide davet etmiş, kavminin inkârda ısrarı üzerine Cenâb-ı Hak'tan izin almadan onları terk etmiştir. Yaptığı deniz yolculuğunda başına gelen olaylar neticesinde denize düşmüş ve bir balık onu yutmuştur. Hatasını anlayan Hz. Yunus balığın karnındayken Allah'a yalvarmış ve mucizevi bir şekilde kurtulmuştur. Kavmine dönerek onları yeniden tevhide davet eden Hz. Yunus bu davetine olumlu cevap almış ve kavmi kendisine iman etmiştir. Kur'ân kıssaları sadece tarihi bir olayı aktarılmasından ibaret değildir. Kur'ân'ın kıssalara yer vermesinin nüzül dönemi muhataplarına mesaj vermek, Hz. Peygamber'in nübüvvetini ispatlamak gibi pek çok hikmeti bulunmaktadır. Bunlardan biri, muhatapların bunlardan ders çıkarması ve ibret almasıdır. Kur'ân kıssaları dikkatlice incelendiğinde anlatılan olaylar içerisinde sosyolojik, psikolojik, ahlâkî ve itikâdî mesajların yer aldığı görülür. Hz. Yunus kıssası da bunlardan biridir. Geçmişten bu yana genelde İslâm âlimleri özelde müfessirler bu kıssada yer alan evrensel mesajları bir diğer ifadeyle kıssadan çıkarılacak dersleri tespit etmeye çalışmıştır. Ancak ilk dönem tefsirler daha çok rivayete dayalı olduğu için âyetlerin tefsirinde konunun detaylarına yer verilmek istenmiştir. Daha sonra telif edilen eserlerde ise kıssadan çıkarılacak derslerin de tespit edilmeye çalışıldığı gözlemlenmiştir. Bu çalışmada Hz. Yunus kıssasında yer alan evrensel

mesajlar tespit edilmeye çalışılmıştır. Çalışmada analiz ve mukayese yöntemi kullanılmıştır. Buna göre Hz. Yunus kıssasının her dönem insanına hitap eden yönlerinin bulunduğu tespit edilmiştir. Bunlara örnek olarak; insanın hatasında ısrar etmemesi ve yanlışından dönmesi gerektiği, sorumluluk sahibi insanların duygusal yönden daha dirençli olmaları, şahısların yanlış davranışlarından hareketle vazifesine küsmek gibi tavırlardan uzak durmaları gibi davranışsal ilkeler söylenebilir. Kıssanın bunların dışında her dönem insanının yararlanabileceği itikâdî ve enfüsî dersleri de barındırdığı gözlemlenmiştir.

Anahtar kelimeler: Tefsir, Kur'ân, Kıssa, Hz. Yunus

Giriş

Kur'ân-ı Kerim her şeyden önce bir hidayet kitabı olması hasebiyle muhtevasında yer alan hususların doğrudan veya dolaylı olarak genel amacı insanları doğru yola iletmektir. Kur'ân'da yer alan kıssalar da bu genel amaç çerçevesinde değerlendirilmelidir. Kur'ân-ı Kerim insanoğluna vermek istediği dersleri, kazandırmayı amaçladığı davranışları çeşitli anlatım teknikleriyle aktarır. Bunlardan biri kıssalardır. kıssaları geçmişten bu yana ulemânın dikkatini çekmiş ve bilhassa müfessirler tarafından kıssalar farklı açıklamalara tabi tutulmuştur. Bu kıssalardan biri Hz. Yunus'un yaşadıklarına dairdir. Bu çalışmada Hz. Yunus kıssasının geçmişten bu yana tefsirlerde ne şekilde ele aldığı mukayeseli bir bakış açısıyla incelenecek bihassa kıssada yer alan evrensel mesajlar tespit edilmeye çalışılacaktır.

1. Kavramsal Çerçeve

Lügatte kıssa sözcüğü, “takip etti, peşinden gitti” anlamına gelen فَصَّ fiilinden türemiş bir lafız olup “iş, emir, söz” anlamına gelir (el-Cevherî, 1978, s.1051). Kıssa sözcüğünün çoğulu kasas olup İsfahânî bunu “birbirini takip eden haberler” olarak açıklar (İsfahânî, 1991, s.671). Kur'ân'da kıssa sözcüğünün türediği فَصَّ fiili ve çeşitli türevleri kullanılır. Örneğin Yusuf sûresinin girişinde نَحْنُ نَقُصُّ عَلَيْكَ أَحْسَنَ الْقَصَصِ بِمَا أَوْحَيْنَا إِلَيْكَ هَذَا الْقُرْآنُ “Biz bu Kur'an'ı sana vahy etmekle (başka konular yanında) en güzel kıssayı da anlatıyoruz.” ifadesinde kıssa sözcüğünün fiil formu olan نَقُصُّ lafzı ve isim formu olan الْقَصَصِ lafzı aynı cümlede kullanılır (Yusuf 12/3.)

Kıssalar Kur'ân'da geniş bir yer tutmaktadır. Bu, Kur'ân'ın kıssaları oldukça işlevsel bir şekilde kullandığını göstermektedir. Nitekim Kur'ân'da kıssalara yer verilmesinin hikmetleri veya gayeleri şu şekilde açıklanmıştır: 1- Kıssalar üzerinden insanları tevhide yöneltmek. 2- İman esaslarını kalplerde iyice tesis etmek. 3- İnsanların iki dünya için gerekli dersleri çıkarmalarına imkân tanımak. 4- Başta Hz. Peygamber ve nüzul dönemi muhatapları olmak üzere tarihin değişik dönemlerinde sıkıntılara maruz kalan insanlara teselli vermek. 5- Zalimleri uyarmak. 6- İnsanlık tarihi boyunca Peygamberlerin aynı ortak mesaj için mücadele ettiklerini göstermek (Zuhaylî, 1997, s.157-162), (Şengül, 1994, s.136-138).

Kur'ân'da Hz. Musa, Hz. İsa, Hz. Yusuf gibi farklı peygamberlerin kıssalarına yer verilmiştir (Bazı bölümleri için bk. el-Bakara 2/67-73; Âl-i İmran 3/50-58; Yusuf 12/1-101). Bunlardan biri de çalışmamıza konu olan Hz. Yunus kıssasıdır.

2. Kur'ân'da Hz. Yunus Kıssası

Kur'an'da Hz. Yunus'tan çeşitli şekillerde bahsedilir. Bunlardan bazılarında kendisine “Yûnus” (en-Nisâ 4/163; el-En'âm 6/86), bazısında “Sâhibu'l-hût” (el-Kalem 68/48) bazısında ise “Zünnûn” (el-Enbiyâ 21/87) denilir.

Kur'ân'daki anlatılara göre Hz. Yûnus -kavmi kendisine inanmayınca- kızgınlıkla onlardan uzaklaşmış (el-Enbiyâ 21/87), oldukça yüklü bir gemiye binmiş (es-Sâffât 37/140), -muhtemelen geminin batma tehlikesiyle karşı karşıya kalması sebebiyle- çekilen kura sonucunda kaybedenlerden olmuş ve kendisini bir balık yutmuştur (es-Sâffât 37/141-142), (Harman, 2013, s.598). Bazı âyetlerde Hz. Yunus'un tesbih edenlerden olmaması halinde kıyamete kadar balığın karnında kalacağı belirtilir (el-Enbiyâ 21/87-88; es-Sâffât 37/143-144). Ne var ki gönülden gelerek yapmış olduğu dua kabul edilerek, Allah'ın merhamet etmesi neticesinde (el-Kalem 68/49) bitkin ve güçsüz bir halde balığın karnından çıkarılır, Hz. Yunus için bir gölgelik olması amacıyla yanında kabak cinsinden geniş yapraklı yaktîn bitkisi yaratılır (es-Sâffât 37/145-146; el-Kalem 68/49-50). Bunun ardından yüz bin veya daha fazla insana Resul olarak gönderilir (es-Sâffât 37/147). Önceleri daveti kabul etmeyen Hz. Yûnus'un kavmi bu dönüşünde kendisine iman eder, gönderilecek olan azaptan kurtulur, bir süre daha nimetlerden faydalanarak yaşatılır. (Yûnus 10/98; es-Sâffât 37/148), (Harman, 2013, s.598).

3. Tefsirlerde Hz. Yunus Kıssası

Bu bölümde Hz. Yunus kıssasının genel olarak dirayet tefsirlerinde ne şekilde açıklandığı incelenecektir. Bu inceleme klasik dönem ve çağdaş dönem olarak mukayeseli bir bakış açısıyla ele alınacaktır.

3.1. Hz. Yunus'un Kavminden Ayrılması

Hz. Yunus'un kavmini terk edip gemiye binmesi, denize atılması ve balığın karnında Allah'ı tesbih etmesi olayından çıkarılan bazı mesajlar bulunmaktadır. Örneğin Mâtürîdî bu olaydan sıradan insanların inkâr ve fiskın yaygınlaştığı ortamlardan uzaklaşması gerektiği sonucunu çıkarır. Ona göre böyle davranmaları o kimseler için bir salih ameldir (Mâtürîdî, 2005, s.570). Râzî, Hz. Yunus'un kavminden ayrılması ve balığın onu yutması konusunu genişçe ve oldukça analitik bir bakış açısıyla tefsir eder. Konuyu daha çok peygamberlerin ismet sıfatı çerçevesinde açıklamaya çalışan Râzî'nin bu bölümde çıkardığı derslerden biri peygamberlerin Allah'tan doğrudan bir emir/izin olmadığı sürece, bu konuda özgür oldukları zannıyla ve kendi içtihatlarından hareketle görev yerlerinden ayrılmamaları ve mevcut duruma sabretmeleri gerektiğidir (Râzî, 1999, s.179-181).

Hz. Yunus'un kavminden ayrılması konusu çağdaş bazı tefsirlerde önceki açıklamalarla aynı doğrultuda tefsir edilir (bk. İbn Âşûr, 1984, s.130-131). Mevdûdî ise ilgili surede bu kıssaya yer verilmesinin sebebini "Hz. Yunus'un balığın yutması olayını Peygamberler dahi hata yaptıklarında yargılanabilirler" mesajı üzerinden insanların uyarılmak istenmesine bağlar (Mevdûdî, 2005, s.329). Seyyid Kutub ise davet ehlinin Hz. Yunus kıssasında anlatılanlardan hareketle davetçilerin davet sürecinde karşılaştıkları sıkıntı ve belalara sabretmeleri, bunları göğüslemeleri ve vazifelerini aksatmamaları gerektiği sonucunu çıkarır. Ona göre davetçiler, insanları yüz kere hakka davet etmiş olsa ve yüzünde de olumsuz yanıt almış ve bazı sıkıntılarla karşılaşmış olsa da öfkesini yutmalı yüz birinci kez davetini yinelemelidir. (Kutub, 2004, s.2393-2394).

3.2. Hz. Yunus'un Tevbesi ve Cenâb-ı Hakkı Tesbih Etmesi

Müfessirlerden Râzî, Hz. Yunus'un balığın karnında Allah'ı tesbih etmesinden hareketle benzer durumda olan her Müslümanın da bu şekilde Allah'a yönelmesi gerektiği sonucunu çıkarır (Râzî, 1999, s.181-182). Râzî'nin buradan çıkardığı bir diğer sonuç ise Mâtürîdî'nin yorumuyla benzeşmektedir. Her iki müfessir de kişinin rahat anlarında Cenâb-ı Hakk'ı tesbih etmesi ve ona yönelmesi gerektiği dersini çıkarır. Zira rahat durumlarında Allah'ı unutmayan kulu, Allah sıkıntı anlarında unutmaz (yardımsız bırakmaz). Bunun örneği Hz. Yunus'un balığın karnındaki haliyle Firavun'un boğulduğu andaki durumudur (Mâtürîdî, 2005, s.588), (Râzî, 1999, s.356-357). Zemahşerî de benzer şekilde bu olayda Müslümanın Allah'ı zikretmeye, ibadetlerini arttırmaya ve gayretini buna yöneltmeye bir teşvikin bulunduğunu belirtir (Zemahşerî, 1986, s.61). İbn Kayyım el-Cevzî, konuyla ilgili olarak sıkıntı ve musibet anlarında Allah'a tazarru ile yönelmek gerektiği bunun yapılmamasının Kur'an'da zemmedildiğini (el-Muminun, 23/76) belirtir. Kulun bu tür durumlarda Allah'ı insanlara şikayet etmek yerine halini Allah'a arz etmesi gerektiğini ekler. (el-Cevzî, 1989, s.553).

Çağdaş tefsirlerde de Hz. Yunus'un Allah'a yönelmesi ve O'nu tesbih etmesi hadisesinden benzer çıkarımlar yapılır. Said Havva bu olaydan çıkarılacak derslerden biri olarak Hz. Yunus'un duasının ve Allah'a yönelişinin bizler için örnek olduğunu ve onu örnek almamız gerektiğini belirtir (Havva, 2003, s.3491). Kutub da benzer şekilde bir davetçinin Hz. Yunus kıssası üzerine uzun uzun düşünmesinin lüzumunu, hata yaptığında Allah'a yönelmesini ve O'na yalvarması gerektiğini söyler. (Kutub, 2004, s.2394).

3.3. Hz. Yunus'un Balığın Karnından Sağ Çıkması ve Kavminin İman Etmesi

Tefsirlerde -muhtemelen önceki bölümlerde kıssayla ilgili evrensel mesajlara yer verilmiş olması hasebiyle- kıssanın bu bölümüyle ilgili daha çok hadisenin nasıl olduğuna dair rivayetlere dayalı açıklamalara ve kısa izahlara yer verilir. (Mâtürîdî, 2005, s.586-587), (Ebu Hayyân, 1999, s.123-125). Mevdûdî konuyla ilgili Hz. Yunus'u balığın karnında ölmemesiyle ilgili modern dönemlerde itirazların dillendirilmeye başlandığını söyler ve buna yanıt sadedinde bir olayı aktarır. Buna göre 1891 yılında "Star of East" isimli balıkçı teknesindeki denizciler tam yüz yon ağırlığında bir balina yakalarlar. Balınayı zaptetmek için mücadele ettikleri esnada denizcilerden biri denize düşer ve balina onu yutar. Ertesi gün balina ölü olarak bulunduğu denizciler onu karaya çeker ve karnını yararlar. Olayın üzerinden altmış saat geçmesine rağmen arkadaşlarının hala ölmediğini görürler. Mevdûdî'nin bu olayı aktarmasından maksat Hz. Yunus'un başına gelen olaydaki mucizevi yönü sıradanlaştırmak değildir. O bununla, sıradan insanların dahi başına böyle şeyler gelebileceğine göre Cenâb-ı Hakk'ın bir

Peygambere mucizevî bir olay yaşatmasının gayet mümkün olduğunu göstermek ister. (Mevdûdî, 2005, s.43).

Hız Yunus kıssasını çağdaş İslam âlimlerinden Said Nursî de tefsir eder. Ona göre Hız Yunus'un deniz, gece ve balığın karnından oluşan karanlıklar içerisinde bulunduğu durum, sebeplerden tamamen ümidin yitirildiği bir manzarayı resmetmektedir. Hız Yunus kendisini bulunduğu durumdan ancak denize, geceye, balığa gücü yeten bir kudretin kurtarabileceğinin farkındadır. Hadiseyi bu şekilde yorumlayan Hız Yunus sebepleri yöneten asıl merciye, Cenâb-ı Hakk'a yönelir, O'na yalvarır ve neticesinde selamete sahile çıkar. Nursî, Hız Yunus kıssasında yer alan unsurlardan bazılarını her insanın hayatında bulunan öğelerle eşitleyerek enfüsî bir tefsirde bulunur. Buna göre Hız Yunus'un bulunduğu gece bizim geleceğimize. Deniz, yaşadığımız yeryüzüdür. Balık ise nefsimizdir. Bize musallat olan bu balık, Hız Yunus'u yutan balıktan çok daha tehlikelidir. Çünkü onun balığı sadece dünyada hayatı için bir tehdit iken insanı yutmak isteyen "nefis balığı" onun sonsuz hayatını tehdit etmektedir. Bu durumda bir kişinin yapması gereken Hız Yunus gibi Cenâb-ı Hakk'a yönelmek ve nefisine karşı daima O'na sığınmaktır. (Nursî, 2015, s.5-8). Onun bu kıssayla ilgili bu tefsiri evrensel mahiyete sahip olmakla birlikte enfüsî/işarî tefsir olarak yorumlanabilir.

SONUÇ

Hız Yunus, Kur'an'da kıssası anlatılan peygamberlerden biridir. Kur'an'daki her bir kıssa gibi Hız Yunus kıssası da evrensel mesajlar içermektedir. Bu mesajlar şu şekilde özetlenebilir: 1- İnsan hata edebilir ancak hatasında ısrar etmemelidir. 2- Hatasını fark eden kişinin özür dilemesini bilmelidir. 3- Sorumluluk sahibi insanların duygusal yönden daha dirençli olmalıdır. 4- Sıkıntı anlarında Allah'ın kendisini yalnız bırakmamasını isteyen kişi rahat anlarında Cenâb-ı Hakk'ı bolca zikretmelidir. 5- İnsan, Allah'ın sebeplerin de üstünde mutlak güç sahibi olduğu bilincini daima diri tutmalıdır. 6- Allah'tan hiçbir zaman ümit kesilmemeli, O'nun yardımıyla en zor durumlardan bile kurtulmanın mümkün olduğu bilinmelidir. 7- Kişi sürekli nefis muhasebesi yapmalıdır. 8- Dünyadaki sıkıntılardan ziyade ahirette karşılaşacağı sıkıntıları dert edinmelidir.

KAYNAKÇA

- Cevherî, el-Farabî Ebu Nasr İsmâil. (1978). *es-Sihâh Tâcü'l-Luga ve Sihahü'l-Arabiyye*. (cilt 3). Dârü'l-İlm.
- Cevzî, İbn Kayyım. (1989). *Tefsîrü'l-Kur'âni'l-Azim*. Dâru ve Mektebetu Hilâl.
- Ebu Hayyân, Muhammed b. Yusuf. (1999) *el-Bahru'l-muhî fi't-tefsîr*. (c.9. s.123-125) içinde. Dâru'l-Fikr.
- Harman, Ömer Faruk. (2013). Yûnus. *TDV İslâm Ansiklopedisi*. (c.43. s.598) içinde. TDV Yayınları.
- Havva, Said. (2003). *el-Esâs fi't-Tefsîr*. (c.7. s.3491) içinde. Dârü's-Selâm.
- Kutub. Seyyid. (2004). *Fi Zilâli'l-Kur'an*. (c.4. s.2393-2394). içinde. Dârü's-Şurûk.
- İsfahanî, Ragıb. (1991). *el-Müfredât fi Garîbi'l-Kur'an*. Dârü'l-Kalem.
- Mâtürîdî, Ebû Mansûr. (2005). *Te'vîlâtü'l-Kur'an*. (c.8 s.570) içinde. Dâru'l-Kütubu'l İlmiyye.
- Mevdûdî, Ebû'l-Âlâ. (2005). *Tefhîmu'l-Kur'an*. (c.3 s.329) içinde. Dâru'l-Kütubu'l İlmiyye.
- Nursî, Said. (2015). *Lem'alar*. Rnk Neşriyat.
- Râzî, Muhammed Fahrudîn. (1999). *Mefâtihu'l-Gayb*. (c.22 s.179-181; c.26. s.356-357) içinde. Beyrut: Dâru İhyâi't-Turâsi'l-Arabi.
- Şengül, İdris. (1994). Kur'an Mesajını Ulaştırmada Kıssaların Önemi. Mehmet Akif Ersin vd. (Ed.), *I. Kur'an sempozyumu* içinde (s. 133-140). Bilgi Vakfı Yayınları.
- Zemahşerî, Ebu'l-Kâsım Mahmûd. (1986). *el-Keşşâf an Hakâiki gavâmidit-tenzil*. (c.4. s.61) içinde. Dâru'l-Kitâbi'l-Arabi.
- Zuhayli, Vehbe b. Mustafa. (1997). *et-Tefsîru'l-Munîr*. (cilt 12. s. 157-162.) içinde. Dâru'l-Fikri'l-Muâsira.

THOMAS GAINSBOROUGH'UN RESİMLERİNDE ROKOKO DÖNEM MODASININ ETKİSİ

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Öz

XVIII. Yüzyılın sanat üsluplarından olan Rokoko, Barok sanatına bir tepki olarak önce Fransa'da daha sonra İngiltere'de ortaya çıkmış; zevk, zarafet, aşk, eğlence temaları, aristokratik yaşam, pastoral mekânlar içinde kadınlar ile resmin konuları arasında yer edinmiştir. Barok sanatının dramatik ve gerçekçiliğine karşın Rokoko üslubu, eğlence ve özgürlük anlayışlarını barındırmaktadır. Dolayısıyla aşk, zarafet temaları ressamların başlıca konularından olmuştur. Resimlerinde Rokoko döneminin kadın figürlerini detaylıca resmeden sanatçılardan biri olan Thomas Gainsborough, İngiliz asıllı bir ressam olup resim sanatında manzara resimleri ve portreleriyle öne çıkmıştır. Resimlerinde Rokoko dönem modasını, aristokrasiyi ve onların yer aldığı kır mekânlarını betimleyerek dönemin burjuva kesiminden beğeni toplamıştır. Kadın figürlerinin yer aldığı resimlerindeki, kompozisyon yapısı, renk kullanımı, arka mekân figür ilişkisi ahenk oluşturarak bütünü oluşturmuştur. Giysi ve aksesuarlarındaki detay ve incelik, onun fırçasının bir mahareti sayılmış; bu detaylar ile dönemin moda anlayışı hakkında bilgilendirici eserler üretmiştir. Zaruri bir ihtiyaç olan giyinme; zamanla ticaret, ekonomi, kültür, doğa şartları gibi farklı nedenlerden etkilenerek kendine has biçimler oluşturmuştur. Resim sanatı ile dönemlere ait bu biçimler (moda anlayışları, giyim kuşam stilleri) çağlara aktarılabilmiştir. Bu çalışma ile Rokoko dönemine ait giysi ve aksesuarların kompozisyon yapısı içinde incelenmesi amaçlanmış ve bu doğrultuda Thomas Gainsborough'un Rokoko dönem moda anlayışı içerisindeki 1760-1782 yılları arası seçilen sekiz figüratif resmi, eser analizi metoduyla incelenmiş, konuya dair teorik bilgi çerçevesi için de literatür taraması yapılmıştır. Çalışmanın sonucunda, ele alınan sekiz resmin daha çok dikey kompozisyonda, manzara önünde, mavi, mor ve pastel tonları barındıran renklerde resmedildiği; bolca kumaşın ve kumaşı bütünleyen aksesuarların (dantel, kurdele, farba, fırfır, birit) kullanıldığı görülmüştür. Elbiselerin içinde *Le Grand Habit* adı verilen korsajlar kullanılmış; bu korsajı tamamlayan Polonez tarz elbiselerle, dantel kesim yakalar dikkat çekmiştir. Dönemin zarafet ruhunu yansıtan duruşlarda; başların belli bir yöne baktığı, bir ayağın diğerine göre daha önde durduğu, ellerin kenetlendiği ya da bir aksesuarla bütünleştiği (şal, yelpaze, tüy, şapka, şemsiye, eldiven) tespit edilmiştir.

Anahtar Kelimeler: Thomas Gainsborough, Rokoko resmi, Rokoko modası

THE INFLUENCE OF ROCOCO PERIOD FASHION ON THOMAS GAINSBOROUGH'S PAINTINGS

Abstract

XVIII. Rococo, one of the art styles of the century, emerged first in France and then in England as a reaction to Baroque art; The themes of pleasure, elegance, love, entertainment, aristocratic life, and women in idyllic settings have taken their place among the subjects of the painting. Despite the drama and realism of Baroque art, the Rococo style contains the concepts of fun and freedom. Therefore, the themes of love and elegance have become the main subjects of painters. Thomas Gainsborough, one of the artists who depicted female figures of the Rococo period in detail in his paintings, is a painter of English origin and came to the fore with his landscape paintings and portraits. By depicting the Rococo period fashion, aristocracy and the rural places in which they lived, his paintings attracted appreciation from the bourgeoisie of the period. In his paintings featuring female figures, the composition structure,

use of color, and the relationship between the figures in the background create harmony and form the whole. The detail and elegance in his clothes and accessories were considered a skill of brush; With these details, he produced informative works about the fashion concept of the period. Dressing is an essential need; Over time, it has created its own unique forms by being influenced by different reasons such as trade, economy, culture and natural conditions. With the art of painting, these forms (fashion styles, clothing styles) belonging to the periods could be transferred to the ages. With this study, it is aimed to examine the clothes and accessories of the Rococo period within their composition structure, and in this direction, eight figurative paintings of Thomas Gainsborough, selected between 1760 and 1782, within the Rococo period fashion concept, were examined with the art analysis method, and a literature review was conducted for the theoretical framework of knowledge on the subject. has been made. As a result of the study, it was concluded that the eight paintings considered were mostly painted in vertical composition, in front of the landscape, in colors including blue, purple and pastel tones; It was observed that a lot of fabric and accessories that complement the fabric (lace, ribbons, flounces, ruffles, bridal) were used. Bodices called *Le Grand Habit* were used in the dresses; Polonaise style dresses and lace cut collars that complement this bodice attracted attention. In postures that reflect the elegance spirit of the period; It has been determined that heads look in a certain direction, one foot stands ahead the other, hands are clasped or integrated with an accessory (shawl, fan, feather, hat, umbrella, gloves).

Key Words: Thomas Gainsborough, Rococo painting, Rococo fashion

1. GİRİŞ

Toplumların sosyo-kültürel yapısını ifade eden unsurlardan biri olan moda kavramı ile dönemlere ait bilgiler, yazılı ve görsel araçlarla günümüze kadar taşınabilmektedirler. Dönemlerin moda anlayışları hakkında bilgi edinmemize olanak sağlayan görsel araçlardan biri de resim sanatıdır. Böylece dönem modasına ait kalıcı görsel bilgiler, detaylar ressamın tablolarıyla yaşayan birer tarihi belge konumuna gelmektedir. 18. yüzyılın önemli sanat üsluplarından biri olan Rokoko, resim sanatı ve iç mekân alanında öne çıkmış olup Barok sanatının dramatik yapısına karşın zarafet ve eğlence anlayışını ön planda tutan bir yapıya sahip olmuştur.

Rokoko, 1700 ve 1760 yılları arasında Barok sanatına tepki olarak zarafeti simgeleyen bir ifade ile önce Fransa’da daha sonra da İngiltere’de ortaya çıkan bir resim tarzıdır. Rokoko sanat, resim sanatında ve iç mekân dekorasyonunda öne çıkmıştır. Rokoko terimi Fransızca “*rocaille*” kelimesinden gelmekte olup “Düzensiz İnci” anlamını karşılamaktadır. Rokoko sanatı, dönemin asilleri tarafından desteklenmiştir. Ekonomideki ve siyasi hayattaki bozulmaların yarattığı gerginlik, saray ve açık hava eğlencelerini (kır) daha ön plana çıkarmıştır. Sanatçıların birincil konuları; dönem modası olan göz alıcı giysiler içindeki kadınlar ve peruklu adamların kırlardaki eğlenceleri ve aşk olmuştur (Keser, 2009, s. 283).

Sanatta eğlence, süs ve hafiflik öne çıkarak sanatın gizli dili yerine şeffaflık önem kazanmıştır. Sanattaki bu değişim kraliyet saraylarında ve burjuva sınıflarında moda olmuştur. Resimde, tarihi ve dini konuların yerini daha çok mitoloji, romans, hayal gücüne dayalı gündelik hayattan kesitler almıştır. Özenle seçilmiş renkler, zarif çizgiler etkileyici fırça darbeleriyle hafif, dekoratif, süslü tarzı ön plana çıkarmıştır. Fantastik ortamlarda flört eden, müzik çalan, piknik yapan zarif pastoral fonlar içindeki aristokratlar, Rokoko döneminin tipik konuları olmuştur (Hodge, 2018, s.49-50).

Rokoko resminde fazlasıyla tamamlanmış, parıldayan yüzeylerinde baskın olmayan renkler ve ustalıklı kullanılmış fırça darbeleri ön plandadır. Bu yüzeylerde göz kamaştırıcı kumaşlar, eriyen ten tonları ve süslü manzara arka planları, dikkat çekmektedir. Resimlerdeki kadın figürlerde süslü kumaşlar içinde hareketlilik, cilve, tebessüm, çekicilik ön plandadır (Cumming, 2008, s. 226).

Resimlerinde kadın figürleri ön planda tutan ve onların giysilerindeki detayları incelikle tuvaline aktaran ressamdan biri de İngiliz ressam Thomas Gainsborough’tur. Sanatçı, resimlerdeki Rokoko dönem modasını ayrıntılarıyla resmederek dönemin moda kültürünü yansıtmıştır. Thomas Gainsborough’un kadın figürü içeren 1760-1782 yılları arası sekiz Rokoko dönem resminin, kompozisyon yapısı içerisindeki giysi ve aksesuarlarının incelenmesi, çalışmanın amacını ortaya koymuştur. Çalışmanın yöntemini literatür tarama ve eser analizi metodu oluşturmaktadır.

1.1. Thomas Gainsborough

Thomas Gainsborough (1727-1788) 18. Yüzyıl İngiliz ressamıdır. 1952’de portre ressamı olmadan önce gravür eğitimi almıştır. Resimlerinde dönem modası ön planda olup kadın figürlerinin yüzlerindeki

duygusallığı göz kamaştırıcı giysiler ve şapkalarla bir arada sunmuştur. Satenin ve ipeğin ışıltısını, kadınların yanaklarındaki doğal pembeliği, rüzgârın hışırtısıyla dalgalanan ağaçları tüm gerçekliğiyle betimlemiştir (Cumming, 2008, s. 240).

Çoğu ressam gibi Gainsborough, akademik bir ressam değildi. Kendine has üslubu, boyayı ustaca kullanışı ve renklere karşı olan sezgisel duyarlılığı onun 18. Yüzyıl Avrupa sanatının dâhilerinden biri olmasını sağlamıştır (Beykan, 1997, s. 171).

Babasının dokumacı ve yün işleyicisi olarak çalıştığı kumaş endüstrisinde tekstilleri gözlemleyerek edindiği doku ve kumaş bilgisi, portrelerde tasvir ettiği kostümler için kolaylık sağlamıştır. Gainsborough'un kariyeri 1759'da Bath (İngiltere) şehrine taşındığında ilerlemiş, portrecilik pratiği ona kasabanın aristokrat ve seçkin sakinlerinden maddi olarak kayda değer katkılar sağlamıştır. Bu yüksek sosyete müşterilerinin portrelerine, ailesinin tekstil endüstrisiyle bağından dolayı dönem moda ve giyimin karmaşık ayrıntılarını dahil etmiştir. Kadın portreleriyle ilgili olarak Gainsborough, naiflik ve çekiciliğin yanı sıra gizli bir duygusallık duygusunu aşlamak için ekstra özen göstermiştir. Bu durum Peter Paul Rubens'in eserlerinden etkilendiğinin bir göstergesidir (Url 1).

1763'te sinirsel bir hastalıktan dolayı gerileyen sanatçı, daha sonra *Royal Academy of Arts*'in kurucu üyesi olmuş ve ilk sergisine Van Dyck tarzında dikkat çekici bir kadın portresiyle katkıda bulunmuştur. Çağdaşlarının çoğundan farklı olarak Gainsborough, portrelerini genellikle bir yardımcı olmadan tamamen kendi eliyle çizmiştir. Gainsborough, 1774'te Londra'ya taşındıktan sonra 1777'de kraliyet ailesinden aldığı birçok siparişin ilkinin hazırlamıştır. 1780'de ise çok çeşitli manzara kompozisyonları resimlerine girmiştir. Bir baskı sanatçısı olan Gainsborough, bu yıllarda yumuşak zeminli gravür ve sulu boya ile deneyler yapmıştır. Resimlerinin sergilenmesi konusu Kraliyet Akademisi ile tartışmalara yol açmış, bunun üzerine Gainsborough 1784'ten itibaren stüdyosunda yıllık sergiler düzenlemeye başlamıştır. O zamana kadar nispeten iyi durumda olan sanatçı, 2 Ağustos 1788'de Londra'da kanserden hayatını kaybetmiştir (Url 2).

1.2. Rokoko Dönemi Modası

Barok stiline karşı olarak ortaya çıkmış olan Rokoko tarzı; Neoklasizm'in etkisinde kalarak sadeleşmiş bir tarzın oluşmasını sağlamıştır (Altar, 2009, s. 85). Oxford sözlüğünde "Olağanüstü seviyede veya zevksiz bir şekilde şaşaalı ve süslü bir sanat şekli" olarak ifade edilen Rokoko estetiği, kıvrımlı motifler ve deniz kabuğu ile nitelendirilmektedir (Chilvers, 2009, s. 534).

Fransız devriminin etkileriyle moda anlayışı sadeleşmeye uğramış; sadeleşme ile hazır giyim ürünlerine talep artarak sınıflar arasındaki giyim farkı azalmıştır. Bu talebin en önemli nedeni ise Fransa'nın gelişmiş tekstil endüstrisi olarak nitelendirilmesidir (Totor & Eubank, s. 273). Ayrıca Fransa'nın ipek dokumacılığı ve nakışta ana merkez konumunda olan Lyons ile tuhafiyeye, aksesuar ve manifaturacılığın merkezi olan Paris sayesinde tekstil ürünlerinin ticaretinde lider konumunda olması, bu durumu desteklemiştir (Fogg, 2014, s.106).

XIV. yüzyılda kadın giyiminde iç etek çevresinin genişlemesi ile kadınlar birkaç kişilik yer kaplamış böylece kapıdan geçmek için bile yan dönmek zorunda kalmışlardır (Rooney, 2005, s. 6). Fakat Fransa kralı XV. Lous'in eşi Marie Antoinette bu eteğin şeklini değiştirerek ön ve arkayı tamamen düz, yanları ise geniş bir şekilde kullanmıştır (Dereboy, 2004, s. 83).

Yüzyıl boyunca en temel kadın kıyafeti günümüzdeki paltolar yerine giyilen dış elbiseler olmuştur. Dış elbiselerin altına iç etek olarak adlandırılan etekler giyilmiş, korsaj üzerinde kalan boşluk ise karın koruyucu adı verilen sert bir panelle kapatılmıştır. Bu sert paneller iğnelerle elbiseye sabitlenmiştir. Resmi baloların modası, başında XV. Louis bulunan Fransa Sarayı'nda belirlenmiş ve bu moda tüm Avrupa tarafından taklit edilmiştir. Özellikle de *Le Grand Habit* (Görsel 1.) olarak bilinen kemik destekli korsajlardan ve sofistike eteklerden oluşan tarz, yoğun olarak kullanılmıştır. Yan kısmı drapelardan, arkası da düz bir panelden oluşan mantolar da İngiliz sarayında oldukça popülerlik kazanmıştır (Özen, 2013, s. 290).



Görsel 1. 18. Yüzyıl korse/ karın koruyucu
<https://tr.pinterest.com/pin/468163323765236854/>

Giysi detaylarında çokça kullanılan fiyonklar Rokoko stiline olmazsa olmazlarından olmuştur. Maria Antoinette'nin öncülüğünde moda haline gelen pudralı saç tuvaletleri, yıllar boyu hem erkekler hem de kadınlar tarafından kullanılmıştır. Bu durumun; kraliçenin zarif ve narin yapısıyla da ilişkilendirilmesi Rokoko tarzına bir atıf olarak değerlendirilmiştir (Erkuş, 2013, s. 48).

Rokoko dönemi giysilerinin kumaş tasarımında, renklerinde, süslemelerinde ve aksesuarlarında görülen değişim aslen Avrupa ile özleşmiş olsa da Manş Denizi ve Atlantik Okyanusu'nun ötesindeki moda akımlarını da etkisi altına almıştır. Özellikle baskılı ve nakışlı ipek ve basma kumaşlarıyla ön plana çıkan dönemin Fransız ve İngiliz tasarımcıları, motiflerde düzensiz kabartma şekiller kullanmışlardır (**Görsel 2.**). Bu şekiller asimetrik veya kabuk şeklindeki boş alanın içine doğal ya da mimari başka bir motifin yerleştirilmesi şeklinde tasarlanmıştır. Fransız motiflerinde görülen bu dekoratif süslemelere karşın, dünyanın çeşitli yerlerinden Britanya'ya getirilen kumaşlarda görülen yeni bitki motifleri ile daha natüralist bir hava oluşturulmuştur (Fogg, 2014, s. 107).



Görsel 2. Rokoko dönem motifi
<https://tr.pinterest.com/pin/985231152515011/>

Avrupalı şirketlerin Uzak Doğu ve Hindistan'la kurdukları ticari ilişkilerin etkisiyle özellikle Çin motiflerine olan ilgileri artmış böylece tasarımcılar bu motifleri oldukça sık kullanmışlardır. Fransız soyluların, yeniliklere istekli ve düşkün olmaları nedeniyle Doğu'nun bu fantastik dünyası hızlıca kabul görmüş olsa da İngiliz soyluları motiflerinde daha milli unsurlar kullanmışlardır (Erkuş, 2013, s. 37).

Avrupa’da dönemin modalarından farklı olarak ortaya çıkan Rokoko stili; yarattığı zarafet ve şıklık ile sofistike inceliği yansıtmıştır. Rokoko modasıyla birlikte kıyafetlerin daha kabarık durması için kare şeklinde gösterişli tarlatanlar kullanılmaya başlanmıştır. Kıyafetlerdeki silüetler moda tarihindeki en geniş şeklini alarak, giysilerin formlarını enlemesine düz bir şekle dönüştürülmüştür. Geniş tarlatanlı giysiler özellikle hususi davetler için tercih edilmiş ve yapılan eklemelerle genişlikleri 4-5 metreyi bulmuştur (**Görsel 3.**) (Erkuş, 2013, s. 60).



Görsel 3. İç Etek Kasnakları

https://bloggermaisiyah.blogspot.com/2016/02/rokoko-stili_11.html

Rokoko modası zamanla sarayın dışına çıkararak burjuvazinin kıyafetlerine de yansıtılmış; eğlenceli, coşkulu, zarif bir tasarım stili olarak karşımıza çıkmıştır. Ayrıca bu dönemde aksesuar kullanımı oldukça önemli bir detay olarak gözlemlenmiştir. Çünkü aksesuarlar zenginliğin göstergesi olarak adlandırılmıştır. En dikkat çeken aksesuarların başında ise kurdeleler gelmiştir (Şenkal, 2022, s. 47). Rokoko döneminde ayakkabıların topukları kısaltılması, burun sivriliğinin azaltılması ile düz tabanlı ayakkabılar moda olmuştur (Dereboy, 2012, s. 135). Ayakkabılar genellikle kumaş kaplanarak yapılmıştır (**Görsel 4.**). Kumaş olarak motifli ipek kullanımına rağmen elbise ve ayakkabılar her zaman aynı kumaştan yapılmamıştır. Kimi zaman kumaş ayakkabıları korumak için ayrıca giyilen deri ayakkabılar da olmuştur. Ayakkabı kayışlarında kristallerle süslü metal tokalar kullanılarak şıklık kazandırılmak istenmiştir (Özen, 2013, s. 291).



Görsel 4. Rokoko dönemi ayakkabıları

<https://www.soylentidergi.com/bir-statu-gostergesi-olarak-xviii-yuzyil-ayakkabilari-ve-aydinlanma-cagi/>

Dönemin sonlarına doğru giysilerde drape kullanımı sıklıkla artmıştır. Kıvrımları oluşturmak için etekler bele kadar üç bağcık yardımıyla büzülmüştür (Contini, 1965, s. 194). Kollarda dantelden

yapılmış manşetlere sıkça rastlanmıştır. Fakat danteller pahalı olduğu için kollara eldiven gibi ayrı takılmıştır (Poyraz & Değerli, 2023, s. 4927).

2. BULGULAR

2.1. Thomas Gainsborough'un Resimlerindeki Rokoko Modası



Resim 1. Thomas Gainsborough, *Portrait of Mary Countess Howe*, Tuval üzerine yağlıboya, 244 x152,4 cm, 1760

<https://totallyhistory.com/thomas-gainsborough-paintings/>

Resmin ana teması olan dikey kompozisyondaki figürün, arka planındaki sonbahar manzarası ile benzer pastel tonlarda ve geçişlerde oluşu bir bütünlük sağlamaktadır. Rokoko döneminin zarafeti, figürün bir eliyle eteğini tutuşu ve sağ ayağını ön atışıyla dikkat çekmektedir. Dönem giysi detaylarının resmedildiği **Resim 1.**'de, elbisenin göğüs kısmındaki derin dekolte, boyunda kullanılan inci gerdanlıktan sarkan tüllerle kapatılmıştır. 'Le Grand Habit' olarak bilinen korsajlı görünümün bittiği yerde iç etek başlamış ve dışında dönemin modası olan mantoyla birleştirilmiştir. Kol manşetleri dantelli firfir katmanlarıyla bezenmiştir. Kolun dirsek kısmında bulunan yırtmaç üstünde birer adet fiyonkla süsleme detayı verilmiştir. Pastel renklerinin kullanıldığı elbisenin boyu bilek hattında biterek ayağına giydiği tokalı ve az topuklu ayakkabının görünmesi sağlanmıştır. Bilek boyundaki ince tül eldiven ve geniş siperlikli hasır çoban şapkası uzun kurdeleler ile tamamlanmıştır.



Resim 2. Thomas Gainsborough, *Lady Alston*, Tuval üzerine yağlıboya, 226,1 x 165,1 cm, 1761
<https://totallyhistory.com/thomas-gainsborough-paintings/>

Resmin arka fonunu oluşturan manzaranın, dikey kompozisyondaki figürün aksine flu geçişlere sahip olması, ilgiyi figüre daha da yoğunlaştırmıştır. Figürün ellerini bağlayışı ve sağ tarafa doğru bakışı ile Rokoko dönem ruhunu yansıtan bir görüntü ortaya çıkmıştır. Rokoko döneminde kullanılan kumaşlarla benzerlik gösteren **Resim 2.**' de doğal ipekten yapılmış harelî bir kumaş görülmektedir. Haresinin emprime dokumadan kaynaklandığı düşünülen kumaş, genellikle Çin ve Hindistan'da dokunmaktadır. Elbise, tarlatanlı eteklerin abartısından uzak, son derece yumuşak katlar halinde dökümlenmiştir. Daha pastel renkten olan eşarp, bir şal gibi kullanılmıştır. Eşarbin uçları elbisenin içine yerleştirildiği gibi dışardan çapraz şekilde bağlanmıştır. Yakada dantel kesim çok ince bir şeffaflıkla resmedilmiştir. Siyah dantel kumaş, omuz ve kol üstünü kapatarak belde birleşmiştir. Dirsek hizası dar kollar, çok katlı dantel manşetlerle süslenmiştir. Bilek hattında bitmiş kısa ipek eldiven, model boyuyla orantılı olarak kısa tutulmuştur. Modelin saçları topuz olarak resmedilmiş olup, alnın hemen üstündeki saça tutturulan inci dizisi ile de süsleme detayı verilmiştir. Ayakkabılar ise dönemin ayakkabı modasının birebir örneğini oluşturmaktadır.



Resim 3. Thomas Gainsborough, *Isabella*, Tuval üzerine yağlıboya, 236 cm x 155 cm, 1769
<https://totallyhistory.com/thomas-gainsborough-paintings/>

Dikey kompozisyondaki figürle beraber arka fon kızıl tonlarında flu bir manzaradan oluşmaktadır. Figürün şalı tutuşu, başını sağa çevirişi ve bir ayağını öne atışı zarafetin bir göstergesi olarak belirlemektedir. **Resim 3.**'te Rokoko döneminde sıkça kullanılan çizgili kumaştan oluşan elbise dikkat çekmektedir. Elbisenin üst bedeninde vücuda oturtulması için kullanılan korse; yine aynı motiften oluşan kumaşla tamamlanmıştır. Etek uçlarında firfırlar, dönemin giysi özelliklerindedir. Dar kollar dirsek hattında dantelden yapılmış firfır katlarla hareketlendirilmiştir. Yakada dikey yönde dikilmiş dantel ve siyah renkteki eşarp şal ile dönemin ruhu canlandırılmıştır. Boyunda şerit kolye kullanılmış, saç dönem topuzu ile arkaya tutturulmuştur. Dönem modasını yansıtan ayakkabı, önde görülen ucu ile elbiseyle aynı kumaştan yapıldığı izlenimini vermektedir.



Resim 4. Thomas Gainsborough, *Frances Duncombe*, Tuval üzerine yağlıboya, 152,4 x 231,1 cm, 1777

<https://totallyhistory.com/thomas-gainsborough-paintings/>

Arka fonu oluşturan manzaranın önünde duran figür, başını sağa çevirmiş, bağladığı ellerinin birinde şapkasını tutmaktadır. Figürün duruş pozisyonu ve bir ayağını öne atışı dönem ruhunu yansıtan bir zarafet göstergesidir. **Resim 4.** elbiseyi oluşturan üst eteklerin tıpkı perdeyi andıran torbaya benzer biçimde toplanması Polonez tarzı anımsatmaktadır. Dirsek hattında biten kollardaki firfır detayı göze çarpmaktadır. Arka yakadan çıkan dantel kesim, derin göğüs dekoltesini yumuşatmıştır. Etek uçları inci boncukları ile süslenmiş ve bilek hattında bitirilmiştir. Modelin elinde tuttuğu yüksek tepeli şapkadan sarkan kuş tüyleri ise Rokoko döneminde sıklıkla rastlanan bir aksesuar parçası olarak dikkat çekmektedir. Kabarıklık durması için desteklen saçlar geriye doğru taranıp uçları omuzlardan sarkıtılmıştır.



Resim 5. Thomas Gainsborough *Mrs. Graham*, Tuval üzerine yağlıboya, 237 cm × 154 cm, 1777
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Arka fonu manzara olan resmin merkezindeki figür, sol koluyla bir sütuna yaslanmış sağ tarafa doğru bakmaktadır. Bir eliyle tüy tutarken bir ayağını biraz daha ileri atarak dönemin zarafet duruşunu sergilemektedir. **Resim 5.**'te iç etekte kullanılan mor renk Rokoko dönemde sıkça kullanılan renkler arasında yer almaktadır. Figürün yaka formunu çevreleyen kolalanmış dantel kalkık duruşu ile elbiseye sertlik kazandırırken inci süslemeleri ise romantik hava katmıştır. Kısa kolun ucuna bağlanan fiyonk, bilek hattına kadar kolu saran dantel ile bütünleştirilmiştir. Bedenin dar ve sivri bitişli olması döneme uygun görünüm yaratmıştır. Polonez tarzı yansıtan elbisenin boyu bilek hattında bitirilmiştir. Modelin geniş şapkasından sarkan kuş tüyleri elinde aksesuar olarak tuttuğu kuş tüyü ile bütünlük sağlamıştır.



Resim 6. Thomas Gainsborough, *Mrs. Grace D. Elliott*, Tuval üzerine yağlıboya, 234,3 × 153,7 cm, 1778

<https://totallyhistory.com/thomas-gainsborough-paintings/>

Arka fonun üçte ikisi bir kapıdan, diğer kalan kısmı da koyu tonlardan oluşan bir manzardır. Resmin merkezindeki figür, zarafeti simgeleyen duruşuyla bir eliyle şalını göğsüne tutarken diğer eliyle de şalının ucundan tutmaktadır. Başı sola çevrili olan figürün bir ayağı biraz daha öndedir. Rokoko dönemine ait süslemelerin sıklıkla kullanıldığı **Resim 6.**'daki elbisenin yaka kısmından, iç giysinin

fırfırlı kenarları görülmektedir. 'Le Grand Habit' olarak bilinen bu korsajlı görünümün bittiği yerde iç etek başlamış ve dışında dönemin modası olan mantoyla birleştirilmiştir. Kol manşetleri farbalı fırfır katmanlarıyla bezenmiştir. Kolun dirsek kısmında bulunan yırtmaç üst tarafta birer adet fiyonkla süslenmiştir. Yakadan sarkan siyah kurdele ile yaka süslenmiştir. İnce tül eldiven dönemin modasına uygun olarak resmedilmiştir. Ayağına giydiği tokalı, az topuklu, açık renk ayakkabı ile kol manşetlerinin bütünlüğü sağlanmıştır. Figürün saçları geriye doğru taranıp uçları lüle şeklinde serbest bırakılmıştır.



Resim 7. Thomas Gainsborough, *Portrait of Queen Charlotte*, Tuval üzerine yağlıboya, 238,8x 158,7 cm 1781

<https://totallyhistory.com/thomas-gainsborough-paintings/>

Arka fonun üçte ikisi kapıdan, üçte biri ışığın yansıdığı manzaradan oluşmaktadır. Kapının önünde zarafeti ile bir bütün olan figür, ellerini bağlamış bir eliyle yelpazesini tutmaktadır. Figür önündeki köpeğiyle beraber sağa doğru bakmaktadır. Sırmalı ipek kumaştan oluşmuş yaka kısmı açık olan **Resim 7.**'deki figürün elbisesinin altında kamış ya da kemikten yapılmış bir tarlatan olduğu düşünülmektedir. İç eteği olan elbisenin, ön kısmı içteki süslü karın koruyucuyu gösterecek biçimde açılmıştır. Geniş bir hat ile oyulmuş ve ortasında iri bir kurdele ile yaka görünümü tamamlanmıştır. Dirsek hattında biten kolların ucuna kurdele takılıp fırfırlı dantellerle süsleme detayı verilmiştir. Saçlar geriye doğru taranıp saç süsleri ile kabartı verilmiştir. Aksesuar olarak tek elde tutulan açılmamış yelpaze dikkat çekmektedir. Etek boyu ayakkabıyı kapatsa da ayakkabının ucundan kıyafetiyle uyumlu renkte olduğu anlaşılmaktadır.



Resim 8. Thomas Gainsborough, *Giovanna Baccelli*, 226,7x 148,6 cm, Tuval üzerine yağlıboya, 1782
<https://totallyhistory.com/thomas-gainsborough-paintings/>

Aydınlık bir manzaranın önündeki figür, dans ederken resmedilmiştir. Bu dansı en iyi belirleyen unsurlar; figürdeki hareket ve sağ tarafta duran tef çalgısıdır. Figür bir eliyle eteğinin ucunu kaldırırken bir ayağını da öne atarak zarafetinin yanında neşesini de göstermektedir. **Resim 8.**'deki figürün elbisesi mavi renkli kurdeleler ile süslenmiştir. Polonez tarzdaki üst eteğin kenarlarında, kollarında, belinde, şapkasında kullanılan fiyonklar elbiseye hareket katmıştır. Alt etekte kullanılan yatay kurdeleler yaka hattını da çevrelemiştir. Bilek hattında biten elbisenin altına giyilen ayakkabı, kısa topuklu ve elbise ile aynı renk kumaştandır. Figürün bileğindeki ve saçındaki mavi kurdele, aksesuar olarak görünümü tamamlamıştır.

3. SONUÇ

Thomas Gainsborough, sanat hayatına manzara resmiyle başlamış, ilerleyen yıllarda buna portrecilik anlayışı da eklenmiştir. Özellikle İngiliz aristokrasisi ve zarafeti simgeleyen kadın figürleri ile büyük beğeni toplamıştır. Manzaradan kopamayışından dolayı resimlerinin çoğunda manzara, figürlerinin arkasına eşlik etmiştir. Sanatçı, Rokoko dönem modasının giysi ve aksesuarlarını resmettiği figürlerinde, fırçasını ustaca kullanışıyla öne çıkmıştır. Bir satenin parlaması, bir tülün şeffaflığı, bir tüyün hafifliği gibi detaylar onun resimlerinde gerçeğini aratmayacak realitededir. Zarafet, hafiflik, çiçek motifleri, pastel tonlar, kıvrımlı, asimetrik çizgilerle karakterize edilen Rokoko dönem modasında, bir elbisede (genellikle Polonez tarz) saten, atlas, brokar, tafta gibi kumaşlar; ortasında büyük bir kurdele olan derin göğüs dekolteli sıkı bir gövde, geniş tarlatan, ve savurganca kullanılmış yüksek miktarda dantel, kurdele, farba, firfir, birit ve çiçeklerden oluşan süslemeler, dantel kesim yakalar, dikkat çekmektedir. *Le Grand Habit* adı verilen korsajlar, hareketleri kısıtladığı için oturmayı da neredeyse imkânsız kılmış, giyenleri sürekli ayakta ve dik durmak zorunda bırakmıştır. Elbiseler genellikle pastel tonlar, mavi ve mor gibi renklerde görülmüş; elbiseleri tamamlayan aksesuarlarda şapka, yelpaze, tüy, şemsiye, eldiven, şal, öne çıkmış; ayakkabı, eldiven, şemsiye gibi aksesuarlarda da fiyonk sıklıkla kullanılmıştır. Thomas Gainsborough'un sekiz figüratif resmi incelendiğinde Rokoko dönem modasına ait giysi ve aksesuarların, dönemin ruhunu yansıtan duruşlarıyla ustaca tasvir edildiği görülmüştür. Bir yöne bakan başlar, kenetlenen eller ve kollar, bir ayağın diğer ayağa göre daha önde durduğu pozisyonlar en belirleyici özelliklerdendir. Bunun yanı sıra sanatçı, resimlerinin arka planında manzarayı sıklıkla kullanarak pastel tonlara ağırlık vermiştir. Thomas Gainsborough'un Rokoko dönem modasına ait detayları resimlerinde en ince ayrıntısıyla betimlemesi, dönem kültürünü yansıtan bir belge niteliği taşıdığından bu resimleri önemli kılmaktadır.

KAYNAKÇA

- Altar, M.C. (2009). Sanat Felsefesi Üzerine, 2. Baskı, İstanbul: Pan Yayınları
- Beykan, M. (Edt.) (1997). Sanat kitabı 500 sanatçı 500 sanat eseri. İstanbul: Yem.
- Chilvers, I. (2009). The Oxford Dictionary of Art and Artists, 4. Baskı, Oxford University Press, New York.
- Contini, M. (1965). Fashion: From Ancient Egypt to the Present Day, The Odyssey Press, New York.
- Cumming, R. (2008). Görsel rehberler sanat. 2. Baskı. İstanbul: İnkılâp.
- Dereboy, E. (2004). Kostüm & Moda Tarihi, Güzel Sanatlar Merkezi Stilizlik Kursu ve Tic. Ltd. Şti. Ankara
- Erkuş, G. (2013). *17. Yüzyıldan 20. Yüzyıl Sonuna Kadar Avrupa'da Toplumsal Süreçlerin Şapka Biçimlerine Etkisi*, (Yüksek Lisans tezi), T.C. Beykent Üniversitesi Sosyal Bilimler Enstitüsü, İstanbul, Türkiye.
- Fogg, M. (2014). Modanın Tüm Öyküsü, İstanbul: Hayalperest Yayınevi
- Hodge, S. (2018). Gerçekten bilmeniz gereken 50 sanat fikri. 7. Baskı, İstanbul: Domingo
- Keser, N. (2009). Sanat sözlüğü. Ankara: Ütopya Yayınevi.
- Özen, D. (2013). Moda. İstanbul: Kaknüs Yayınları.
- Poyraz E. & Değerli, G, N. (2023). Filmlerde Kadın Kostümlerinin Rokoko Dönemine Uygunluğunun İncelenmesi. *Internatioal Social Sciences Studies Journal*. Vol:9 Issue: 107.
- Rooney, A. (2005). The Eighteenth Century History of Costume and Fashion. Bailey Publishing Associates Ltd, New York
- Şenkal, A., G. (2022). *Barok ve Rokoko Dönemlerinin Erkek Giyimine Yansımaları*. (Yüksek Lisans tezi). T.C. İstanbul Okan Üniversitesi Lisansüstü Eğitim Enstitüsü, İstanbul, Türkiye.
- Tortora, P. G. & Eubank, K. (2006). Survey of Historic Costume, 14th Edition, New York: Fairchild Publications.
- Url 1: <https://www.theartstory.org/artist/gainsborough-thomas/>
- Url 2: <https://www.nga.gov/collection/artist-info.1329.html>

NEGATİF BİNOMİAL REGRESYON MODELİ İLE COVID-19 DÖNEMİNDE YAŞAM MEMNUNİYETİNİN SOSYODEMOGRAFİK BELİRLEYİCİLERİ

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ÖZET

Dünya tarihine bakıldığında çok sayıda salgın hastalığın mevcut olduğu görülmektedir. 2020 senesinde içinde yaşadığımız dünya çok ağır etkileri bulunan bir pandemiyle karşılaşmıştır. Çin'in Wuhan kentinde ilk defa ortaya çıkan COVID-19, hızla yayılmış ve dünya üzerindeki birçok ülkede yaşamı durma noktasına getirmiştir. Araştırmacılar, insanoğlunun hayatı üzerinde bu derece etkili olan COVID-19 ilgili sosyoloji, sağlık, psikoloji, eğitim gibi alanlarda çalışmalar yürütmektedirler. Yaşam memnuniyeti konusu da bu alanlarda yürütülen çalışmalardan biridir. Bu çalışmanın amacı, Türkiye İstatistik Kurumu tarafından 2021 yılında yapılmış olan Yaşam Memnuniyeti Araştırması'nın mikro veri setlerinden yararlanılarak Negatif Binomial Regresyon Analizi ile COVID-19 döneminde Türkiye'de bireylerin yaşam memnuniyetini etkileyen faktörleri belirlemektir. Model sonuçları incelendiğinde cinsiyet, yaş, eğitim düzeyi, çalışma durumu, hanehalkı büyüklüğü ve konut mülkiyeti değişkenlerinin anlamlı olduğu görülmektedir. Çalışmanın frekans analizleri incelendiğinde çalışmaya katılanların %29,2'sinin bekar olduğu, %29,2'sinin ise kadıncı olduğu görülmektedir. Ayrıca çalışmaya katılanların %64,8'i yaşadığı konutun sahibidir. Ayrıca çalışmaya katılan bireylerin %20,6'sı üniversite mezunudur. Çalışmanın sonucunda 55-64 yaş aralığındaki bireylerin 65 ve üzeri yaş grubundaki bireylere göre yaşamlarından memnun olma olasılığının %84,3 daha fazla olduğu tespit edilmiştir.

Anahtar kelimeler: COVID-19, Negatif Binomial Regresyon, Yaşam Memnuniyeti, Türkiye

SOCIODEMOGRAPHIC DETERMINANTS OF LIFE SATISFACTION DURING COVID-19 PERIOD WITH NEGATIVE BINOMIAL REGRESSION MODEL

ABSTRACT

When we look at world history, we see that there are many epidemics. In 2020, the world we live in encountered a pandemic with very serious effects. COVID-19, which first appeared in Wuhan, China, spread rapidly and brought life to a standstill in many countries around the world. Researchers are conducting studies in fields such as sociology, health, psychology, and education regarding COVID-19, which has such an impact on human life. Life satisfaction is one of the studies carried out in these fields. The aim of this study is to determine the factors affecting the life satisfaction of individuals in Turkey during the COVID-19 period using Negative Binomial Regression Analysis using the micro data sets of the Life Satisfaction Survey conducted by the Turkish Statistical Institute in 2021. When the model results are examined, it is seen that the variables of gender, age, education level, employment status, household size, and housing ownership are significant. When the frequency analyzes of the study are examined, it is seen that 29.2% of the participants in the study are single and 29.2% are women. In addition, 64.8% of the participants in the study own the house they live in. In addition, 20.6% of the individuals participating in the study were university graduates. As a result of the study, it was determined that individuals between the ages of 55-64 were 84.3% more likely to be satisfied with their lives than individuals aged 65 and over.

Keywords: COVID-19, Negative Binomial Regression, Life Satisfaction, Türkiye

1.GİRİŞ

Koronavirüs salgını, yüzyılın en önemli küresel sağlık felaketi ve 2. Dünya Savaşı'ndan bu yana insanlığın karşılaşmış olduğu en büyük zorluktur (Alkan, Küçüköğlü & Ünver, 2024). Bu durumun neden olduğu hastalık, 11 Şubat 2020'de Dünya Sağlık Örgütü (WHO) tarafından resmi olarak "COVID-19" olarak adlandırılmıştır ve hızla dünya çapında bir pandemiye dönüşmüştür (Chakraborty & Maity, 2020). Araştırmacılar, insanoğlunun hayatı ve sağlık sistemleri üzerinde önemli derece etkili olan COVID-19 ile ilgili sosyoloji, sağlık, psikoloji, eğitim gibi alanlarda çalışmalar yürütmektedirler. Toplumlarımızın yaşayan hafızalarda karşı karşıya kaldığı en büyük zorluk olan COVID-19 döneminde yaşam memnuniyeti konusu da bu alanlarda yürütülen çalışmalardan biridir (Xie, Xie, & Guo, 2022). Memnuniyet, "bir mal veya hizmetin zaman içindeki toplam satın alma ve tüketim deneyimine dayanan genel bir değerlendirmedir" (Anderson, Fornell, & Lehmann, 1994). Memnuniyet aslında kişinin yaşamının kaliteli ve ideal olarak değerlendirilmesi sonucu oluşan duygusal temelli bir kavramdır (Zeithaml, Bitner, & Gremler, 2006). Bir zihin hali olarak yaşam memnuniyeti, bireyin kendi yaşam kalitesini bütünüyle değerlendirmesi sonucunda ulaştığı olumluluk derecesi anlamına gelmektedir. Aynı zamanda yaşam doyumu olarak da ifade edilebilen memnuniyet ve haz içeren yaşam memnuniyeti, bireyin sürdürmekte olduğu yaşamından ne kadar hoşlandığını ifade etmektedir (Güler & Emeç, 2006). Anlamlı bir yaşama sahip olma, yaşamdan zevk alma, yaşamdaki uğraşının fazla olması gibi faktörlerin yaşam memnuniyeti ile ilişkili olduğu görülmüştür (Peterson, Park, & Seligman, 2005).

Bu çalışmanın amacı, Türkiye İstatistik Kurumu (TÜİK) tarafından 2021 yılında yapılmış olan Yaşam Memnuniyeti Araştırması'nın mikro veri setinden yararlanarak Negatif Binomial Regresyon Modeli ile COVID-19 döneminde Türkiye'de bireylerin yaşam memnuniyetlerini etkileyen faktörleri belirlemektir.

2. MATERYAL VE METOT

2.1. Veri

Bu çalışmanın veri seti TÜİK'in 2021 yılında yaptığı Yaşam memnuniyeti araştırmasından elde edilmiştir. Yaşam Memnuniyeti Araştırmasının kapsamına Türkiye Cumhuriyeti sınırlarında yaşayan 18 ve daha üzeri yaş grubundaki hanehalkı fertleri alınmaktadır (TÜİK, 2021).

Bu çalışmada Yaşam Memnuniyeti Araştırması'na 2021 yılında katılmış olan 10073 bireyin verisi kullanılmıştır.

2.2. Değişkenler

Çalışmada bağımlı değişken, Yaşam Memnuniyeti Araştırmasının mikro veri setinde yer alan "Bir bütün olarak düşündüğünüzde, son zamanlardaki yaşam memnuniyetinizi 0 ile 10 arasında derecelendiriniz ("0: Hiç memnun değil" "10: Çok memnun" olarak değerlendirilecektir.) ifadesiyle ölçülen yaşam memnuniyet puanıdır.

Çalışmada yer alan bağımsız değişkenler ise Yaşam Memnuniyeti Araştırması'nda mevcut olup, yapılan literatür taraması sonucunda ön plana çıkan değişkenlerdir. Çalışmada yer alan bağımsız değişkenler; yaş (24 ve altı, 25-34, 35-44, 45-54, 55-64 ve 65+), cinsiyet (erkek, kadın), medeni durum (evli, bekar), eğitim düzeyi (bir okul bitirmeyen, ilköğretim, lise ve üniversite), çalışma durumu (çalışıyor, çalışmıyor), konut sahipliği (ev sahibi, ev sahibi değil) ve hanehalkı büyüklüğü (1-3 kişi, 4-5 kişi, 6 ve üstü)'dür.

Tablo 3.1'de bağımlı ve bağımsız değişkenlere ait tanımlayıcı istatistikler verilmiştir. Bağımsız değişken referans sınıfları elde edilecek en iyi modele göre seçilmiştir. Ordinal ve nominal değişkenler, modele alınacak bütün değişkenlere ilişkin kategorilerin etkilerinin gözlemlenmesi amacıyla kukla değişken olarak tanımlanmıştır (Alkan vd., 2020; Alkan ve Ünver, 2022).

Saymalı modellerin kullanılabilmesi için ilk koşul bağımlı değişkenin saymalı yapıda olmasıdır (Üç doğruk Birecikli ve diğerleri, 2021). Çalışmada bağımlı değişken olarak alınan yaşam memnuniyet puanı negatif olmayan tamsayılardan oluşmaktadır. Tablo 3.1 incelendiğinde, bağımlı değişkeni oluşturan yaşam memnuniyet puanının minimum 0 maksimum 11 olduğu görülmektedir. Çalışmada bireylerin %47,4'inin erkek olduğu görülmektedir. Eğitim düzeyine göre bireylerin %31,2'si ilköğretim mezunu iken, %20,6'sı de üniversite mezunudur. Ayrıca çalışma incelendiğinde bireylerin %64,7'sinin ev sahibi olduğu görülmektedir.

Tablo 3.1. Tanımlayıcı İstatistikler

Değişkenler	Ortalama	Min	Max
Yaşam memnuniyet puanı	6.381	1	11
Yaş			
24 ve altı	0.125	0	1
25-34	0.191	0	1
35-44	0.216	0	1
45-54	0.181	0	1
55-64	0.151	0	1
Cinsiyet			
Erkek	0.474	0	1
Medeni durum			
Evli	0.708	0	1
Eğitim düzeyi			
İlkokul	0.312	0	1
İlköğretim	0.140	0	1
Lise	0.227	0	1
Üniversite	0.206	0	1
Çalışma durumu			
Çalışıyor	0.447	0	1
Konut sahipliği			
Ev sahibi	0.647	0	1
Hanehalkı büyüklüğü			
1-3 kişi	0.518	0	1
4-5 kişi	0.370	0	1

2.3. İstatistiksel Analiz

İstatistiksel çıkarımın temel alanlarından biri, istatistiksel hipotezlerin test edilmesidir (Ünver & Alkan, 2022). Verileri analiz etmek için SPSS 20 ve Stata 14 programları kullanılmıştır. Çalışmada sayma verisi ile oluşturulan regresyon modelleri kullanılmıştır. Sayma modelleri, bağımlı değişkenin kesikli değişken olduğu regresyon modelleridir. Sayma verisi ile oluşturulan regresyon modelleri, bağımlı değişkenin yalnızca negatif olmayan tamsayı değerleri aldığı ve en küçük değerın sıfır olduğu özel durum için kullanılan modellerdir (Verbeek, 2004). Literatürde sayma verilerinin özelliklerini dikkate alan birçok model bulunmaktadır. Bu çalışmada Negatif Binomial Regresyon (Negative Binomial Regression) Modeli kullanılarak bireylerin COVID-19 döneminde yaşam memnuniyet puanlarını etkileyen faktörler belirlenmiştir.

2.4. Model Tahmini

Çalışmada yer alan bireylerin COVID-19 döneminde yaşam memnuniyet puanlarını etkileyen faktörleri belirlemek için Negatif Binomial Regresyon Modeli kullanılmıştır. Kurulan modele ait tahmin katsayıları Tablo 3.2’de verilmiştir. Tablo 3.2’de tahmin sonuçları incelendiğinde; yaş, cinsiyet, medeni durum, eğitim düzeyi, çalışma durumu, konut sahipliği ve hanehalkı büyüklüğü değişkenlerinin anlamlı olduğu görülmektedir.

Tablo 3.2. Negatif Binomial Regresyon Modeli Katsayılarının Tahmin Sonuçları

Değişkenler	β	Standart Hata	t	Güven Aralığı (%95)	
				Alt sınır	Üst sınır
Yaş (referans kategori: 65+)					
24 ve altı	-0,052 ^a	0,020	-2,63	-0,091	-0,013

25-34	-0,094 ^a	0,017	-5,51	-0,127	-0,061
35-44	-0,104 ^a	0,017	-6,25	-0,137	-0,071
45-54	-0,081 ^a	0,016	-5,13	-0,112	-0,05
55-64	-0,067 ^a	0,015	-4,46	-0,097	-0,038
Cinsiyet (referans kategori: kadın)					
Erkek	-0,072 ^a	0,009	-7,81	-0,09	-0,054
Medeni durum (referans kategori: bekar)					
Evli	0,102 ^a	0,011	9,61	0,082	0,123
Eğitim düzeyi (referans kategori: bir okul bitirmeyen)					
İlkokul	0,060 ^a	0,015	3,85	0,029	0,09
İlköğretim	0,066 ^a	0,019	3,51	0,029	0,103
Lise	0,112 ^a	0,017	6,51	0,078	0,146
Üniversite	0,135 ^a	0,017	7,76	0,101	0,169
Çalışma durumu (referans kategori: çalışmıyor)					
Çalışıyor	0,041 ^a	0,010	3,95	0,021	0,061
Konut sahipliği (referans kategori: ev sahibi değil)					
Ev sahibi	0,032 ^a	0,009	3,64	0,015	0,050
Hanehalkı büyüklüğü (referans kategori: 6 ve üstü)					
1-3 kişi	0,058 ^a	0,016	3,54	0,026	0,091
4-5 kişi	0,083 ^a	0,016	5,22	0,052	0,115

^a $p < .01$

Tablo 3.2’de katsayı değerlerine bakıldığında burada sadece bağımlı ve bağımsız değişkenler arasındaki ilişkinin yönüne dair bilgi edinebildiğinden Negatif Binomial Regresyon Modeline ait yorumlar tablo 3.3’te hesaplanan marjinal etki değerleri üzerinden yapılmıştır. Ayrıca çalışmada bağımsız değişkenlerin VIF değerleri incelenerek modelin çoklu doğrusal bağlantı içerip içermediği test edilmiştir (Alkan & Ünver, 2022). VIF değerleri 5 ve üzerinde olanların orta derecede, 10 ve üzeri olanların ise yüksek derecede çoklu doğrusal bağlantıya sebep olduğu düşünülmektedir (Alkan & Ünver, 2020). Çalışmada, değişkenlerin aralarında çoklu doğrusal bağlantı sorunu oluşturacak herhangi bir değişken bulunmamaktadır. VIF değerleri Tablo 3.3’te görülmektedir.

Tablo 3.3. Negatif Binomial Regresyon Modeli Marjinal Etki Sonuçları

Değişkenler	M.E	Standart Hata	t	Güven Aralığı (%95)		VIF
				Alt sınır	Üst sınır	
Yaş (referans kategori: 65+)						
24 ve altı	-0,345 ^a	0,131	-2,64	-0,601	-0,088	2,66
25-34	-0,610 ^a	0,112	-5,45	-0,829	-0,391	2,86
35-44	-0,672 ^a	0,109	-6,16	-0,886	-0,458	2,98
45-54	-0,527 ^a	0,104	-5,07	-0,731	-0,323	2,39
55-64	-0,443 ^a	0,100	-4,44	-0,638	-0,247	1,92
Cinsiyet (referans kategori: kadın)						
Erkek	-0,456 ^a	0,058	-7,82	-0,57	-0,342	1,31
Medeni durum (referans kategori: bekar)						
Evli	0,637 ^a	0,065	9,81	0,51	0,764	1,4
Eğitim düzeyi (referans kategori: bir okul bitirmeyen)						
İlkokul	0,358 ^a	0,092	3,91	0,179	0,538	2,84
İlköğretim	0,398 ^a	0,113	6,53	0,177	0,618	2,34
Lise	0,692 ^a	0,104	6,64	0,488	0,896	3,02

Üniversite	0,843 ^a	0,106	7,92	0,634	1,051	2,92
Çalışma durumu (referans kategori: çalışmıyor)						
Çalışıyor	0,259 ^a	0,066	3,94	0,130	0,388	1,52
Konut sahipliği (referans kategori: ev sahibi değil)						
Ev sahibi	0,204 ^a	0,056	3,66	0,095	0,314	1,08
Hanehalkı büyüklüğü (referans kategori: 6 ve üstü)						
1-3 kişi	0,358 ^a	0,099	3,61	0,164	0,553	3,17
4-5 kişi	0,519 ^a	0,097	5,37	0,33	0,709	2,83

^a $p < .01$; M.E: Marjinal Etki

Tablo 3.3'te verilen Negatif Binomial Regresyon Modeline göre, erkeklerin kadınlara göre yaşam memnuniyet puanı ortalama 0,456 daha azdır. Çalışmaya göre 24 ve altı yaş grubundaki bir bireyin referans gruba göre yaşam memnuniyet puanı ortalama 0,345 daha azdır. Tablo 3.3'e göre 25-34 yaş aralığındaki bir bireyin referans gruba göre yaşam memnuniyet puanı ortalama 0,610 daha azdır. Çalışmaya göre 35-44 yaş aralığındaki bir bireyin referans gruba göre yaşam memnuniyet puanı ortalama 0,672 daha azdır. Çalışmaya göre 45-54 yaş aralığındaki bir bireyin referans gruba göre yaşam memnuniyet puanı ortalama 0,527 daha azdır. Tablo 3.3'e göre 55-64 yaş aralığındaki bir bireyin referans gruba göre yaşam memnuniyet puanı ortalama 0,443 daha azdır. Tablo 3.3 incelendiğinde evli olan bir bireyin bekar olan bir bireye göre yaşam memnuniyet puanı ortalama 0,637 daha fazladır. İlkokul mezunu olan bir bireyin referans gruba göre yaşam memnuniyet puanı ortalama 0,358 daha fazladır. İlköğretim mezunu olan bir bireyin referans gruba göre yaşam memnuniyet puanı ortalama 0,398 daha fazladır. Ayrıca lise mezunu olan bir bireyin referans gruba göre yaşam memnuniyet puanı ortalama 0,692 daha fazladır. Tablo 3.3 incelendiğinde üniversite mezunu olan bir bireyin referans gruba göre yaşam memnuniyet puanının ortalama 0,843 daha fazla olduğu görülmektedir. Çalışmaya göre çalışan bir bireyin çalışmayan bir bireye göre yaşam memnuniyet puanı ortalama 0,259 daha fazladır. Tablo 3.3 incelendiğinde ev sahibi olan bir bireyin referans gruba göre yaşam memnuniyet puanı ortalama 0,204 daha fazladır. Hanehalkı büyüklüğü 1-3 kişi arasında olan bir bireyin referans gruba göre yaşam memnuniyet puanı ortalama 0,358 daha fazladır. Çalışmaya göre hanehalkı büyüklüğü 4-5 kişi arasında olan bir bireyin referans gruba göre yaşam memnuniyet puanı ortalama 0,519 daha fazladır.

3. TARTIŞMA VE SONUÇ

Bu çalışmada, TÜİK tarafından 2021 yılında yapılan Yaşam Memnuniyeti Araştırması'nın mikro veri setleri kullanılmıştır. Çalışmanın amacı sayma verisi modellerinden Negatif Binomial Regresyon Modeli kullanılarak bireylerin COVID-19 döneminde yaşam memnuniyet puanlarını etkileyen faktörleri belirlemektir. Analiz sonuçlarına göre yaş, cinsiyet, medeni durum, eğitim düzeyi, çalışma durumu, konut sahipliği ve hanehalkı büyüklüğü değişkenlerinin anlamlı olduğu görülmektedir.

Çalışmada erkeklerin kadınlara göre yaşam memnuniyet puanlarının daha az olduğu bulgusuna ulaşılmıştır. Cinsiyet değişkeninin yaşam memnuniyetine etkileri konusunda yapılan çalışmaların fikir birliği içinde olmadığı söylenebilir (Güler & Emeç, 2006). Kadın ve erkeklerin yaşamdan elde ettikleri doyum düzeylerinin birbirlerinden pek farklı olmadığını iddia eden çalışmalar olsa da (Francis vd., 1998; Grace vd., 2005) bazı çalışmalar yaşam doyumunu açısından cinsiyetler arası farkın olduğunu ifade etmektedir. Özellikle kadınların erkeklere göre biraz daha avantajlı olup daha fazla yaşam doyumuna sahip oldukları gözlenmektedir (Lu, 2000; Peterson vd., 2005; Güler & Emeç, 2006)). Erkeklerin yaşamlarından daha az memnun olması; genellikle iş gücü noktasında zorlanılan alanların çoğunda erkeklerin yer alması ile ve toplum yapısından kaynaklı sorumluluk alanlarının erkekler için daha ağır şartlar barındırması ile ilişkili olabilir (Karaaslan, Çalmaşur, & Aysin, 2021). Cinsiyet ile yaşam memnuniyeti arasında ilişki olmadığını bulan çalışmalar da bulunmaktadır (Diener ve Diener, 2009; Şimşek vd., 2010)

Çalışmaya göre bireylerin yaşları arttıkça yaşam memnuniyet puanlarının azaldığı tespit edilmiştir. Benzer bulguların elde edildiği çalışmalar mevcuttur (Fernández Ballesteros, Zamarrón ve Ruiz, 2001; Peterson, Park ve Seligman, 2005). Ayrıca bu çalışma ile zıt bir şekilde gençlerin yaşamından daha az memnun olduğu tespit edilen çalışmalar da mevcuttur (Kahyaoglu, 2008; Karaaslan, Çalmaşur, & Aysin, 2021).

Çalışmada evli bireylerin yaşam memnuniyet puanlarının bekar bireylere göre daha fazla olduğu bulgusuna ulaşılmıştır. Türkiye örneğinde yapılan önceki bir çalışmada da hem evli kadınların hem de evli erkeklerin bekarlara göre yaşam memnuniyetlerinin daha yüksek olduğu sonucuna varılmıştır. Çalışmada evli insanların mutluluğu bekarlara kıyasla daha iyi fiziksel ve psikolojik sağlıklarına bağlanmaktadır (Alkan & Kavalcı, 2023).

Çalışmaya göre bireylerin eğitim düzeyleri arttıkça yaşam memnuniyet puanlarının arttığı tespit edilmiştir. Türkiye’de yapılan önceki bir çalışmada farklı eğitim seviyesine sahip bireylerin farklı beklentileri ve algılanan hizmet kalitesi değeri olduğu ve eğitim düzeyindeki artışın devlet ve özel sektör kuruluşlarında daha yüksek gelir düzeyi ile yeniliklere ve memnuniyete yönelik daha fazla algı anlamına geldiği bulgusuna ulaşıldığı görülmektedir (Ünver ve Alkan, 2021). Önceki bir çalışmada da eğitime yapılan yatırımların arttırılması ve kesintisiz şekilde devamlılığının sağlanmasının ekonomideki potansiyel üretim ve istihdam artışı olanaklarını geliştirerek, sağlık ve birçok alanda iyileşmeler yaratabileceği ileri sürülmüştür (Yılmaz & Ünver, 2019).

Çalışan bireylerin yaşam memnuniyet puanları çalışmayan bireylere göre daha fazladır. Benzer bulguların elde edildiği çalışmalar mevcuttur (Kahyaoğlu, 2008; Yücel, 2017). Çalışmaya göre ev sahibi olan bireylerin ev sahibi olmayan bireylere göre yaşam memnuniyet puanlarının daha fazla olduğu tespit edilmiştir. Bu durum kişilerin gelir düzeyi arttıkça yaşam memnuniyetlerinin artması ile açıklanabilmektedir. Literatürde benzer sonuçlar bulan çalışmalar (Aslangiray, 2016; Kahyaoğlu, 2008). Ayrıca birçok çalışma ekonomik göstergelerin bireylerin mutluluk ve umut düzeyiyle pozitif ilişkili olduğunu göstermektedir (Deaton, 2008; Graham, 2011).

Hanehalkı büyüklüğü 1-3 kişi arasında olan bireylerin hanehalkı büyüklüğü 6 ve üzeri olan bireylere göre yaşam memnuniyet puanlarının daha fazla olduğu tespit edilmiştir. Ayrıca Hanehalkı büyüklüğü 4-5 kişi arasında olan bireylerin hanehalkı büyüklüğü 6 ve üzeri olan bireylere göre yaşam memnuniyet puanlarının daha fazla olduğu tespit edilmiştir.

Dünya tarihine bakıldığında çok sayıda salgın hastalığın mevcut olduğu görülmektedir. 2020 senesinde içinde yaşadığımız dünya çok ağır etkileri bulunan bir pandemiyle karşılaşmıştır. COVID-19, dünya üzerindeki birçok ülkede yaşamı durma noktasına getirmiştir. Araştırmacılar, insanoğlunun hayatı üzerinde bu derece etkili olan COVID-19 ilgili çeşitli alanlarda çalışmalar yürütmektedirler. Yaşam memnuniyeti konusu da bu alanlarda yürütülen çalışmalardan biridir. Bireylerin yaşamlarından duyduğu memnuniyet düzeyinin belirleyicileri bulunmaktadır. Bu belirleyiciler üzerinde etkili olan durumlar da bireylerin genel yaşam memnuniyeti düzeylerini etkilemektedir.

Bu çalışmanın sınırlılıkları bulunmaktadır. İlki, bu çalışmanın verilerinin ikincil verilerden oluşması ve istatistiki analize konu olan değişkenlerin veri setimizde var olan değişkenlerden ibaret olduğunun dikkate alınması gerektiridir. Ayrıca veriler kesitsel olduğundan, bireylerin yaşam memnuniyet puanları ile ilgili sosyoekonomik faktörler arasında kesin nedensel bir ilişki çıkarılamamaktadır.

KAYNAKÇA

- Alkan, Ö., & Kavalcı, K. (2023). Gender differences in Happiness During COVID-19 Pandemic: Evidence from Türkiye. *Psychiatry and Behavioral Sciences* ;13(3), 55-67.
- Alkan, Ö., Oktay, E., Ünver, Ş., & Gerni, E. (2020). Determination of Factors Affecting the Financial Literacy of University Students in Eastern Anatolia using Ordered Regression Models. *Asian Economic and Financial Review*;10(5), 536-546.
- Alkan, Ö., & Ünver, Ş. (2022). Secondhand smoke exposure for different education levels: findings from a large, nationally representative survey in Turkey. *BMJ Open*;12:e057360., 1-12.
- Alkan, Ö., & Ünver, Ş. (2022). Tobacco smoke exposure among women in Turkey and determinants. *Journal of Substance Use*; 27(1), 43-49.
- Alkan, Ö., & Ünver, Ş. (2020). Determinants of Domestic Physical Violence Against Women in Turkey. *Humanities & Social Sciences Reviews*;8(6), 55-67.
- Anderson, E. W., Fornell, C., & Lehmann, D. R. (1994). Customer satisfaction, market share, and profitability: Findings from Sweden. *Journal of Marketing*;58, 53-66.
- Aslangiray, A. (2016). Yaşam Memnuniyetini Etkileyen Faktörlerin Modellenmesi: Batı Akdeniz Örneği. (Yayımlanmamış doktora tezi). Akdeniz Üniversitesi, Sosyal Bilimler Enstitüsü, İşletme Anabilim Dalı, Antalya

- Chakraborty, I., & Maity, P. (2020). COVID-19 outbreak: Migration, effects on society, global environment and prevention. *Sci Total Environ.*;728(1), 1-7.
- Deaton, A. (2008). Income, health, and well-being around the world: evidence from the Gallup World Poll. *J Econ Perspect.*;22(2), 53-72.
- Diener, E., & Diener, M. (2009). Cross-cultural correlates of life satisfaction and self-esteem. In *Culture and well-being* (pp. 71-91). Springer, Dordrecht
- Fernández-Ballesteros, R., Zamarrón, M. D., & Ruiz, M. A. (2001). The contribution of socio-demographic and psychosocial factors to life satisfaction. *Ageing & Society*, 2, 1-28
- Francis, L. J., Brown, L. B., Lester, D., & R. Philipchalk, (1998), "Happiness as Stable Extraversion: A Cross-cultural Examination of the Reliability and Validity of the Oxford Happiness Inventory Among Students in the UK, USA, Australia and Canada, *Personality and Individual Differences*, 24, 167-171.
- Grace, C., Miller, P. W. & M. J. Tcha (2005), "Happiness in University Education", *International Review of Economics Education*, 4(1), 20-45.
- Graham, C. (2011). Does more money make you happier? why so much debate? *Appl Res Qual Life*;6(3), 219-239.
- Güler, B. K., & Emeç, H. (2006). Yaşam Memnuniyeti Ve Akademik Başarıda İyimserlik Etkisi. *D.E.Ü.İ.İ.B.F. Dergisi*;21(2), 129-149.
- Kahyaoğlu, O. (2008). Yaşam memnuniyeti ve yaşam memnuniyetini etkileyen değişkenler ile ekonometrik uygulama: Türkiye örneği (dissertation, DEÜ Sosyal Bilimleri Enstitüsü).
- Karaşlan, K. Ç., Çalmaşur, G., & Aysin, M. E. (2021). Bireylerin Yaşam Memnuniyetlerini Etkileyen Faktörlerin İncelenmesi, . *Atatürk Üniversitesi İktisadi ve İdari Bilimler Dergisi*;35(1), 263-290.
- Lu, L. (2000), "Gender and Conjugal Differences in Happiness", *Journal of Social Psychology*, 140(1), 132-141
- Peterson, C., Park, N., & Seligman, M. E. (2005). "Orientations to Happiness and Life Satisfaction: The Full Life versus the Empty Life. *Journal of Happiness Studies*;6, 25-41.
- Şimşek, T. T., Yümin, E. T., Sertel, M., Öztürk, A., & Yümin, M. (2010). Kadın ve erkek yaşlı bireylerde depresyonun sağlıkla ilgili yaşam kalitesi ve yaşam memnuniyeti üzerine etkisi. *Fırat Üniversitesi Sağlık Bilimleri Tıp Dergisi*, 24(3), 147-153
- TUİK. (2021). *Yaşam Memnuniyeti Araştırması Mikro Veri Seti*. Retrieved from https://www.tuik.gov.tr/Kurumsal/Mikro_Veri
- Üçdoğruk Birecikli, Ş., Kökçen Eryavuz, A., & Özdemir, M. O. (2021). Saymalı Modeller ve Stata Uygulamaları. Editör Şenay Üçdoğruk Birecikli & Seda Şengül. Uygulamalarla Mikroekonometri. 1. Baskı. Nobel Akademik Yayıncılık. Ankara. ss: 179-217.
- Ünver, Ş., & Alkan, Ö. (2021). Determinants of e-Commerce Use at Different Educational Levels: Empirical Evidence from Turkey. *International Journal of Advanced Computer Science and Applications*;12(3), 40-49.
- Ünver, Ş., & Alkan, Ö. (2022). Experienced Problems with Online Shopping: The Case of Turkey. *Toros University FEASS Journal of Social Sciences Special Issue on 2nd International Symposium of Sustainable Logistics "Circular Economy"*, 87-96.
- Verbeek, M. (2004). *A Guide to Modern Econometrics*. England: John Wiley & Sons Ltd.
- Yılmaz, Ö., & Ünver, Ş. (2019). Beşeri Sermaye ve Ekonomik Büyüme İlişkisi:Türkiye Üzerine Ekonometrik Bir Analiz. *İktisadi ve İdari Bilimler Dergisi*;33(3), 1011-1026.
- Yücel, Y. B. (2017). Yaşam memnuniyetini etkileyen faktörlerin sınıflama ve regresyon ağacı ile belirlenmesi (Yüksek lisans tezi, İstanbul Ticaret Üniversitesi).
- Xie, Q., Xie, X., & Guo, S. (2022). The Factors Influencing Public Satisfaction with Community Services for COVID-19: Evidence from a Highly Educated Community in Beijing. *Int. J. Environ. Res. Public Health*;19 (11363), 1-19.
- Zeithaml, V., Bitner, M., & Gremler, D. (2006). *Services marketing: integrating customer focus across the firm*. Singapore: McGraw-Hill.

CORCİ ZEYDAN "SELAHADDİN EYYÜBİ" KİTABINDA İMADÜDDİN'İN AŞKININ İZİNİ SÜRMEK .
TRACING THE LOVE OF IMADUDDIN IN THE BOOK OF CORCİ ZEYDAN "SALADIN AYYUBI"

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Öz: Tarih insanoğlu için önemlidir. Tarihi yapan ve tarihi yazan insanlar vardır. Tarihi yapanları yazanlar tarafında Lübnanlı Hıristiyan bir yazar Corci Zeydan bulunmaktadır. Corci Zeydan anlatılarında tarihi özellikle kurgularında vermektedir. Corci Zeydan anlatılarında tarihi aşkla kurgular ve öyle güzel anlatır ki o zamanki tarih aralığında yaşar gibi olursunuz. Corci Zeydan bir Hıristiyan olmasına rağmen tarihi çok objektif bir şekilde ele alır ve anlatır. Corci Zeydan kitabında Şarkın sultanı ve Haçlılarla mücadele eden Selahaddin Eyyubi ve onun sağ kolu İmaduddin'in Seyyidetulmelike ile olan aşkı hikayelemiştir. Başlangıçta Fatımilerin önde gelen adamlarından Ebulhasan bu aşk üzerinden oyun kurmaya çalışsa da Selahaddin Eyyubi'nin basireti karşısında başarısız olmuştur. Fatimi halifesi Azıd'ın kız kardeşi Seyyidetulmelike önce İsmaililerle evlendirilmek istenmiş, sonraları Selahaddin Eyyubi ve has adamı İmaddüddin'in aralarını bozmak için kullanılmaya çalışılmıştır. Ama sonunda Selahaddin Eyyubi'nin basireti üstün gelmiş ve aşk kazanmıştır. Selahaddin Eyyubi has adamı İmaduddin'e güzel bir düğün tertip etmiştir. Corci Zeydan ayrıca kitabında İsmaililere önem vermiş ve İsmaililerin dönemi etkilemesi sebebiyle ayrıntılı anlatmıştır. Bu romanda ayrıca İmaduddin'in Selahaddin Eyyubi için canını tehlikeye atması da anlatılmıştır. Bu romandan Selahaddin Eyyubi'nin büyüklüğünü ve kendisini sevenlerin çok olduğunu anlıyoruz. Ayrıca romanda İslam dünyasında o dönemde fitnenin bolca bulunduğunu ve kol gezdiğini anlamaktayız. Şam'da bulunan Nureddin'in Selahaddin Eyyubi'nin güçlenmesinden çekindiğini anlıyoruz. Selahaddin Eyyubi Mısır'da Şam hâkimi Nureddin adına bulunmaktadır. Her ne kadar Selahaddin Eyyubi ve Şam hâkimi Nureddin'i birbirine düşürmek isteseler de Selahaddin'in babası hep oğluna Nureddin'e itaatte kusur etmemesini tenbih eder. Selahaddin Eyyubi'nin babasının ileri görüşlülüğü sayesinde Selahaddin fitnelerden kurtulur. Hatta Nureddin Mısır'a Selahaddin'in üzerine gelmek üzere iken Allah'ın yardımı gelir ve Nureddin ilahi rastlantı sonucu vefat eder. Yani Selahaddin Eyyubi Allah'ın sevgili kuludur ve Allah ona hem hakimiyet hem sultanlık hem İslam aleminin kurtarıcısı rolünü bahşetmiştir.

Anahtar Kelimeler: Tarih, Corci Zeydan, Selahaddin Eyyubi, İsmaililer, Haçlılar

Abstract: History is important for humanity. There are people who make history and write history. On the side of those who make and write history, there is a Lebanese Christian writer Corci Zeydan. Corci Zeydan gives history in his narratives, especially in his fiction. Corci Zeydan fictionalizes history with love in his narratives and tells it so beautifully that you feel like you are living in the period of history at that time. Despite being a Christian, Corci Zeydan handles and tells history very objectively. In his book, Corci Zeydan tells the story of the love between Saladin Ayyubi, the Sultan of the Sharq and the Crusaders, and his right-hand man Imaduddin, with Seyyidetulmelike. At the beginning, Ebulhasan, one of the leading men of the Fatimids, tried to set up a game over this love, but he failed in the face of Saladin Ayyubi's insight. First, Seyyidetulmelike, the sister of the Fatimid caliph Azid, was tried to be married to the Ismailis, and later, attempts were made to use her to cause trouble between Saladin Ayyubi and his real man Imaduddin. But in the end, Saladin Ayyubi's insight prevailed and love won. Saladin Ayyubi organized a beautiful wedding for his special man Imaduddin. Corci Zeydan also gave importance to Ismailis in his book and explained in detail how Ismailis influenced the period. This novel also tells the story of Imaduddin risking his life for Saladin Ayyubi. From this novel, we understand the greatness of Saladin Ayyubi and the many people who loved him. In addition, in the

novel, we understand that there was a lot of discord and rampant in the Islamic world at that time. We understand that Nureddin, who was in Damascus, was afraid of Saladin Ayyubi's gaining power. Saladin Ayyubi was in Egypt on behalf of Nureddin, the ruler of Damascus. Although Saladin Ayyubi and Nureddin, the ruler of Damascus, wanted to turn Saladin against each other, Saladin's father always warned his son not to fail in obeying Nureddin. Thanks to the foresight of Saladin Ayyubi's father, Saladin was saved from the strife. Even when Nureddin was about to come to Egypt against Saladin, Allah's help came and Nureddin died as a result of divine coincidence. In other words, Saladin Ayyubi was the beloved servant of Allah and Allah granted him both sovereignty, sultanate and the role of savior of the Islamic world.

Keywords: History, Corci Zeydan, Saladin Ayyubi, Ismailis, Crusaders

GİRİŞ

Tarih yapanlar ve tarih yazanlar önemlidir. Ayrıca tarihi kurgulayan Corci Zeydan gibi yazarlarda önemlidir. Tek fark romanda anlatıcının kurguyla istediği gibi oynayabilmesidir. Ama Corci Zeydan'ın romanları okunduğunda genellikle gerçeklikle uygunluklar görmemiz olasıdır. Ayrıca Corci Zeydan insan hayatında önemli bir yer tutan aşkı da bütün romanlarında bir çeşni olarak kullanmaktadır. Tabi ki bu durum Corci Zeydan'ın romanlarına ayrı bir estetik zevk katmaktadır.

Corci Zeydan ve Hayatı

Corci Zeydan (1861-1914) Lübnanlı bir yazar, romancı, tarihçi ve gazetecidir. Yazar Arap diline hakimdir ayrıca İbranice ,Süryanice , Fransızca ve İngilizce bilmektedir. Editörlüğünü kendi yaptığı El-Hilal dergisini , H. 1892 yılına denk gelen Rebi'ül-Evvel '1310da çıkarmış ve kitaplarını bu dergide yayınlamıştır. Kitapları arasında “İslam Medeniyeti Tarihi”, “Arap Dili Edebiyatı Tarihi”, “Doğu Ünlülerinin Biyografileri” ve başka kitaplar yer almaktadır. Ayrıca “ El-Memluk” gibi tarihi romanlarıyla da ünlüdür. .Al-Sharad“ ” ,Armanusa Al-Misriyya ” ve diğerleri .Arap milliyetçiliği teorisinin formüle edilmesine yardımcı olan ilk düşünürlerden biridir.

Doğumu ve yetiştirilişi

Corci Zeydan , 14 Aralık 1861 'de Beyrut'ta , Lübnan Dağı'nın Ain Enab köyünde yaşayan fakir bir Hıristiyan ailenin çocuğu olarak dünyaya geldi. Kökeninin Suriye'deki Hauran'a dayandığına inanılıyor. Babası onu, kendisine yardım edebilmesi için okuma, yazma ve aritmetik öğrenmesi için mütevazı bir okula gönderdi. restoranı yönetti ve hesapları ayarladı. Daha sonra Shawam Okulu'na katıldı ve Fransızca öğrendi, ardından İngilizce öğrenmek için bir akşam okuluna katıldı ve ardından babasının restoranında çalıştı. Ancak annesi Maryam Matar, oradaydı. Bu konuda tatmin olmadı, babasından ona başka bir zanaat öğretmesini istedi. On iki yaşında ayakkabıcılık eğitimi aldı ama o bu işi istemediği için bıraktı. Bilgiye, okumaya ve edebiyata merak duymaya başladı. Amerikan Koleji mezunları, gazeteciler ve Yaqoub Sarrouf , Fares Nimr , İbrahim Al-Yaziji gibi düşünce ve edebiyat insanlarıyla tanıştı . Salim Al-Bustani ve diğerleri onu üniversitenin kutlamalarına davet edeceklerdi. Tıp okumak için giriş sınavını geçtiği Suriye Protestan Koleji'ne Amerikan Üniversitesi girdi , ancak bir yıl okudu, ardından tıp eğitimini bırakıp eczacılık okumaya gitti. Ancak okumak için Mısır'a gitmeye karar verdi. Beyrut'taki bir komşusundan altı sterlin borç aldı.

Kahire'ye göç etti

Mısır'a göç etti ve tıp fakültesine kaydoldu, ancak maddi durumu ve eğitim süresinin uzunluğu onu iş aramaya yöneltti .Ermeni asıllı bir adamın sahibi olduğu Al-Zaman gazetesinin editörlüğünü yaptı . Bu gazete , İngiliz sömürgeciliğinin o dönemin basınını durdurmasından sonra Kahire'deki tek gazeteydi. Daha sonra Kahire'deki İngiliz İstihbarat Bürosu'nda tercüman olarak çalıştı ve İngiliz komutan "Gordon"u Mehdi Ordusu kuşatmasından kurtarmak için Sudan'a giden İngiliz seferine eşlik etti. Sudan'daki yolculuğu on ay sürdü ve ardından geri döndü 1885'te Beyrut'a giderek 1882'de kurulan Doğu Bilimleri Akademisi'ne katıldı ve İbranice ve Süryanice dillerini öğrendi . Bu ona 1886'da Arap dili felsefesine ilişkin ilk kitabı yazmasını sağladı ardından yeni, revize edilmiş Arap Dili Tarihi başlıklı 1904 tarihli basımı bir kitap yayınladı .Daha sonra İngiltere'yi ziyaret ederek Mısır'a döndü ve kendini yazarlığa ve gazeteciliğe adanmış.

Kahire'ye yerleşerek yazarlık ve çeviri işlerinde çalıştı .El-Muktataf dergisini yönetti ve 18 ay çalıştıktan sonra El-Ubeydiye el-Kübra Mektebi'nde iki yıl Arapça öğretmenliği yaptıktan sonra oradan ayrıldı. Najib Mitri ile matbaanın kurulmasına katıldı ancak bir yıl sonra aralarındaki ortaklık bozuldu ve Corci Zeydan matbaayı elinde tutarak, Naguib Mitri Al- adında bağımsız bir matbaa kurdu.

El Hilal Dergisi

Corci Zeydan, 1892'de Al-Hilal dergisini çıkardı , editörlüğünü kendisi yaptı, ardından oğlu Emil ona yardım etti. Al-Hilal dergisinin ilk sayısı 1892'de çıktı ve beş yıl sonra en çok dağıtılan dergilerden biri oldu. Mısır ve Arap dünyasındaki düşünce ve edebiyat devleri bu dergide yazılar yazdı ve genel yayın yönetmenliğini Ahmed Zaki , Hüseyin Mu'nis , Ali Al-Rai , şair Saleh Jawdat gibi kıdemli yazarlar yaptı. ve diğerleri.

Onun ölümü

Corci Zeydan, Temmuz 1914 ile ilgili kitap ve makalelerinin arasındayken aniden öldü . Ahmed Şevki , Hafız İbrahim ve Halil Mutran gibi büyük şairler onu övdü.

Yazıları:**Tarih**

- İslam'dan Önce Araplar - Birinci Bölüm, 1908'de Mısır'da basıldı.
- İslam Medeniyeti Tarihi - Beş Bölüm - Mısır'da Basılmıştır 1902-1906.
- Mısır'ın Modern Tarihi - iki bölüm - Mısır 1889'da basılmıştır.
- Masonluğun Genel Tarihi. El Hilal.
- Doğu'nun ünlü kişilerinin biyografileri.

Dil ve edebiyatta

- Arapça kelimeler ve dil felsefesi - Beyrut 1889.
- Arap Dili Edebiyatı Tarihi - Dört Bölüm - Mısır 1911
- Arap dili yaşayan bir organizmadır - Beyrut 1988 - ikinci baskı

Seyahat edebiyatında

- Avrupa'ya Yolculuk 1912
- Üç gezi: Astana - Avrupa - Filistin

Doğa bilimlerinde

- Modern fizyonomi - 1901

İslam tarihi üzerine bir dizi roman

- Ghassan'ın kızı
- Mısırlı Armanusa : Mısır'ın Amr ibn el-As tarafından fethinin hikayesi
- Kureyş Meryemi : Osman'ın öldürülmesi ve Deve ile Sıffin olayları . Farsçaya Khosravi el-Kirmanshahi tarafından çevrilmiştir.
- 17 Ramazan: Büyük Fitne olayları ve İmam Ali bin Ebi Talib'in öldürülmesi
- Gada Kerbela : Hüseyin bin Ali bin Ebi Talib'in öldürülmesi
- Haccac bin Yusuf : Emeviler dönemindeki siyasi koşullar
- Endülüs'ün Fethi : Tarık bin Ziyad önderliğinde Endülüs'ün fethinin hikayesi
- Charles ve Abd al-Rahman : Avrupa'da İslami fetihler
- Ebu Müslim El-Horasani : Emevi Halifeliğinin Düşüşü
- Al-Abbasah ,Al-Rashid'in kız kardeşi : Harun Al-Rashid'in hükümdarlığı döneminde Abbasi sarayının koşulları
- El-Emin ve El-Memun : Abbasi Devleti'nin Altın Çağı
- Fergana'nın Gelini : El-Mu'tasim Billah dönemindeki eyalet ve yeni halifeliğin başkenti Samarra'dır.
- Ahmed İbn Tulun : H. 3. yüzyılda Mısır
- Abdel Rahman Al-Nasser : Endülüs'ün Altın Çağı
- Kairouan kızı
- Selahaddin el-Eyyubi : Haçlı Seferleri
- Shajarat al-Durr:
- Osmanlı darbesi : II. Abdülhamid döneminin siyasi koşulları
- Mehdi Tutsağı : Ahmed Urabi liderliğindeki Urabi devriminin ve ardından Sudan'daki Mehdi devriminin hikayesi anlatılıyor. Bu, kıssanın kahramanları (Şafik) ve (Fedva) aracılığıyla yapılır.
- Sahip olunan başıboş
- Memluk zulmü
- Sonuç olarak
- Aşıkların cihadı

Corci Zeydan birçok alanda kalem oynatmıştır. Ancak daha çok tarihi romanları ile ön plana çıkmıştır. Bu tarihi romanlarında da aşk kendine yer bulur ve aşk bu romanlarda öne çıkan bir konudur.

Selahaddin Eyyubi Romanı

Selahattin el-Eyyübi romanı okunduğunda Selahattin ne büyük bir komutan olduğunu anladığımız gibi, Selahattin'i tesadüflerin değil tevafukların ilahi rastlantılarında koruduğuna Corci Zeydan ağzıyla şahit oluruz. Nurettin'in tam Selahaddin üzerine yürüyecekken ölümü de ilahi rastlantıdır. Ayrıca bu romanda Selahattin'in adamlarının kendisine ne kadar sadık olduğunu ve Selahaddin'in de kendi adamlarına sadık olduğunu anlıyoruz. Selahaddin kendi nefsi için hareket etmeyip kendi has adamı İmaduddin'in de aşkına sahip çıkmaktadır. Tabi ki roman içerisinde tarihi güzel kurgulayan ve her romanında aşka yer veren yazarın da üslubu burada önemlidir.

Yazar romanına tarihi bir girişle başlayarak adeta okuyucusunu roman okumaya girişe hazırlamaktadır (Zeydan,2014:9-15). Bu roman Selahaddin'in romanıdır da denebilir. Roman Fatimilerin 11. ve son Halifesi Azıd ile başlamaktadır (Zeydan,2014:20). Azıd Nureddin'e haraç ödemekte ve Nureddin'in veziri olarak Kahire'de Selahaddin bulunmaktadır. Selahaddin'in yanından ayırmadığı ve güvendiği bir genç te vardır bu gencin adı İmadüddin'dir (Zeydan,2014:23). Selahaddin'in kitaptaki diğer ismi Yusuf Bin Necmeddin'dir (Zeydan,2014:9-13). Necmeddin ile oğlu Selahaddin başbaşa kalınca oturup konuştular ve ne yapacaklarına karar verdiler (Zeydan,2014:35). Babası Selahaddin'e Abbasi halifesi adına hutbe okutmalısın deyince Selahaddin o zaman Mısır benim olmalı der. Babası ona münasip zamanı beklemelisin diye ikaz eder (Zeydan,2014:38). Selahaddinler olmasa vezir Şaver Haçlılara yüz bin altın verilmesini kabul etmişti (Zeydan,2014:40). Seyyidetülmelik'te saray da önemli bir isimdi (Zeydan,2014:45). Fatımi halifesi Azıd Selahaddin'den korkuyor ve ondan kurtulmak istiyordu. Azıd'ın adamı Ebulhasan Azıd' İsmailileri önerdi (Zeydan,2014:51). Ebulhasan bunların reisleri Hasan Sabbah Kazvin'in yakınlarında Alamut Kalesi'nde ikamet etti. Şimdiki reisleri Raşiddün Sinan'dır. Halep yakınlarında Sumak Dağı'nda ikamet etmektedir (Zeydan,2014:52). Fakat Ebulhasan İsmaililerin yardımının Azıd'ın kız kardeşi Seyyidetülmelikle mümkün olacağını söylemek istiyordu (Zeydan,2014:54). Azı ve Ebulhasan başka türlü bu Kürt Selahaddin Eyyübi'den kurtulamayız diye konuşurlar (Zeydan,2014:55). İmadüddin Seyyidetülmeliği ölümden kurtarmıştı (Zeydan,2014:64). Azıd bu Kürt komutandan kurtulmamız gerekiyor deyince Celis amcazadeniz Ebulhasan'ın teklifi hakkında ne düşünüyorsunuz diye sorar? Bu cümleyi işiten Seyyidetülmeliğin tüyleri ürperir (Zeydan,2014:67). Seyyidetülmelik üzgündür zira kendisini kurtaranlara karşı kardeşi oyun planlamaktadır. Seyyidetülmelik Celis'e Ebulhasan yalancı bir adamdır sizi kandırıyor demektedir (Zeydan,2014:69). Fakat kardeşi Azıd buna itiraz edince Seyyidetülmelik peki bekleyip görelim der (Zeydan,2014:70). İhtiyar Celis Ebulhasan'ın iyi biri olduğunu düşünüyordu (Zeydan,2014:77). Selahaddin'in yanında sürekli akıl danıştığı İsa el-Hakkâri isminde bir zat vardı. Bu zat amcası Esedüddin'e intisap etmişti (Zeydan,2014:79). Hakkâri Ebulhasan'ın yanına giderek Türklüğe temel kuran Selçukluların tarihi ile ilgili kitaplara bakmak istediğini söyler (Zeydan,2014:82). Hakkâri büyük adam Tuğrul Bey'in kitabını aradığını Ebulhasan'a söyler (Zeydan,2014:83). Ebulhasan, Hakkari'ye Selahaddin güçlü olmak istiyorsa Azıd'ın kız kardeşi ile evlenmeli der (Zeydan,2014:87). Zira Azıd'ın kız kardeşinin Selahaddin'in has adamı İmadduddin'i sevdiğini bilmektedir. Seyyidetülmelik ağlar ve bu Kürtlerden bu sarayda bizi kim kurtaracak diye üzülür (Zeydan,2014:90). Seyyidetülmeliğin Kürtlerden kastı Selahaddin ve ekibidir. Seyyidetülmeliğin mürebbiyesi demek Selahaddin'in küçük bir zabıtine gönül verdiniz diye hayıflanmaktadır (Zeydan,2014:99). Seyyidetülmelik halası mürebbiyeye durumu olanca açıklığıyla anlatmış ve yardım istemiştir (Zeydan,2014:103). Seyyidetülmelik kardeşi Azıd'ın İsmaili lideri ile evlenme fikrine sıcak bakmıyordu. Ancak kardeşi Azıd evlenmesi için bastırınca o da tamam Selahaddin'i öldürsünler evleneyim der (Zeydan,2014:111). Hakkâri Selahaddinle evlilik durumunu görüşür. Ayrıca İmadüddin'e dostluğunun nişanesi olarak hançerini hediye eder ve iyice muhafaza etmesini ister (Zeydan,2014:123). İmaddüddin artık Selahaddin'in has adamı olmuştur (Zeydan,2014:124). İsmaililer Sumak Dağı yani Nusayriler Dağı'nda faaliyetlerine devam ettiler (Zeydan,2014:131). İmadüddin İsmaililerin ortadan kaldırılmadan dünyanın huzura kavuşacağına inanmıyordu (Zeydan,2014:135). Seyyidetülmelik İmadüddin'i sarayına davet etmiş ve o da bu davete karşılı vermişti (Zeydan,2014:146-156). Seyyidetülmelik İmadüddine aşkını ilan etmişti (Zeydan,2014:161). İmadüddin de önemli bir vazifesinin olduğunu bu vazifeyi tamamlayınca ona geri döneceğini ifade etmişti (Zeydan,2014:162). İmadüddin Selahaddin'den bu önemli vazife için izin istemişti (Zeydan,2014:171). Nureddin'in Şam'dan Mısır'a geleceği söyleniyordu ve Selahaddin saygıda kusur

etmemesi için babasından nasihat almıştı (Zeydan,2014:186). Ebulhasan Azıd'a kız kardeşinin Selahaddin'in küçük zabıtlarından biriyle görüştüğünü rapor etmişti (Zeydan,2014:189). Azıd vefat etmiş ve İmadüddin'den mektup gelmiş ve Kudüs'te hapisanede olduğu haber verilmişti (Zeydan,2014:243). Selahaddin ile beraber Seyyidetulmelik'te bu mektubu dinliyordu ki o an İmadüddin olduğunu anlayınca bayıldı. Selahaddin bunu görünce Seyyidetulmeliğin İmadüddini sevdiğini anladı (Zeydan,2014:245). Selahaddin Seyyidetulmeliğe endişe etmeyiniz onu kurtaracağız der (Zeydan,2014:247). Selahaddin'in düşmanları Şam'da Nureddin'i Selahaddin'e karşı biliyorlardı. Nureddin'de Mısır'a sefere çıkmak için hazırlanıyordu (Zeydan,2014:271). İmadüddin Kahire'den ayrılıp Kudüs'e gitmiş ve orada tutuklanmış ve önde gelen asıl ismi Abdurrahimi Cercise çevirmiş olan birisi ile tanışmış ve dost olmuştu (Zeydan,2014:283). İmadüddin Cercis ile dost olmuş ve İsmaililerin güvenini kazanmıştı. İmadüddin İsmaililerden Şeyh Debus ile görüşmek ister (Zeydan,2014:295). İmadüddin İsmaililerin lideri Şeyh Raşidüddin'i öldürmek istiyordu (Zeydan,2014:315). İmadüddin İsmaililerin yerlerinde sanki cennete gitmiş gelmişti (Zeydan,2014:330). Şeyh Raşidüddin İmadüddin'e Selahaddin'i öldürmeni istiyorum dedi (Zeydan,2014:347). İmadüddin Şeyh Süleyman'ı İsmaililerin yerinde öldürdü (Zeydan,2014:357). İmadüddin Seyyidetulmeliğin yanına gittiğinde Melike gözlerine inanamadı karşısında duran İmadüddindi (Zeydan,2014:364). Selahaddin'e İmadüddin'in sağ döndüğü haberi verildi (Zeydan,2014:377). Selahaddin adamı İmadüddine güzel bir düğün yaptı (Zeydan,2014:382).

Corci Zeydan İmadüddin'in aşkıyla beraber Selahaddin'i ve İsmailileri o kadar güzel anlatır ki kurgu mu gerçek mi ayırt etmek güçleşir. Corzi Zeydan'ın romanlarının güzelliği de burada aranmalıdır sanırım.

SONUÇ

Bu romanı okuyunca Selahaddin'in ne zorluklarla bir devlet kurduğunu görmekteyiz. Selahaddin devletini kurarken Nureddin engellemek istemiş ama tam Şam üzerinden Mısır'a yürüyecekken vefat etmiştir. Sultan Selahaddin devlet kurmak için germekten çok mücadele etmiştir. Selahaddin devlet kurarken yoldaşlarını yolda bırakmamış ve arkadaşlarına hep sahip çıkmıştır. Sultan Selahaddin devlet kurarken İsmaililerle de mücadele etmiştir.

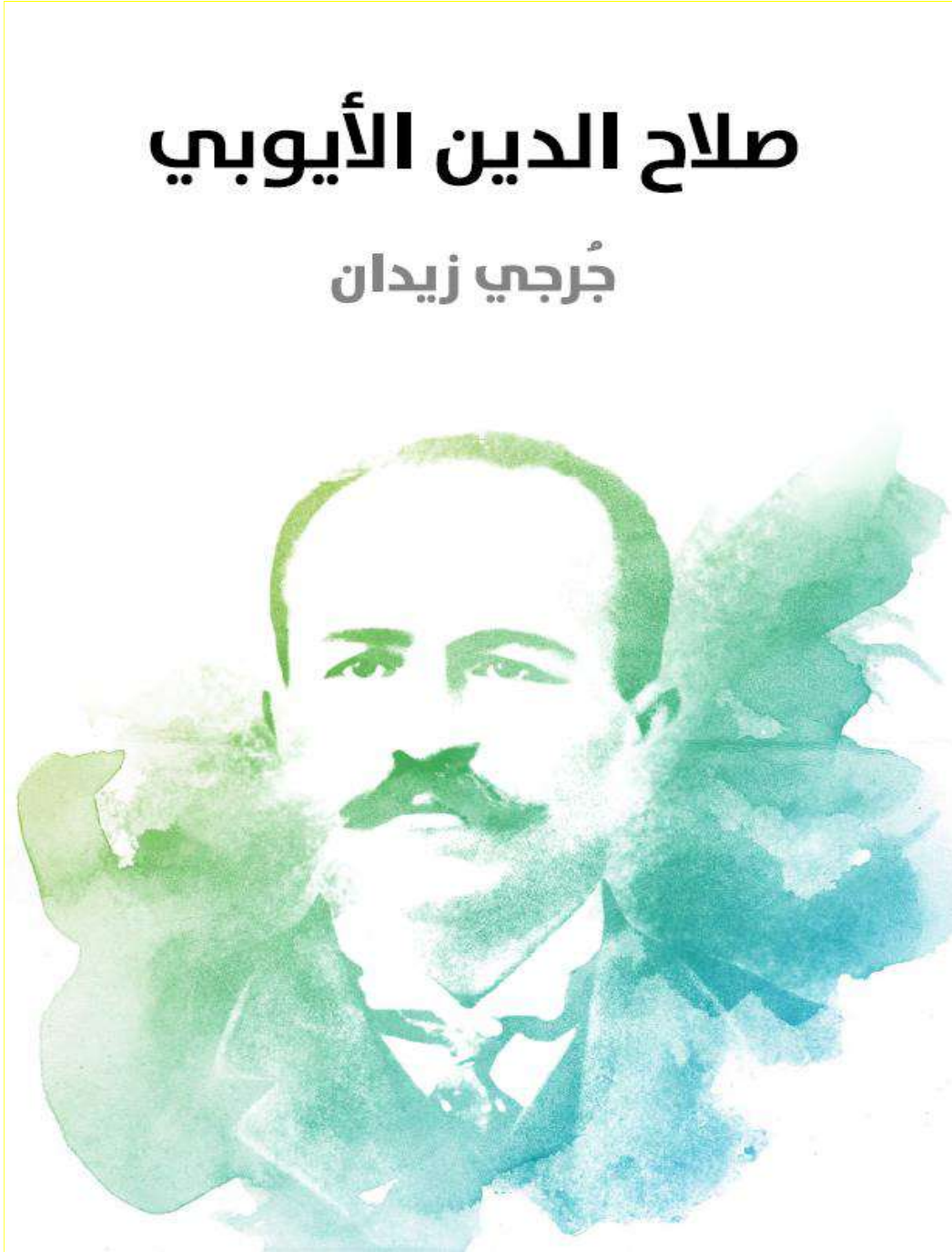
KAYNAKÇA

Zeydan, Corci (2014). Selahaddin Eyyübi ve Haşhaşiler. Çev. Zeki Megamiz. 1. baskı. İstanbul: Kapı Yayınları.

Zeydan, Corci (2014). Salâhaddîn el-Eyyübî. 1. baskı. İstanbul: Hindavi Yayınları.

Ekler:

Ek1: Kitabın Ön kapağı Kaynak dilde



Ek2: Kitabın Ön kapağı Erek/Hedef/ikinci dilde



Ek3: Kitabın Ön kapağı Ereğ/Hedef/ikinci dilde



**BRUCE ALAN MASTERS'IN KİTABI "OSMANLI İMPARATORLUĞU'NUN ARAPLARI (1516-1918) SOSYAL VE KÜLTÜREL BİR TARİH" KİTABI ÜZERİNE DEĞERLENDİRME
REVIEW OF BRUCE MASTERS' BOOK "THE ARABS OF THE OTTOMAN EMPIRE (1516-1918) A SOCIAL AND CULTURAL HISTORY"**

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Öz: Bruce Alan Masters bu kitabında Arapların özellikle Osmanlının gücünü iyiliği emretmek ve kötülüğü nehyetmek noktasında gönüllü kabul edişlerini ele alıyor. Fransız ihtilali ile başlayan milliyetçilik akımları ve Osmanlı ekonomisinin 17. Yüzyıldan sonra kötüye gitmeye başlamasıyla Osmanlı da yavaş yavaş sorunlar belirmeye başlıyor. Fransız İhtilalinin etkisini göstermeye başladığı 19. Yüzyılda başlayan milliyetçilik hareketleri sonucunda Osmanlının dağılmaması adına İttihat ve Terakkiciler Ümmetçilik ve Osmanlılık fikri yerine Türk Milliyetçiliğini ön plana çıkarmaya başladıkları için Araplar da Arap milliyetçiliğini ön plana çıkarmaya başlarlar. Yani ulusçuluğun başladığı yerde bütün kavimler kendini üstün görüp diğerini yani ötekiyi dışlamaya başlarlar. İşte bu noktada Arap milliyetçileri Osmanlıyı öteki gösterip Osmanlının Arapları sömürdüklerini söylemektedir. Halbuki bunu söyleyenler Çağdaş Arap tarihçileridir. Bu çağdaş Arap tarihçilerini tarih yalanlamaktadır. Araplar niçin Osmanlıya dört yüzyıldır itaat etmiştir bu soru önemlidir. İşte bu kitap objektif bir şekilde aslında Arapların Osmanlıya gönüllü itaat ettiğini ortaya koymaktadır. Ta ki 20. Yüzyılda İttihat ve Terakki (1908-1918) ortaya çıkana kadar. Araplar bu noktada ayrılmayı düşünmüşlerdir zira hem İttihat ve Terakkinin Araplar üzerinde uygulamaları hem de İngilizlerin Arapları kışkırtmaları sonucunda Araplar ayrılmak için çalışmışlar ve bunu da 22 Arap ülkesine bölünerek başarmışlardır. Burada önemli olan soru özellikle Arapların Sünni kesiminin Osmanlıya itaat ettiği şekildedir. Osmanlı, Arapların yerel kesimiyle Arapları kendisine bağlamış ve refahı da paylaşmıştır. Ta ki Osmanlının ekonomisi bozulana kadar. Arapları Osmanlıya bağlayan etkenlerin başında tasavvuf da önemli bir faktördür. Özellikle Nakşilik, Kadirilik ve Şazililik, Hurufilik ve Bektaşilik önem arz etmektedir.

Anahtar Kelimeler: Osmanlı, Araplar, Ümmetçilik, Milliyetçilik, İttihad ve Terakki

Absrtact: In this book, Bruce Alan Masters examines the Arabs' voluntary acceptance of the Ottoman power, especially in terms of enjoining good and forbidding evil. With the nationalist movements that began with the French Revolution and the Ottoman economy starting to deteriorate after the 17th century, problems gradually began to emerge in the Ottoman Empire. As a result of the nationalist

movements that began in the 19th century when the French Revolution began to show its effect, the Union and Progress Party began to emphasize Turkish nationalism instead of the idea of Ummah and Ottomanism in order to prevent the disintegration of the Ottoman Empire, and the Arabs began to emphasize Arab nationalism. In other words, where nationalism begins, all nations see themselves as superior and begin to exclude the other, that is, the other. At this point, Arab nationalists present the Ottomans as the other and say that the Ottomans exploited the Arabs. However, those who say this are modern Arab historians. History refutes these modern Arab historians. The question of why the Arabs obeyed the Ottomans for four centuries is important. This book objectively reveals that the Arabs actually obeyed the Ottomans voluntarily. Until the emergence of the Union and Progress Party (1908-1918) in the 20th century. At this point, the Arabs thought of separating because both the Union and Progress Party's practices on the Arabs and the British's provocations against the Arabs, the Arabs tried to separate and achieved this by dividing into 22 Arab countries. The important question here is how the Sunni section of the Arabs obeyed the Ottomans. The Ottomans connected the local section of the Arabs to themselves and shared the prosperity. Until the Ottoman economy deteriorated. Sufism is also an important factor among the factors that connected the Arabs to the Ottomans. Especially the Naqshbandi, Qadiri and Shazilism, Hurufism and Bektashism are important.

Key Words: Ottoman, Arabs, Ummah, Nationalism, Committe of Union and Progress

GİRİŞ

Topluma fikirleriyle hizmet eden entelektüeller vardır. İşte bunlardan birisi de Bruce Alan Masters'dır. Masters Osmanlı İmparatorluğu'nun Arapları 1516-1918 adlı bu kitabında objektif olmaya çalışmıştır.

Bruce Alan Masters Hayatı

Bruce Masters, Georgetown Üniversitesi'nde Arapça anadal yaptı ve bu süre zarfında üçüncü sınıfını Kudüs'teki İbrani Üniversitesi'nde geçirdi. Mezun olduktan sonra üç yılını Kahire'de Arapça öğrenerek ve Cambridge Üniversitesi İngiltere'de günlük Mısır Arapçası sözlüğünü oluşturmak için yürütülen bir projede araştırma asistanı olarak çalışarak geçirdi. Daha sonra Chicago Üniversitesi'ne gitti ve burada Osmanlı Tarihi ve İslam hukuku alanlarında Yakın Doğu Dilleri ve Medeniyetleri alanında doktora derecesi aldı. 1982'den beri Wesleyan'da İslam'ın yükselişinden günümüze Orta Doğu tarihi dersleri veriyor.

Güncel projeler:

Bölünmüş toplumlarda çatışmaların yaratılmasında toplumsal belleğin rolünün karşılaştırmalı çalışması: Kuzey İrlanda, Bosna, Lübnan ve Irak; Yayınlanmış eserleri şunlardır:

Osmanlı İmparatorluğu Arapları, 1516-1918: Bir Toplumsal ve Kültürel Tarih (2013, Cambridge University Press),

Osmanlı Arap Dünyasında Hıristiyanlar ve Yahudiler (2001) Orta Doğu'da Batı'nın Ekonomik Hakimiyetinin Kökenleri: Halep'te Merkantilizm ve İslam Ekonomisi, 1600-1750 Doğu (1988);).

Edhem Eldem ve Daniel Goffman ile birlikte yazılan Doğu ve Batı Arasında Osmanlı Şehri (1999).

Gabor Agoston ile birlikte yazılan Osmanlı İmparatorluğu Ansiklopedisi (2009). Cambridge Türkiye Tarihi (2006) ve Cambridge İslam Tarihi'ne (2010) katkılar, çeşitli makaleler ve editörlü kitaplarda bölümler.

2013 yılında Cambridge University Press tarafından “*The Arabs of the Ottoman Empire 1516-1918: A Social and Cultural History*” adıyla İngilizce olarak yayımlanan Bruce Alan Masters’ın bu kitabı, *Osmanlı İmparatorluğu’nun Arapları 1516-1918: Sosyal ve Kültürel Bir Tarih* adıyla Türkçe’ye Feray Coşkun tarafından çevrilmiş ve 2017 yılında Doğan Kitap tarafından yayınlanmıştır.

Kitap sekiz bölüme ayrılmakta olup başlıklar şunlardır:

“1. *Arap topraklarında Osmanlı saltanatının kuruluşu ve bekası 1516-1798*

2. *Osmanlı yönetiminin kurumları*

3. *Erken modern dönemde ekonomi ve toplum*

4. *Alimlerin ve velilerin dünyası/Osmanlı Arap topraklarında entelektüel hayat*

5. *İmparatorluk savaşta Napoleon, Vehhabiler ve Mehmet Ali*

6. *Tanzimat ve yeniden Osmanlılaşma dönemi*

7. *İlişkinin sonu (Masters,2017:9,10).”*

Kitap iki önemli olaya vurgu ile başlar. Birincisi Suudilerin tarihi Osmanlı kalesi Ecyad’ı yıkıp yerine otel yapmalarıyla başlayan süreç, ikincisi İsrail tarafından 31 Mayıs 2010’da şehit edilen on bir şehidin olduğu Mavi Marmara gemisi. Birinci olay Türkiye Cumhuriyeti’nde yaşayan herkesi rahatsız ederken, ikinci olaya bütün İslam alemini rahatsız etmiştir. Yani İslam alemi ümmetçilik fikri etrafında birleşmekte ulusçuluk fikrini de dışlamamaktadır. Ama yazar tarihi Ecyad kalesinin Suudiler tarafından yıkılmasını Arapların normal karşıladığını Türklerin ise bu kuyruk acısı karşısında yalnız kaldığını yazmaktadır. Tabi ki burada Türkiye Cumhuriyeti’nin bu olaya karşı çıkması normaldi çünkü bizim tarihimizi temsil ediyordu. Yazar bu konuyu şöyle vermiştir:

“Kültür Bakanı İstemihan Talay UNESCO’ya Suudi eylemini Afganistan’daki dünya mirası alanı yıkılmasında olduğu gibi kınama talebinde bulundu. Arap yorumcularsa tam tersine, Türklerin, atalarının 1918’de Arap Yarımadası’nın kontrolünü kaybetmesinin kuyruk acısı olarak niteledikleri protestolara karşı ilgisizdiler. Sonuç olarak, UNESCO, korunması gereken yerler listesinde bulunmadığı için kalenin kaderinin Suudi otoritelerinin elinde olduğuna karar verdi (Masters,2017:15). 20. Yüzyılda hâkim söylem milliyetçilikti ve Arap tarihçileri Türkleri Efendi Arapları ise tebaa olarak gösteriyordu. Bu meta tarih (tarih ötesi) içerisinde Osmanlılar Arap tarihçiler tarafından yağmacılar ve zalimler olarak gösterildiler. Milliyetçi tarihçiler Osmanlı İmparatorluğu’nu Arap topraklarında yabancı bir işgalci olarak gördükleri için, atalarının da aynı şekilde hissettiklerini varsaydılar (Masters,2017:16). Bu milliyetçi anlatılar karşısında, Arap araştırmacılar ve başkaları, 1970’lerde kendilerinden önceki tarihçilerin büyük oranda ihmal ettiği arşiv kaynaklarını kullanarak Osmanlı yüzyıllarını tekrar incelemeye başladılar (Masters,2017:17). Osmanlı sınırları içerisinde yaşayan Arapların çoğu Sünni Müslümanlardı. Bu aynı zamanda Türkler, Kürtler, Arnavutlar ve Boşnaklar içinde böyleydi (Masters,2017:19). 19. Yüzyılın başlarındaki Vehhabi ayaklanmasında da Araplar

Osmanlıdan yana tavır almıştır (Masters,2017:22). Anadolu ve Balkanlar'daki eyalet sarayları ve şeri mahkemelerde kullanılan resmi dil Osmanlı Türkçesi idi (Masters,2017:30).

Yavuz Sultan Selim Şiiler iyi davranmazken Kanuni Sultan Süleyman Şiilere iyi davranmaktadır (Masters,2017:45). Ancak Yemen Şiileri Zeydiler Osmanlıya hep sorun çıkarmıştır (Masters,2017:49). Fas'da Alevi kökeni olduğu için Osmanlıya reddetmiş ayrıca şerif soyundan oldukları için Osmanlıdan üstün olduklarını savunmuşlardır (Masters,2017:52). Osmanlıda kadılar diğer eyaletlere İstanbul'dan gönderilirdi (Masters,2017:60). Osmanlı Arap topraklarındaki bölge seçkinlerinin gönüllü iş birliği sayesinde Sünni elitler yaratmış ve bu Sünni elitler Osmanlıyı desteklemiştir (Masters,2017:62). Osmanlıda geçerli mezhepler Şafii, Hanefi, Maliki ve Hanbelidir (Masters,2017:78). Yazar bu görüşüyle Osmanlıyı tam tanımamaktadır. Zira Osmanlı da ağırlıklı mezhep Hanefiliktir.

Osmanlı alimler ve velilere önem vermiştir. Osmanlı'nın Vehhabilerden ayrıldığı nokta tasavvufa verdiği önemdir (Masters,2017:117). İmparatorluk fermanları Osmanlı Türkçesiyle yazılsa da Arapça'ya tercüme ediliyordu. Zira Araplar Türkçe bilmiyordu (Masters,2017:123). Tasavvuf özellikle İbn Arabi önemli bir figürdü (Masters,2017:125). Nakşiler ve Mevleviler özellikle Arap ülkelerinde önemliydi (Masters,2017:126). İbn Arabi'nin Sin Şın'a girecek dediğini Sin'in Yavuz Sultan Selim Şın'ın ise Şam olduğu söylenir. Sultan Selim İbn Arabi'nin kabrini tamir ettirmiştir (Masters,2017:130,131). İbn Arabi Hristiyanlar ve Yahudiler de cennete gidebilir dediği için eleştiriler almıştır (Masters,2017:134). Arapçayı çok sayıda Osmanlı uleması ve padişahlar bilirken Araplardan Türkçe bilen çok az sayıdaydı (Masters,2017:143). Bunun sebebi Osmanlı'nın İslam'a ve Kuran'a muhabbetiydi. Ama Araplarda Türkçe'yi öğrenebilirlerdi. Osmanlı yönetimi iki bölgeyi Lübnan ve Kürdistan'ı yönetmekte sürekli zorluk yaşamıştır. Fernand Braudel dağlarda yaşayanları yönetmenin güç olduğunu söylemektedir (Masters,2017:180). Osmanlılar Kürdistan'da mir olarak bilinen derebeylerine yani yerel aşiret reislerine tam bir özerklik verdiler ve bunların çoğuda Sünni idi (Masters,2017:182). Yavuz Sultan Selim döneminde Kürtler Şah İsmail'e karşı Yavuz'a destek vermişlerdir (Masters,2017:182). Kürt bir baba ve Arap bir anneden doğan Mısırlı Kasım Emin önemli bir isimdir. Zira İslam dünyasında ilk defa 1889 yılında Kadınların Özgürleşmesi adıyla kadınların özgürlüğüne dair bir kitap yazmıştır. 1901 yılında Yeni Kadın ismiyle ikinci kitabını yayımlamıştır (Masters,2017:217,218). Ebu'l Huda gibi Osmanlıyı destekleyen alimler olduğu gibi Abdurrahman el-Kevakibi (ö.1903) Osmanlı otoriteleriyle sorunu olanlarda vardı. Cemal Paşa'ya suikast düzenlendiğinde de Cemal Paşa Kevakibi'yi de suikast de dahli var diye tutuklattı (Masters,2017:225,226). Kevakibi bu olaya kızıp "Tiranlığın Nitelikleri" ve "Şehirlerin Anası" ismiyle Osmanlı yani Türkler aleyhine iki kitap yazdı. İngiliz ajanları tabiki Kevakibi'nin kitaplarını Osmanlı aleyhine kullanmış ve bastırarak Araplara ücretsiz dağıtmışlardır (Masters,2017:226). Araplar kendilerince Türklerin askere almalarını anlatan Seferberlik isimindeki kitapta Osmanlıyı eleştirmişlerdir (Masters,2017:233). Araplar Cemal Paşa'yı kana susamış Saffah ismiyle isimlendirmişlerdir (Masters,2017:235). Cemal Paşa kendi döneminde birçok Arap milliyetçiyi asmıştır ve bu durum Araplar'da tepkiye neden olmuştur (Masters,2017:236). Cemal Paşa'nın Arap

milliyetçilerine sert davranması neticesinde Araplar İngilizlerle işbirliği yapmış ve bunun neticesinde 1 Ekim 1918'de Faysal Şam'da Emevi Camisi'nde namaz kılmıştır (Masters,2017:238).

Arap dünyasının önde gelen düşünürlerinden Mısırlı Taha Hüseyin Osmanlı hakkında şunları söylemiştir:

“Onlar Avrupalılar yeni hayatlarına 15. Yüzyılda başladılar, bizse Osmanlı Türklerince 19. Yüzyıla kadar geciktirildik. Eğer Tanrı bizi Osmanlı fethinden korusaydı, Avrupa ile devamlı temas halinde kalırdık ve onun rönesansını paylaşırdık. Bu şu an içinde yaşıyor olduğumuzdan daha farklı bir tarzda bir medeniyet meydana getirdi (Masters,2017:241).”

Taha Hüseyin ve başka Arap aydınları suç Osmanlı üzerine atarak rahatlıyorlar. Osmanlıda kültürel ve teknolojik olarak geri kaldığı için dağıldı zaten. Araplar geri kalmışlıklarının suçunu Osmanlı üzerine atarak kurtulmak istiyorlar. Eğer Mısır Taha Hüseyin'in dediği gibi Osmanlı yüzünden geri kaldıysa bugün Mısırın Osmanlıdan kurtulmuş olması sebebiyle uzaya gitmesi gerekirdi. Ama maalesef Mısır yine bugün geri kalmış bir ülkedir. İslam dünyasının geri kalmışlığı Âmin Maalouf'un dediği gibi Doğu toplumlarının kitap okumayıp cahil kalmasındandır. Ayrıca Doğu toplumları geçmişleriyle övünmekte ve ileriye doğru atılımlarını tembelliklerinden dolayı ertelemektedirler.

SONUÇ

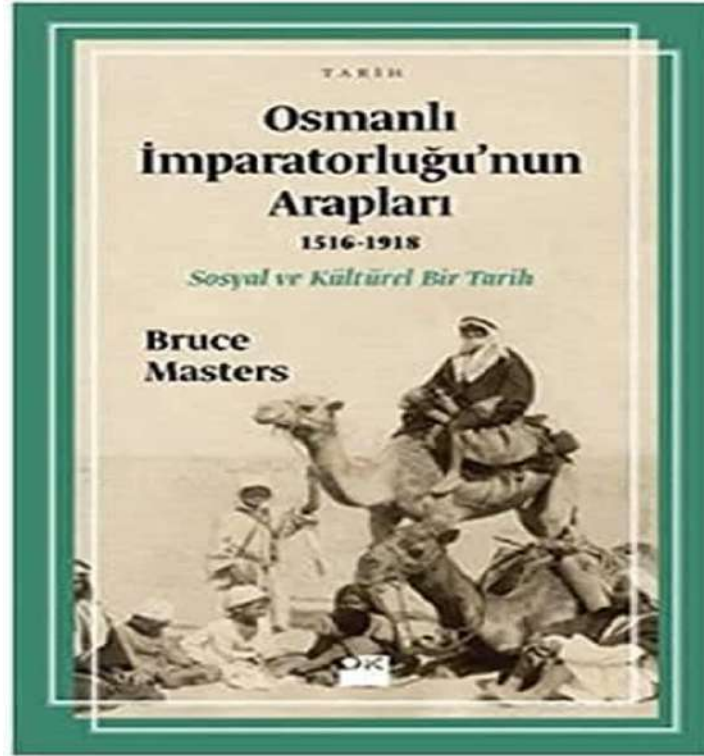
Bu kitap okunduğunda Arapların gönüllü olarak Osmanlıyla birlikte olduğunu anlamaktayız. Fransız ihtilali ile gelişen milliyetçilik yüzünden imparatorluklar dağılmıştır. Osmanlı da gelişen ulusal milliyetçilik yüzünden dağılmış ve Osmanlının hükmettiği alanda bugün 45 ayrı devletin olduğunu görmekteyiz. Bu da Osmanlı imparatorluğunun 24 milyon metrekaarelik bir alana hükmettiğinin göstergesidir. Osmanlı dağılmaya yüz tuttuğu için Osmanlıdan 22 Arap devleti ayrılmış ve yeni devletler olarak ortaya çıkmışlardır. Tabiki gelişen milliyetçilik karşısında bu devletler Osmanlıyı sömürgeci olarak ele almışlardır. Bu kitap Arapların Sünnilik temelinde gönüllü olarak Osmanlı ile birlikteliğini ortaya koymasından önemli bir kitaptır.

KAYNAKÇA

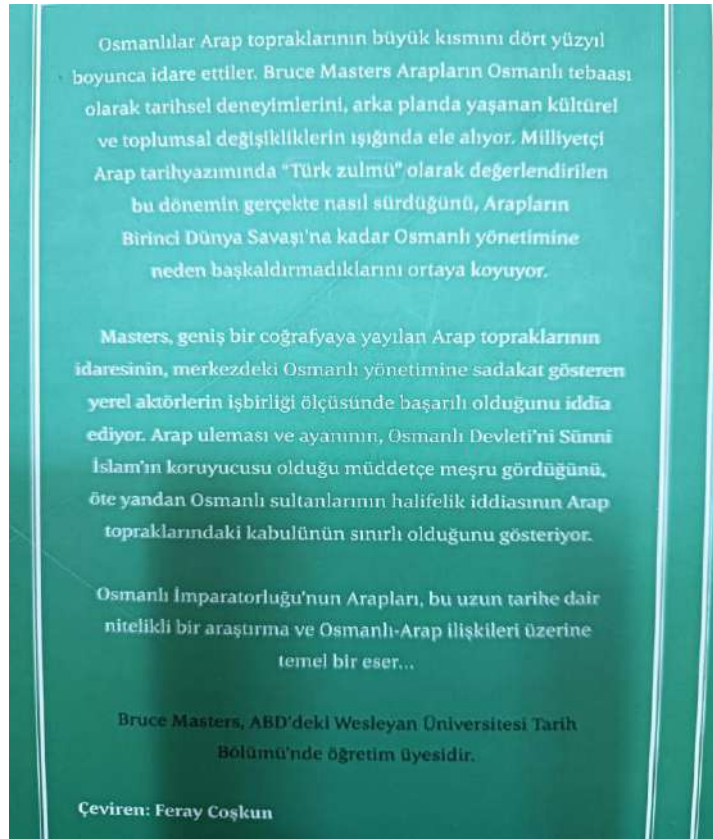
Masters, Alan Bruce (2017). Osmanlı İmparatorluğu'nun Arapları (1516-1918) Sosyal ve Kültürel Bir Tarih. 1. baskı. İstanbul: Doğan Kitap.

Ekler:

Ek1: Kitabın Ön kapağı



Ek2: Kitabın Arka kapağı



**SÜRDÜRÜLEBİLİRLİK HEDEFİ DOĞRULTUSUNDA YÜN ELYAFINDA GERİ
DÖNÜŞÜM ÇALIŞMALARINA GENEL BAKIŞ
AN OVERVIEW OF RECYCLING STUDIES IN WOOL FIBER IN LINE WITH THE
SUSTAINABILITY GOAL**

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ÖZET

Giyim dünya çapında sık sık değişen moda trendlerine ve tarzlarına maruz kalmaktadır. Giyimdeki hızlı değişim tekstil endüstrisinin büyümesine neden olsa da bunun olumsuz tarafı önemli miktarda tekstil atığı üretmesidir. Atıkların çöp depolama alanlarından uzaklaştırılması için dünya çapında çeşitli tekstil atık yönetimi faaliyetleri uygulanmaktadır. Yeniden kullanım, yakma ve geri dönüşüm başlıca tekstil atık yönetimi teknikleridir. Diğer güncel atık yönetimi teknolojileri arasında piroliz ve tekstillerin ömrünü uzatmak, daha az satın almak ve geri dönüştürülebilir tekstil üretimi gibi kaynak yönetimi yöntemleri yer almaktadır (Baloyi ve ark., 2024). Temel olarak, geri dönüşüm süreci, yeni giysiler ve diğer endüstriyel ürünlerin üretimi için düşük maliyetli bir lif kaynağı sağlar. Uygulamada, tekstillerin geri dönüşümü ve yeniden kullanımı, tüketicilerin eski giysileri belediye atık toplama yoluyla imha etmek yerine giyim bankaları, kapı eşiği toplamaları veya mağazalardaki iade kutuları gibi geri dönüşüm toplama yolları aracılığıyla bağışlamalarına dayanmaktadır (Wiedemann ve ark., 2022). Tekstil atıklarının kullanımının veya geri dönüştürülmesinin azaltılması çevreye fayda sağlayacak ve elyaf üretiminde kullanılan yenilenemeyen fosillere olan bağımlılığı azaltacaktır (Baloyi ve ark., 2024). Atık yün, termal ve ses yalıtım malzemeleri, kompozit malzemeler ve kirlenmiş suyu arıtmak için adsorban malzemeler olarak kullanılabilir. Ayrıca, keratin özütlenerek yüksek değerli ürünlerin üretiminde de kullanılabilir. Geri dönüşümün mevcut oranları göz önüne alındığında, atık yün kaynaklarının etkin yönetimi için sürekli araştırma ve geliştirme çalışmaları gerekmektedir. Atık yün tekstillerinin yenilikçi ve yüksek verimli geri dönüşüm yöntemleri geliştirilmesi, kaynak israfını önlemek ve çevresel kirliliği azaltmak açısından büyük önem taşımaktadır (Sun ve ark., 2022). Bu çalışmada yün elyafının geri dönüşümüne ve geri dönüşüm yünün kullanımına ilişkin bazı araştırmalar özetlenmektedir.

Anahtar kelimeler: Yün, geri dönüşüm, yeniden kullanım, yakma

ABSTRACT

Clothing is subject to frequently changing fashion trends and styles around the world. Although the rapid change in clothing causes the textile industry to grow, the downside of this is that it produces a significant amount of textile waste. Various textile waste management activities are implemented worldwide to divert waste from landfills. Reuse, incineration and recycling are the main textile waste management techniques. Other current waste management technologies include resource management methods such as pyrolysis and extending the life of textiles, purchasing less, and producing recyclable textiles (Baloyi et al., 2024). Essentially, the recycling process provides a low-cost source of fiber for the production of new clothing and other industrial products. In practice, recycling and reuse of textiles relies on consumers donating old clothing through recycling collection routes such as clothing banks, doorstep

collections or return bins in stores, rather than disposing of them through municipal waste collection (Wiedemann et al., 2022). Reducing the use or recycling of textile waste will benefit the environment and reduce dependence on non-renewable fossils used in fiber production (Baloyi et al., 2024). Waste wool can be used as thermal and sound insulation materials, composite materials, and adsorbent materials to purify contaminated water. Additionally, keratin can be extracted and used in the production of high-value products. Considering the current rates of recycling, continuous research and development is required for the effective management of waste wool resources. Developing innovative and highly efficient recycling methods of waste wool textiles is of great importance in preventing resource waste and reducing environmental pollution (Sun et al., 2022). This study summarizes some research on the recycling of wool fiber and the use of recycled wool.

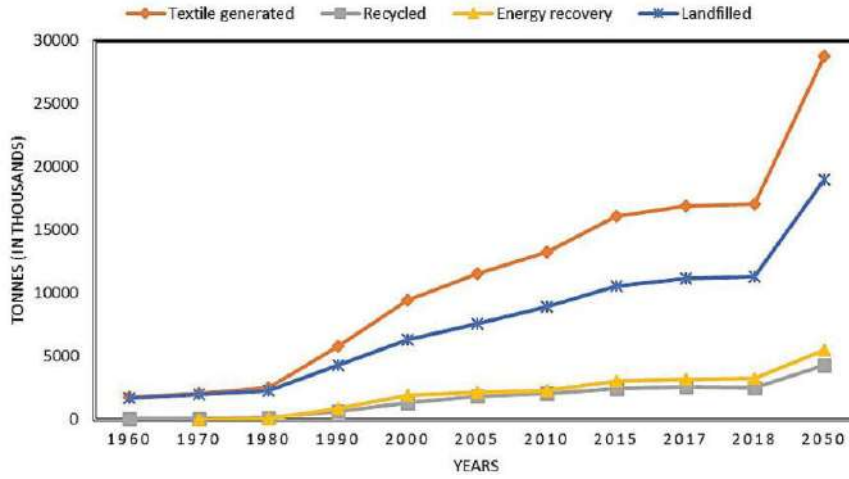
Key words: Wool, recycling, reuse, incineration

GİRİŞ

Dünya kumaş üretimi son yıllarda sürekli olarak artmıştır. Giyim dünya çapında sık sık değişen moda trendlerine ve tarzlarına maruz kalmaktadır. Giyimdeki hızlı değişim tekstil endüstrisinin büyümesine neden olsa da bunun olumsuz tarafı önemli miktarda tekstil atığı üretmesidir. Atık tekstillerin bertarafı, sürekli depolama için yer bulunmaması, çevresel riskler ve atık depolama alanlarında atık bertarafıyla ilgili maliyetler nedeniyle artık istenmeyen ve maliyetli hale gelmiştir. Dolayısıyla tekstil atıklarının kullanımının veya geri dönüştürülmesinin azaltılması çevreye fayda sağlayacak ve elyaf üretiminde kullanılan yenilenemeyen fosillere olan bağımlılığı azaltacaktır. Hızlı moda endüstrisi yıllık 92 milyon ton tekstil atığı üretmektedir. Tekstil üretiminde kullanılan kimyasallar ve su tüketimi de önemli çevresel sorunlara yol açmaktadır. Örneğin, tekstil endüstrisi yıllık 93 milyar metreküp su tüketmekte olup dünya genelinde endüstriyel su kirliliğinin %20'sinden sorumludur (Baloyi ve ark., 2024).

Tekstil atıkları, atık üretimini azaltacak veya döngüyü kapatarak atıkları yeni ürünlere dönüştürecek pratik ve ekonomik çözümler bulunmadığı takdirde büyümeye devam edecek ciddi bir çevre sorunudur. Tekstil üretim süreçleri yüksek miktarda su, enerji ve kimyasal gerektirir. Küresel olarak, tekstil liflerinin %64'ü petrokimyasallardan elde edilmektedir. Geri kalan %36'sını pamuk (%24), işlenmiş rejenere selüloz (%6), yün (%1) ve diğer doğal lifler oluşturmaktadır. Seri üretim, çeşitlilik, çeviklik ve satın alınabilirlik ile karakterize edilen mevcut hızlı moda iş modeliyle moda endüstrisi, atık hacimlerine ve bu atıkların üretilme oranına büyük ölçüde katkıda bulunmuştur. Hızlı moda her yıl 80 milyar yeni giysiye talep yaratıyor, ancak giysiler genellikle doğrusal bir yaşam döngüsü izliyor. Bu yaşam döngüsünde giysiler, kullanımdan sonra yeniden kullanılmak veya geri dönüştürülmek yerine çöp sahasına atılıyor. Bu “beşikten mezara” yaşam döngüsü, tekstil üretimiyle ilgili önemli kaynakların israf edilmesi anlamına geliyor. Bunun tersine döngüsel ekonomi modeli, ürünlerin yeniden kullanılması, onarılması, yeniden üretilmesi ve geri dönüştürülmesi gibi stratejiler yoluyla kaynakların mümkün olduğu kadar uzun süre kullanımda tutulması anlamına gelmektedir (Navone ve ark., 2020).

Çevre Koruma Ajansı verilerine göre ABD, 2018 yılında 11,3 milyon ton tekstilin çöplüklere atıldığını kaydetti ve bu rakam o yılki toplam belediye katı atık üretiminin %7,7'sini oluşturdu. Üretilen, geri dönüştürülen, enerji geri kazanımıyla yakılan ve çöp depolama alanlarına atılan toplam ton tekstil miktarına ilişkin 1960'tan 2050'ye kadar olan projeksiyona ilişkin veriler Şekil 1'de gösterilmektedir. Şekil 1'den yıllar içinde üretilen tekstillerin çöplüklerde son bulunduğu açıkça görülmektedir. Tekstil atıklarının geri dönüştürülmesi 1980'lerden beri rapor edilmektedir. Ancak geri dönüşümde 2000 yılından bu yana önemli bir ilerleme kaydedilmedi. Tekstil üretimi 1980 yılından bu yana %80'in üzerinde bir büyüme göstererek hızla arttı, ancak üretilen atıkların geri dönüşümü aynı oranda artmadı (Baloyi ve ark., 2024).



Şekil 2. ABD’de üretilen tekstil ürünleri ve üretilen atık akışlarına ilişkin veriler (Baloyi ve ark., 2024)

2. ATIK YÖNETİMİ

Atıkların çöp depolama alanlarından uzaklaştırılması için dünya çapında çeşitli tekstil atık yönetimi faaliyetleri uygulanmaktadır. Yeniden kullanım, yakma ve geri dönüşüm başlıca tekstil atık yönetimi teknikleridir. Diğer güncel atık yönetimi teknolojileri arasında piroliz ve tekstillerin ömrünü uzatmak, daha az satın almak ve geri dönüştürülebilir tekstil üretimi gibi kaynak yönetimi yöntemleri yer almaktadır (Baloyi ve ark., 2024).

2.1 Yeniden kullanım (Reuse)

Tekstilin yeniden kullanımı, tekstil ürünlerinin yararlı hizmetini ilk sahibinden diğerine uzatmak için çeşitli araçlara odaklanan bir atık yönetimi tekniğidir. Sonuç olarak bu, tekstilin ömrünü uzatır ve su, kimyasal madde, kaynak ve atık yolları azalır (Baloyi ve ark., 2024). Temel olarak, geri dönüşüm süreci, yeni giysiler ve diğer endüstriyel ürünlerin üretimi için düşük maliyetli bir lif kaynağı sağlar. Uygulamada, tekstillerin geri dönüşümü ve yeniden kullanımı, tüketicilerin eski giysileri belediye atık toplama yoluyla imha etmek yerine giyim bankaları, kapı eşiği toplamaları veya mağazalardaki iade kutuları gibi geri dönüşüm toplama yolları aracılığıyla bağışlamalarına dayanmaktadır (Wiedemann ve ark., 2022).

2.2 Yakma

Enerji geri kazanımlı/geri kazanımsız yakma, hâkim tekstil atık arıtma yöntemidir. Ryu ve arkadaşlarına göre, 1 ton ev tekstili atığının yakılmasıyla 15.800 MJ enerji geri kazanılabiliyor ve 27 kg kül üretilebiliyor. Tekstil malzemesi/lifleri içeren atıkların yakılması normalde 4-5 saatlik bir süre boyunca 500 °C ile 800 °C arasında değişen sıcaklıklarda kül külü veya elektrikli yakma fırınında gerçekleştirilir. Ancak tekstillerin yakılması tartışmalı bir atık arıtma yöntemi olarak kabul edilir. Bunun nedeni, harmanlanmış tekstil atıklarının oluşturduğu tutuşma oranının ve sıcaklık profiline düzensiz davranışdır. Ayrıca tekstil atıkları, yakılma sırasında havaya zehirli sera gazları yayar ve kül biriktirir (Baloyi ve ark., 2024).

2.3 Geri dönüşüm (Recycle)

Tekstil malzemelerinin geri dönüşümü açık ve kapalı döngülerde uygulanmaktadır. Ancak yüksek fiyatlar, hacim ve hammadde bulunabilirliği gibi faktörler ekonomik açıdan uygun operasyonlar kurma yeteneğini sınırladı. Benzer şekilde, moda endüstrisinde açık döngü geri dönüşümün mümkün olduğu kanıtlandı. Açık döngü geri dönüşüm, tekstil atıklarının farklı ürünlere/uygulamalara kanalize edilebilirken kapalı döngü geri dönüşümde atık ürünler, orijinal ürünle aynı türde ürün üretmek üzere geri dönüştürülür. Çoğu tekstil atıklarında, lif türleri ve renklerinin çeşitliliği, çekici olmayan ve iplik olarak yeniden eğilmeye uygun olmayan kalitesiz liflerle sonuçlanır. Bu nedenle, geri dönüştürülmüş tekstiller yalnızca halı altlığı veya

yalıtım astarı gibi daha az değerli ürünler için hammadde olarak uygundur. Son zamanlarda yapılan arařtırmalar, rejenere lifler, kompozitler, mikrokristalin selüloz ve sentetik elyaf rejenerasyonu için hammaddeler gibi daha yüksek değerli ürünler üretmek için tüketici sonrası atıkların kullanılmasına odaklanmıştır (Baloyi ve ark., 2024).

Eđer giysiler yeniden kullanım için satılmaya uygun deęilse, mekanik çekme yeni tekstil yapımına uygun gevşek lifli bir malzemenin üretilmesini sağlamadan önce çeşitli geri dönüşüm derecelerine göre sınıflandırılır. Bu süreçte, geri dönüřtürülmüş yün elyafı işlenmemiş yün veya diđer liflerle harmanlanır (işleme verimliliğine yardımcı olmak ve nihai ürünün gerekli performans özelliklerini karşılamak için) ve giyim üretimine uygun yeni kumaşlar halinde dokunmadan veya örülmeden önce iplik haline getirilir. Geleneksel olarak paltolar, askeri üniformalar ve ceketler gibi giysiler bu şekilde yapılmıştır ve son zamanlarda kazaklar da dahil olmak üzere bir dizi tüketici giysisi de geri dönüřtürülmüş elyaftan yapılmıştır. Alternatif olarak, kullanılmış yün için en büyük pazar haline gelen bölgede, yün elyafının geri dönüşümü geleneksel eğirme, örme ve dokuma işlemlerini atlıyor ve elyafın akustik ve aleve dayanıklılık özellikleri nedeniyle iç yatak bileşenleri ve otomotiv yalıtımı gibi endüstriyel ürünler için çeşitli dokusuz yüzey kumaşların yapımında kullanılıyor. Hem önceki (kapalı döngü) hem de sonraki (açık döngü) geri dönüşüm sistemlerinde, kullanılmış yün giysiler, kullanım ömrünün sonunda imha edilmekten (yani çöp depolama veya yakma) hizmet ömrü genellikle uzun yıllara uzanan yeni ticari ürünlere yönlendirilir. Bu döngülerin, orijinal malzemeden daha düşük veya daha yüksek kalitede ve işlevsellikte geri dönüşüm ürettięi durumlarda, geri dönüşüm işlemi sırasıyla ařaęı dönüşüm veya ileri dönüşüm olarak adlandırılabilir. İkincisi, ařaęı dönüşümün en aza indirilmesinin ve kapalı döngü geri dönüşümün maksimuma çıkarılmasının, kısmen mekanik geri dönüşüm işlemi sırasında elyaf uzunluğunun maksimuma çıkarılmasına baęlı olduęu yün liflerinde uygulanamaz (Wiedemann ve ark., 2022).

Mekanik geri dönüşüm yaygın olmakla birlikte genellikle düşük kaliteli ürünler üretmekte ve karışım kumaşlar için uygun olmamaktadır. Kimyasal geri dönüşüm ise selülozik tekstillerin ve poliesterin kapalı döngüde geri dönüşümü için umut vaat etmektedir, ancak henüz geniş çapta uygulanmamaktadır. Biyolojik geri dönüşüm, daha çok süksinik asit ve etanol gibi açık döngü işlemlerinde kullanılmakta, tekstilden tekstile geri dönüşümde henüz yaygın olarak uygulanmamaktadır (Baloyi ve ark., 2022).

Bhatia ve ark. (2014), geri dönüřtürülmüş tekstil liflerinin türleri ve geri dönüşüm süreçlerini ele alarak tekstil endüstrisindeki atıkların yönetimini incelemiştir. Tekstil üretim süreçlerinden kaynaklanan atıklar üç ana kategoriye ayrılmaktadır: temizlenmesi gereken atıklar, temiz atıklar ve özel makinelerle işlenmesi gereken sert atıklar. Örneęin, ABD’de Patagonia řirketi Polartec poliester kumaşlardan yapılan giysileri geri dönüřtürmekte, Türkiye’de ise geri dönüřtürülmüş polipropilen, ipek ve pamuk atıkları ile güçlendirilmektedir. Çalışma, geri kazanılmış liflerin %15 ila %25’inin pamukla karıştırılmasının, iplięin mukavemetini ve düzgünsüzlüğünü önemli ölçüde etkilemedięini göstermiştir. Geri dönüşüm süreçleri, yeni hammaddelerin kullanımını azaltarak çevresel etkileri en aza indirir ve geri dönüřtürülmüş liflerin enerji gereksinimi diđer geri dönüşüm türlerinden daha düşüktür.

3. YÜN ELYAFININ GERİ DÖNÜŐÜMÜNE İLİŐKİN ÇALIŐMALAR

Yün son derece dayanıklı bir hayvansal liftir, dolayısıyla yünden yapılan giysiler genellikle uzun ömürlüdür. Yün aynı zamanda yüksek oranda ve kolaylıkla geri dönüřtürülebilir. Ortaya çıkan “yeni” elyaf, lüks kumaşlar oluşturmak için yeniden kullanılabilir, böylece giysilerin ömrü uzatılır, işlenmemiş malzemelerin kullanımından kaçınılır ve çevresel yükün azaltılmasına yardımcı olur (manteco.com, 2024). Yıllık yaklaşık 100 milyon ton atık tekstil üretilmekte olup bu atıkların %95’inin geri dönüřtürülebilir olmasına rağmen, geri dönüşüm oranları oldukça düşüktür. Örneęin, Çin’de yıllık tekstil atıkları 40 milyon ton civarındayken, geri dönüşüm oranı %10’dan azdır. Avrupa ve Amerika’da bu oran %20’dir (Sun ve ark., 2022).

Yün elyaf üretimi yılda bir milyon metrik tonu aşmakta olup, sürdürülebilir bertaraf gerekliliğini gündeme getirmektedir. Geri dönüşüm, yün malzemelerinin çevresel etkisini azaltmak için etkili bir yöntemdir ve 2019 itibarıyla dünya genelinde yaklaşık 70.000 metrik ton yün geri dönüştürülmektedir. İtalya, Hindistan ve Çin, geri dönüştürülmüş yün üretiminin yoğunlaştığı ülkelerdir. Bu süreç 1813 yılında İngiltere’de başlamış ve daha sonra İtalya ve Hindistan’da büyük ölçekte uygulanmıştır. Geri dönüştürülmüş yün, nonwoven malzemeler, kompozitler ve giyim sektörlerinde geniş kullanım alanı bulmuştur. Araştırmalar, geri dönüştürülmüş yün elyafı, iplik ve kumaşların özelliklerini ve uygulama alanlarını incelemektedir. Ayrıca, nonwoven ve kompozit malzemeler geri dönüştürülmüş yünden üretilmekte ve yünün yan ürünleri tekstil dışı uygulamalarda değerlendirilmektedir. Geri dönüşüm standartları, yünün sürdürülebilir şekilde kullanılmasını hedeflemekte ve kimyasal ve sosyal gereksinimler ile geri dönüştürülen malzemenin kökeninin korunmasını içermektedir. Geri dönüştürülmüş yünün üretiminde sürdürülebilirlik ve çevresel ayak izi üzerine çalışmalar yapılmış, önde gelen markalar geri dönüştürülmüş yün kullanarak daha sorumlu ve çevre dostu olmayı taahhüt etmiştir. Gelecekteki kullanım alanları arasında, daha fazla değer katma, yeni uygulama alanlarının belirlenmesi, standartların geliştirilmesi, tüketici farkındalığının artırılması ve hükümet müdahalesi yer almaktadır (Wiedemann ve ark., 2022).

Yün geri dönüşümü için en bilinen merkezlerden biri, Avrupa’nın en büyük tekstil bölgesinin aynı zamanda kimyasal madde içermeyen ve boya içermeyen bu döngüsel ekonomi uygulamasında uzmanlaştığı İtalya’nın Prato kentidir. Bu tür geri dönüşüm 19. yüzyıldan beri endüstriyel ölçekte gerçekleştirilmektedir. Manteco firması tarafından yüne uygulanan geri dönüşüm sürecinin aşamaları aşağıda özetlenmektedir (manteco.com, 2024).

1) Giysilerin kalite kontrolü: Yünlü giysilerin döngüsel ekonomisi başlamadan önce, bunların artık kullanılamaz durumda olup olmadıklarının ya da yaşamlarını sürdürüp vintage ya da ikinci el giysi olarak satılıp satılamayacaklarının belirlenmesi için temel bir aşama gerçekleşmektedir. Kontrol edilen giyside kusur varsa ayıklama aşamasına geçilir, burada benzer renk ve bileşimdeki giysilerle birleştirilir, ardından geri dönüştürülerek geri dönüştürülmüş yünlü malzemelerin üretiminde kullanılır. Kontrol edilen giysinin herhangi bir kusuru yoksa ikinci el veya vintage giysi olarak tekrar piyasaya sürülür ve böylece daha uzun ömürlü olması sağlanır (manteco.com, 2024).

2) Giysileri ve artıkları renk ve bileşime göre ayırma: Bu aşamada giysiler renk ve kompozisyona göre ayrılır (manteco.com, 2024).

3) Giysilerin geri dönüştürülemeyen unsurlardan temizlenmesi: Bu aşamada giysiler, “yeni” geri dönüştürülmüş lifleri kirletebilecek geri dönüştürülemeyen unsurlardan ve parçalardan (elastan içeren parçalar, marka etiketleri ve bakım etiketleri, fermuarlar düğmeler, astarlar, nakışlar, dikişler) manuel olarak temizlenir (manteco.com, 2024).

4) Geri dönüştürülmüş yün liflerine dönüştürmek için giysilerin parçalanması: Eski giysiler, kumaşları daha da ince kesmek için önce bir dizi bıçak veya giyotin, ardından iki silindir (biri kavrama, diğeri çekme) yoluyla bir taşıma bandı üzerinde taşınır (manteco.com, 2024).

5) Farklı tonlardaki lifleri boya ve kimyasal madde kullanmadan karıştırarak renk yaratımı: Hammadde zanaatkarları, yalnızca farklı elyafları ve renk tonlarını belirli yüzdelerde karıştırarak, zaman içinde arşivlenen ve çoğaltılan gerçek “tarifler” geliştirerek yeni yün renkleri tasarlamaktadır (manteco.com, 2024). Manteco’da, Recype® proses sayesinde, kaynakları koruyarak ve emisyonları azaltarak 1000’den fazla geri dönüştürülmüş yün rengi üretilbildiği söylenmektedir. Her yıl olduğu gibi ortalama olarak renklerin kimyasal boyamayla yapılmış olması durumuna göre 19.000 kg boyarmadde, 11.000 kg kimyasal yardımcı madde, 722.127 kg CO₂-eşd. emisyon, 10.641.878 MJ enerji, 122.707.000 litre su tasarrufu sağlandığı belirtilmektedir (manteco.com/how-are-recycled-wool-colors-created-without-dyeing/, 2024).



Şekil 2: Çeşitli renklerdeki yün geri dönüşüm kumaşlar (<https://manteco.com/how-are-recycled-wool-colors-created-without-dyeing/>, 2024)

6) Geri dönüştürülmüş yün iplikleri oluşturmak için eğirme: Doğru renk tarifi elde edildikten ve üretilecek iplik kg'ları ile çarpıldıktan sonra, büyük balyalar halinde geri dönüştürülmüş yün elyafı iplikhaneye gönderilir (manteco.com, 2024).

7) Kumaşın çözgüsünü oluşturmak için geri dönüştürülmüş yün ipliklerden çözgü hazırlama işlemi: Bu, gerçek geri dönüştürülmüş yün kumaşı yaratmadan önceki çok önemli aşamadır (manteco.com, 2024).

8) gerçek geri dönüştürülmüş yün kumaşı oluşturmak için iplikleri dokumak: Çözgü aşamasından elde edilen büyük iplik levendleri, gerçek geri dönüştürülmüş yün kumaşın hayat bulduğu dokuma fabrikasına gönderilir (manteco.com, 2024).

9) Geri dönüştürülmüş yün kumaşa özel bir görünüm kazandırmak için bitim işlemleri: Yeni doğan geri dönüştürülmüş yün kumaş, markaların talep ettiği veya tekstil fabrikasının seçtiği nihai görünüme bağlı olarak bir dizi yaş, fiziksel işlemlerden geçer. Geri dönüştürülmüş yünlü kumaşın son görünümü seçilen yapı ve dokumaya (tek renk veya desenli olması) ve hangi bitim işlemleri gördüğüne vb. birçok faktöre bağlı olarak çok fazla değişiklik gösterebilir (manteco.com, 2024).

Atık yün, termal ve ses yalıtım malzemeleri, kompozit malzemeler ve kirlenmiş suyu arıtmak için adsorban malzemeler olarak kullanılabilir. Ayrıca, keratin özütlenerek yüksek değerli ürünlerin üretiminde de kullanılabilir. Geri dönüşümün mevcut oranları göz önüne alındığında, atık yün kaynaklarının etkin yönetimi için sürekli araştırma ve geliştirme çalışmaları gerekmektedir. Atık yün tekstillerinin yenilikçi ve yüksek verimli geri dönüşüm yöntemleri geliştirilmesi, kaynak israfını önlemek ve çevresel kirliliği azaltmak açısından büyük önem taşımaktadır (Sun ve ark., 2022). Aşağıda yün elyafının geri dönüşümüne ve geri dönüşüm yününün kullanımına ilişkin bazı çalışmalar özetlenmektedir.

Radetic ve ark. (2009), tekstil boyahanelerinde kullanılan farklı boyaların giderilmesi için geri dönüştürülmüş yün bazlı dokusuz yüzey malzemenin (RWNM) potansiyel uygulamasını araştırmıştır. Araştırma, sorpsiyon kinetiği, başlangıç boya konsantrasyonu, pH ve sıcaklığın etkilerini analiz etmiştir. Bazik, reaktif, direkt ve metal kompleks boyalar incelenmiştir. Çalışmada, RWNM'nin sorpsiyon özelliklerinin, boyaların kimyasal yapılarındaki farklılıklardan ve dolayısıyla yüne bağlanma mekanizmalarından dolayı büyük ölçüde etkilendiği bulunmuştur. Bulgular, RWNM'nin düşük maliyetli ve etkili bir adsorban olarak kullanılabileceğini göstermektedir. Yüksek başlangıç boya konsantrasyonları, sıcaklık artışı ve düşük pH değerleri, RWNM'nin boyaları daha etkili bir şekilde adsorbe etmesine yardımcı olmuştur. Örneğin, Lanaset Yellow 4GN (Reactive Yellow 39) boyasının başlangıç konsantrasyonu 50 mg/L'den 500 mg/L'ye artırıldığında, RWNM'nin sorpsiyon kapasitesi 5 mg/g'ye kadar yükselmiştir. Sonuçlar, RWNM, tekstil endüstrisinin atık su yönetimi sorunlarını çözmede ekonomik ve çevresel açıdan sürdürülebilir bir seçenek olarak değerlendirilebileceğini göstermektedir.

Navone ve ark. (2020) tarafından yapılan çalışmada, yün/poliester karışım kumaşlardan yün liflerinin seçici olarak parçalanmasını sağlayan enzimatik bir yöntemi ele alınmıştır. Frost Textiles tarafından sağlanan %100 yün, %100 poliester ve karışım kumaş örnekleri üzerinde

yapılan çalışmada, Ronozyme ProAct proteazı kullanılarak enzimatik işlem gerçekleştirilmiştir. Bu yöntemle, yün lifleri tamamen parçalanmış ve poliester lifleri geri kazanılmıştır. Keratinaz aktivitesi belirleme, taramalı elektron mikroskobu (SEM), infra-red (IR) spektroskopisi ve nano-indentation gibi çeşitli testler uygulanmıştır. Keratinolitik aktivite, keratin azure kullanılarak ölçülmüş ve enzimatik muamele sonrası çözünen peptidler ile kumaşın ağırlık kaybı belirlenmiştir. SEM görüntüleri, muamele öncesi ve sonrası kumaş örneklerinin yapısal değişimlerini göstermiştir. IR spektroskopisi analizleri, enzimatik işlem öncesi ve sonrası kumaş örneklerinin kimyasal bileşimlerini değerlendirmiş ve polyester liflerinin kimyasal yapısında önemli bir değişiklik olmadığını ortaya koymuştur. Nano-indentation testi ise, enzimatik işlem sonrası polyester liflerinin mekanik özelliklerinin bakir örneklerle karşılaştırıldığında anlamlı bir değişiklik göstermediğini ortaya koymuştur. Çeşitli enzim konsantrasyonları ve indirgeme ajanları kullanılarak elde edilen ağırlık kaybı sonuçları grafiklerle sunulmuş, SEM ve IR analizleri ile desteklenmiştir. Bu bulgular, enzimatik yöntemin tekstil atıklarının çevresel etkilerini azaltmada ve döngüsel ekonomi modelini desteklemede büyük bir potansiyele sahip olduğunu göstermektedir. Enzimatik degradasyonun verimliliği, yün/poliester karışımı kumaşların geri dönüşümü için umut vaat eden bir çözüm sunmakta ve sürdürülebilir tekstil üretimine katkıda bulunmaktadır.

Bianco ve ark. (2022), İtalyan Manteco SpA şirketi tarafından üretilen geri dönüştürülmüş yün liflerinin (MWool®) çevresel etkilerini araştırmışlardır. Analiz, geri dönüştürülmüş yün liflerinin çevresel etkilerini, öncelikle MWool® için birincil veri ve doğal yün için literatür verileri kullanarak, doğal yün lifleri ile karşılaştırmak için yaşam döngüsü analizi (Life Cycle Assessment: LCA) metodolojisini kullanmaktadır. Sonuçlar, en elverişsiz senaryolarda bile MWool®'un çevresel etkilerinin doğal yünden önemli ölçüde daha düşük olduğunu göstermektedir. Örneğin, 1 kg MWool®'un karbon ayak izi 0,1–0,9 kg CO₂ eşdeğeridir, oysa aynı miktarda doğal yün üretmek 10–103 kg CO₂ eşdeğeri salmaktadır. Bu azalma, doğal yün üretimi ile ilişkili yoğun çiftlik uygulamalarını ve metan emisyonlarını önleyen verimli geri dönüşüm sürecine atfedilmektedir. Geri dönüştürülmüş tekstillerin kökeni ve işlenmesi ile ilgili belirsizlikleri yakalamak için duyarlılık analizleri yapılmıştır. Geri dönüştürülmüş liflerde kalite kaybını hesaba katmak için Döngüsel Ayak İzi Formülü (CFF) uygulanmış ve MWool®'un doğal yünün çevresel etkilerinin yaklaşık %60'ını tasarruf edebileceği ortaya çıkmıştır. Bu çalışma, tekstil sektöründeki LCA'larda veri boşluklarını ele almakta ve geri dönüştürülmüş yün liflerinin faydalarını vurgulayarak, AB'nin döngüsel ekonomi eylem planını desteklemekte ve sürdürülebilir tekstil üretim uygulamalarına katkıda bulunmaktadır. Çalışma, çok çıkışlı sistemlerde tahsis prosedürleri ve geri dönüştürülmüş liflerin kalite oranı gibi metodolojik yönlerin dikkate alınmasının, doğru ve karşılaştırılabilir LCA sonuçları sağlamak için önemini vurgulamaktadır.

Wiedemann ve ark. (2022), tarafından gerçekleştirilen kapsamlı bir yaşam döngüsü değerlendirmesi (LCA), geri dönüştürülmüş yün karışımı bir süveterin çevresel etkilerini saf yünden yapılmış bir süveterle karşılaştırmıştır. Bu çalışma, doğumdan ölüme kadar olan süreçleri analiz ederek iklim değişikliği, fosil enerji talebi, su stresi ve tatlı su tüketimi gibi alanlara odaklanmıştır. Geri dönüştürülmüş yün karışımı süveterin çevresel etkileri, iklim değişikliğine 0.05 kg CO₂-e, fosil enerji talebine 0.63 MJ, su stresi üzerine 0.58 L H₂O-e ve tatlı su tüketimine 0.95 L katkıda bulunarak, sürdürülebilirlik açısından önemli faydalar sağlamaktadır. Buna karşılık, virjin yün süveter için bu değerler sırasıyla 0,36 kg CO₂-e, 5,55 MJ, 0,76 L H₂O-e ve 12,4 L'dir. Geri dönüştürülmüş yün karışımı süveter, çevresel etkiler açısından virjin yün süveterine göre çok daha düşük değerlere sahiptir. Sözü edilen çevresel etkiler, ağırlıklı olarak giysi üretimi ve perakende satış ile giysi bakımını içeren tüketici uygulamalarından kaynaklanmaktadır. Yapılan çalışmada, kapalı döngü geri dönüşüm yoluyla önemli çevresel faydalar elde etme potansiyeli vurgulanmaktadır. Özellikle, en iyi uygulama giysi bakımıyla birlikte geri dönüştürülmüş yün karışımı bir süveterin kullanılması, saf yün

olmadığı ve hemokompatibilite gösterdiği belirlenmiş, bu da onları kanla temas eden uygulamalar için uygun hale getirmiştir. Çalışmada, plakaların çaplarının 1 ila 6 µm arasında olduğu ve SBS süreci kullanılarak üretilbileceği bulunmuştur; bu, tıbbi kullanım için in-situ birikim plakaları oluşturmak için değerli bir platform sunmaktadır.

SONUÇ

Özellikle son yıllarda giyim endüstrisi hızlı bir gelişim ve değişim süreci içerisinde. Bu durum dünyada her yıl önemli miktarda tekstil atığı oluşmasına yol açmaktadır. Yeniden kullanım, yakma ve geri dönüşüm en temel tekstil atık yönetimi teknikleri olsa da özellikle tekstil malzemelerinin daha uzun ömürlü olmalarını sağlamak, daha az satın almak ve geri dönüştürülebilir tekstil üretimi gibi yaklaşımlar da son yıllarda önem kazanmaktadır. Yün geri dönüşümü için dünyada bazı merkezler oluşmuş durumdadır, bunlardan biri de İtalya'nın Prato kentidir. Kaynakların azaldığı günümüz koşullarında yakın gelecekte geri dönüşümün öneminin daha fazla artacağı ve bu tip örnek uygulamaların daha da yaygınlaşacağı düşünülmektedir.

KAYNAKÇA

- Anselmi, S., Provenza, F., Bentivoglio, T., Picerno, G., Cavallo, A., Renzi, M. (2023). Marine Biodegradability and Ecotoxicity of MWool® RecycledWool Fibers: A Circular-Economy-Based Material. *Oceans*, 4, 114-131.
- Baloyi, R.B., Gbadeyan, O.J., Sithole, B., Chuniilall, V. (2024). Recent advances in recycling technologies for waste textile fabrics: a review, *Textile Research Journal*. 94(3-4), 508-529.
- Bhatia, D., Sharma, A., Malhotra, U. (2014). Recycled fibers: An overview, *International Journal of Fiber and Textile Research*, 4(4), 77-82.
- Bianco, I., Gerboni, R., Picerno, G., Blengini, G.A. (2022). Life Cycle Assessment (LCA) of MWool® RecycledWool Fibers. *Resources*, 11, 41.
- Furferi, R., Servi, M. (2023). A Machine Vision-Based Algorithm for Color Classification of Recycled Wool Fabrics. *Appl. Sci.* 13, 2464.
- Maurizii, G., Valentini, L., Sotgiu, G., Zamboni, R., Tonetti, C., Vineis, C., Canonico, B., Montanari, M., Tiboni, M., Casettari, L., Aluigi, A. (2024). The dark side of the wool? From wool wastes to keratin microfilaments through the solution blow spinning process, *International Journal of Biological Macromolecules*. 275, 133722.
- Navone, L., Moffitt, K., Hansen, K.-A., Blinco, J., Payne, A., & Speight, R. (2020). Closing the textile loop: Enzymatic fibre separation and recycling of wool/polyester fabric blends. *Waste Management*, 102, 149-160.
- Radetic, M., Radojevic, D., Ilic, V., Mihailovic, D., & Jovancic, P. (2009). Recycled wool-based nonwoven material for decolorisation of dyehouse effluents. *International Journal of Clothing Science and Technology*, 21(2/3), 109-116.
- Sun, Y., Li, B., Zhang, Y., Dou, H., Fan, W., Wang, S. (2023). The progress and prospect for sustainable development of waste wool resources, *Textile Research Journal*, 93(1-2), 468-485.
- Wiedemann, S.G., Biggs, L., Clarke, S.J., Russell, S.J. (2022). Reducing the Environmental Impacts of Garments through Industrially Scalable Closed-Loop Recycling: Life Cycle Assessment of a RecycledWool Blend Sweater, *Sustainability*, 14, 1081.
- <https://manteco.com/how-are-recycled-wool-colors-created-without-dyeing/>, 2024)
- <https://manteco.com/how-is-a-recycled-wool-fabric-made/>, 2024

EFFECT OF USING PREBIOTIC ADDED WHEAT INSTEAD OF CORN IN MALE BROILER DIETS ON PERFORMANCE AND SLAUGHTERING CHARACTERISTICS

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Abstract

This study was conducted to determine the effects of diets containing 50 and 100% wheat supplemented with 1 g/kg prebiotics instead of corn on the performance, carcass characteristics and visceral weights of male broilers. In the study, 120 male Ross 308 chicks of day-old age were distributed into 3 treatment groups with 4 subgroups of 10 birds each. Treatment groups were composed of diets containing corn as the grain source (Wheat0), wheat with 1 g/kg prebiotics added as 50% of corn (Wheat50) and wheat with 1 g/kg prebiotics added as 100% of corn (Wheat100). Performance parameters were determined on the 10th, 25th and 42nd days, and carcass and visceral weights were determined at the end of the study (42nd day).

In the study, the use of wheat with prebiotics in the diet improved the body weight (42nd day), body weight gain (26-42nd and 0-42nd days) and feed conversion ratio (11-25th, 26-42nd, and 0-42nd days) of male broilers statistically ($P<0.05$). The use of wheat with prebiotic supplementation instead of corn in the diet decreased feed intake on 11-25th days ($P<0.05$), this effect was not observed in other periods ($P>0.05$). Carcass characteristics and visceral weights were not affected by the treatment diets ($P>0.05$). According to the results of this study, it was determined that the use of wheat with prebiotics instead of all corn (100%) in male broiler diets improved performance parameters without affecting slaughtering characteristics.

Keywords: Wheat, prebiotics, broiler, performance, carcass

Introduction

White meat, a cheap and high-quality protein source in human nutrition, is mainly provided from broilers. With genetic progress and improved breeding conditions, chickens today have a high growth rate. To achieve high growth rate, it is inevitable to use quality feeds that do not contain anti-nutritional factors such as corn and soybean meal. This status creates concerns in terms of sustainability for our country and some other countries where corn and soybean cultivation is not sufficient due to environmental demands. Corn, which is the main energy source in the nutrition of poultry, is not produced sufficiently in our country and is supplied by import. Instead of corn, the use of products and by-products such as wheat, which are more suitable for our country's ecological structure and have a higher production, is still up to date. Wheat has low cellulose and high starch content and comes after

corn in terms of energy. Another feature of wheat is the anti-nutritional factors it contains that make it disadvantageous. Wheat contains non-starch polysaccharides (arabinoxylan, beta glucan) and these anti-nutritional factors cause problems such as doughiness in digestive system and wet litter in broilers and cause loss of productivity. Enzymes and other additives are used to eliminate these negative effects of wheat. Prebiotics, one of the additives, are non-digestible food substances that selectively increase the activity of a limited number of colonic bacteria and thus have a positive effect on the host by improving its health (Reid et al., 2003). Prebiotics encourage the development of beneficial microflora in the intestine, have a positive effect on regular and healthy digestion, increase mineral absorption, strengthen the immune system, and thus positively affect animal health. Prebiotics, unlike probiotics, are non-living supplements and must be taken in minimum doses to be effective. However, the number of studies on the use of prebiotics in wheat-containing diets is limited. The aim of this study was to determine the effect of using wheat with prebiotics instead of corn on the performance, carcass characteristics and some organ weights of broilers.

Material and Method

Male broiler chicks (Ross 308) and feed materials were purchased from commercial companies and the diets were prepared in the Feed Unit located in Selçuk University, Faculty of Agriculture, Prof. Dr. Orhan Düzgüneş Animal Husbandry Research and Application Facility. In the study, 120 male broiler chicks were randomly distributed into 3 treatment groups with 4 subgroups. Treatment groups were composed of diets containing corn as the grain source (Wheat0), wheat with 1 g/kg prebiotics added as 50% of corn (Wheat50) and wheat with 1 g/kg prebiotics added as 100% of corn (Wheat100) (Table 1).

Table 1. Treatment diets using different levels of barley and nutrient contents

Ingredients	Treatment diets								
	Wheat0			Wheat50			Wheat100		
	Starter	Grower	Finisher	Starter	Grower	Finisher	Starter	Grower	Finisher
	(0-10. days)	(11-25. days)	(26-42. days)	(0-10. days)	(11-25. days)	(26-42. days)	(0-10. days)	(11-25. days)	(26-42. days)
Maize	48.14	51.28	56.40	26.69	26.65	28.90	---	---	---
Barley	---	---	---	25.00	26.10	28.90	53.00	54.04	59.38
Soybean meal	42.70	39.00	33.80	35.40	37.00	31.80	33.44	35.00	29.50
Corn gluten	---	---	---	4.00	---	---	4.00	---	---
Soybean oil	5.40	6.30	6.80	5.00	6.80	7.40	5.65	7.50	8.10
Limestone	0.70	0.60	0.60	0.85	0.65	0.60	0.85	0.73	0.65
Dicalcium phosphate	2.20	2.00	1.75	2.08	1.95	1.75	2.05	1.85	1.68
Salt	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Premix	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10
L-lysine	0.17	0.26	0.12	0.30	0.28	0.12	0.33	0.31	0.16
DL-methionine	0.34	0.21	0.18	0.33	0.22	0.18	0.33	0.22	0.18
Calculated nutrient contents									
ME, kcal/kg	3003	3105	3203	3007	3101	3200	3008	3105	3203
Crude protein, %	23.012	21.530	19.496	23.052	21.496	19.541	23.082	21.504	19.508
Calcium, %	0.973	0.872	0.794	0.976	0.873	0.789	0.964	0.873	0.785
Available phosphorus, %	0.489	0.445	0.396	0.480	0.448	0.409	0.486	0.441	0.409
Lysine, %	1.288	1.291	1.063	1.288	1.283	1.042	1.291	1.284	1.046
Methionine, %	0.675	0.521	0.467	0.679	0.528	0.466	0.678	0.526	0.463
Methionine+cystine	0.974	0.899	0.815	1.057	0.915	0.823	1.065	0.922	0.829

¹ The premix provided the following per kg of diet: retinyl acetate, 4.0 mg; cholecalciferol, 0.055 mg; DL- α -tocopheryl acetate, 11 mg; nicotinic acid, 44 mg; calcium-D-pantothenate, 8.8 mg; riboflavin sodium phosphate, 5.8 mg; thiamine hydrochloride, 2.8 mg; cyanocobalamin, 0.66 mg; folic acid, 1 mg; biotin, 0.11 mg; choline, 220 mg; Zn, 60 mg; Mn, 60 mg; Fe, 30 mg; Cu, 5 mg; Iodine, 1.1 mg; Se, 0.1 mg.

During the experiment, body weight and feed intake were determined as g/chick by group weighings at the hatching, 10th day, 24th day, and final (42nd day) of the trial. Body weight gain was also found from these measurements. Feed conversion ratio was calculated as g feed/g gain with feed intake / body weight gain formula.

At the end of the experiment, two broilers at six weeks of age from each subgroup were euthanized by cervical dislocation. Carcass, thigh+drumstick, breast, gizzard, liver, pancreas, and abdominal fat were weighed with a 0.01 g precision scale, and then their relative weights were determined. Relative weights of carcasses and some organs were calculated as percentage of body weight. On the other hand, relative weights of thigh+drumstick and breast were determined as a percentage of the carcass.

Data were analysed in the SPSS 18.0 software package (SPSS Inc., Chicago, IL, USA) with a model of one-way ANOVA, using the group mean as an experimental unit. Differences among the group means were determined by Duncan's range tests. A probability value of $P < 0.05$ was considered statistically significant.

Results and Discussion

The effect of using 50% and 100% wheat with prebiotic (1 g/kg) instead of corn in broiler diets on performance is demonstrated in Table 2.

Table 2. Effect of using 50% and 100% wheat with enzyme (1 g/kg) instead of corn in the diet on the performance

Parameters	Treatments			Standard error	P value
	Wheat0	Wheat50	Wheat100		
Body weight, g/bird					
Hatching	40.53	40.60	40.83	0.192	0.822
10 th days	248.6	253.5	251.9	0.154	0.441
25 th days	1191.3	1208.3	1242.6	9.43	0.059
42 nd days	3222.5 ^b	3240.0 ^b	3387.0 ^a	28.57	0.015
Body weight gain, g/bird					
0-10 th days	208.0	212.9	211.1	1.62	0.500
11-25 th days	942.7	954.8	990.7	9.45	0.085
26-42 nd days	2031.3 ^b	2031.7 ^b	2144.4 ^a	22.02	0.033
0-42 nd days	3182.0 ^b	3199.4 ^b	3346.2 ^a	28.56	0.015
Feed intake, g/bird					
0-10 th days	271.8	276.7	274.2	10.47	0.057
11-25 th days	1289.2 ^a	1232.9 ^b	1239.7 ^b	10.47	0.036
26-42 nd days	3372.8	3360.3	3357.6	21.79	0.963
0-42 nd days	4933.7	4869.9	4871.4	28.36	0.624
Feed conversion ratio					
0-10 th days	1.307	1.300	1.300	0.0316	0.942
11-25 th days	1.368 ^a	1.292 ^b	1.252 ^c	0.0157	<0.001
26-42 nd days	1.661 ^a	1.654 ^a	1.566 ^b	0.0138	<0.001
0-42 nd days	1.551 ^a	1.522 ^b	1.456 ^c	0.0126	<0.001

Wheat0: Group without wheat and prebiotic addition, **Wheat50:** Group containing 50% wheat with prebiotic instead of corn, **Wheat100:** Group containing 100% wheat with prebiotic instead of corn. ^{a,b:} The difference between the means shown with different letters in the same row is statistically significant ($P < 0.05$).

Hatching weights of chicks were statistically similar and ranged between 40.53-40.83 g ($P > 0.05$). The body weights were not statistically affected by the treatments on 10th (248.6-253.5 g) and 25th days

(1191.3-1242.6 g) of the study periods ($P>0.05$). The body weights of broilers were considerably affected by the treatment diets on 42nd day ($P<0.05$), and significantly increased in the Wheat100 group (3387.0 g) compared to the Wheat0 (3222.5 g). In the study, body weight gain of broilers was not significantly affected by treatment groups in the periods of 0-10th (271.8 g) and 11-25th days (942.7-990.7 g) ($P>0.05$). Body weight gains of broilers were considerably affected by treatments in the 26-42nd and 0-42nd days periods of the study ($P<0.05$). On the 26-42nd and 0-42nd days, the body weight gains of Wheat100 (2144.4 g and 3346.2 g, respectively) were found to be significantly higher than those of Wheat0 (2031.3 g and 3182.0 g, respectively) and Wheat50 (2031.7 g and 3199.4 g, respectively). Feed intake was 271.8-276.7 g in the 0-10th days period, 3357.6-3372.8 g in the 26-42nd days period and 4869.9-4933.7 g in total (0-42nd days) but the difference in feed intake among the treatments in these periods was not statistically significant ($P>0.05$). Feed intake of broilers in the 11-25th days of the study decreased significantly in the Wheat50 (1232.9 g) and Wheat100 (1239.7 g) groups compared to the Wheat0 (1289.2 g) ($P<0.05$). In this research, the feed conversion ratio of chicks in the first period varied between 1.300-1.307 and there was no statistically significant difference ($P>0.05$). However, the feed conversion ratio of broilers in other periods was statistically affected by the treatments ($P<0.05$). The feed conversion ratio improved with the use of wheat with prebiotics instead of corn in the 11-25th and 0-42nd days periods, and this improvement was significant in each treatment group. In these (11-25th and 0-42nd days) periods, the feed conversion ratio was determined as 1.368 and 1.551 in the Wheat0 group, 1.292-1.522 in the Wheat50 group and 1.252-1.456 in the Wheat100, and the difference between the values was found statistically significant. The feed conversion ratio in the 26-42nd days period was found to be significantly lower in the Wheat50 and Wheat100 groups (1.654 and 1.566) compared to the control (Wheat0) group (1.661).

Contrary to the current study, previous studies indicated that increasing the level of wheat in the diet reduces performance (Preston et al., 2001; Chrystal et al., 2021). However, the fact that these studies did not include prebiotics may have caused a difference with the current study. Prebiotics are indigestible carbohydrates that selectively stimulate the growth of beneficial bacteria. There are several mechanisms that can explain the positive effect of prebiotics on broilers, such as increasing the digestibility of nutrients, increasing the concentration of growth hormone or IGF-1, maintaining intestinal health, and increasing antioxidant capacity (Huang et al., 2005; Li et al., 2007). Similar to the results of the current study, Huang et al. (2005) and Li et al. (2019) observed that the addition of prebiotics to the diet improved body weight gain and feed conversion ratio in broilers. Similarly, Li et al. (2007) reported that the addition of prebiotics to the diet improved body weight gain, feed intake, and feed conversion ratio in broilers.

The effect of using 50% and 100% wheat with prebiotic (1 g/kg) instead of corn in broiler diets on slaughtering traits is given in Table 3.

Table 3. Effect of using 50% and 100% wheat with enzyme (1 g/kg) instead of corn in the diet on the slaughtering characteristics

Parameters	Treatments			Standard error	P value
	Wheat0	Wheat50	Wheat100		
Carcass*	75.44	76.30	76.66	0.313	0.289
Thigh+drumstick**	28.05	27.22	28.63	0.310	0.176
Breast**	35.81	36.62	35.92	0.349	0.638
Abdominal fat*	0.889	0.791	0.518	0.0773	0.120

Wheat0: Group without wheat and prebiotic addition, **Wheat50:** Group containing 50% wheat with prebiotic instead of corn, **Wheat100:** Group containing 100% wheat with prebiotic instead of corn. *Given as a percentage of body weight. ** Given as a percentage of carcass

The use of 50% and 100% wheat with prebiotics instead of corn in the diet did not affect the relative carcass (75.44-76.66%), thigh+drumstick (27.22-28.63%), breast (35.81-36.62%), and abdominal fat (0.518-0.889%) weights of male broilers statistically ($P>0.05$).

The effect of using 50% and 100% wheat with prebiotic (1 g/kg) instead of corn in broiler diets on relative visceral weights is shown in Table 4.

Table 4. Effect of using 50% and 100% wheat with enzyme (1 g/kg) instead of corn in the diet on the visceral weights

Parameters*	Treatments			Standard error	P value
	Wheat0	Wheat50	Wheat100		
Liver	1.65	1.75	1.72	0.032	0.501
Gizzard	1.45	1.50	1.37	0.051	0.663
Pancreas	0.224	0.208	0.221	0.0107	0.839

Wheat0: Group without wheat and enzyme addition, **Wheat50:** Group containing 50% wheat with enzyme instead of corn, **Wheat100:** Group containing 100% wheat with enzyme instead of corn. *Given as a percentage of body weight.

The use of wheat at 50% and 100% levels with prebiotics instead of corn in the diet did not statistically affect the relative liver (1.65-1.75%), gizzard (1.37-1.50%), and pancreas (0.208-0.224%) weights of broilers ($P>0.05$).

In this study, body weight was found to be higher in the group that prebiotic-added wheat was used instead of 100% corn (Wheat100) compared to the control group (Wheat0), and on the contrary, feed intake was lower. Improvement was observed in feed conversion ratio at every level of using prebiotic-added wheat instead of corn in the diet. As a result, using prebiotic-added wheat instead of all corn in male broiler diets was effective in improving performance without changing slaughtering characteristics.

References

- Chrystal, P. V., Greenhalgh, S., McInerney, B. V., McQuade, L. R., Akter, Y., de Paula Dorigam, J. C., Selle, P. H., & Liu, S. Y. (2021). Maize-based diets are more conducive to crude protein reductions than wheat-based diets for broiler chickens. *Animal feed science and technology*, 275, 114867.
- Huang, R. L., Yin, Y. L., Wu, G. Y., Zhang, Y. G., Li, T. J., Li, L. L., Li, M. X., Tang, Z. R., Zhang, J., Wang, B., He, J. H., & Nie, X. Z. (2005). Effect of dietary oligochitosan supplementation on ileal digestibility of nutrients and performance in broilers. *Poultry science*, 84(9), 1383-1388.
- Li, J., Cheng, Y., Chen, Y., Qu, H., Zhao, Y., Wen, C., & Zhou, Y. (2019). Dietary chitooligosaccharide inclusion as an alternative to antibiotics improves intestinal morphology, barrier function, antioxidant capacity, and immunity of broilers at early age. *Animals*, 9(8), 493.
- Li, X. J., Piao, X. S., Kim, S. W., Liu, P., Wang, L., Shen, Y. B., Jung, S. C., & Lee, H. S. (2007). Effects of chito-oligosaccharide supplementation on performance, nutrient digestibility, and serum composition in broiler chickens. *Poultry Science*, 86(6), 1107-1114.
- Preston, C. M., McCracken, K. J., & Bedford, M. R. (2001). Effect of wheat content, fat source and enzyme supplementation on diet metabolisability and broiler performance. *British Poultry Science*, 42(5), 625-632.
- Reid, G., Sanders, M. E., Gaskins, H. R., Gibson, G. R., Mercenier, A., Rastall, R., Roberfroid, M., Rowland, I., Cherbut, C., & Klaenhammer, T. R. (2003). New scientific paradigms for probiotics and prebiotics. *Journal of clinical gastroenterology*, 37(2), 105-118.

KARBON FİBER TAKVİYELİ ALÜMİNYUM İLETKEN (ACFR) ÇEKİRDEĞİNİN BOYUTSAL YAPISININ SONLU ELEMANLAR YÖNTEMİ İLE BELİRLENMESİ

DETERMINATION OF THE DIMENSIONAL STRUCTURE OF ALUMINIUM CONDUCTOR CARBON FIBRE REINFORCED (ACFR) CORE WITH FINITE ELEMENT METHOD

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Özet

Elektrik enerjisine yönelik artan talepler sonucunda günümüzde mevcut enerji nakil hatlarının kapasiteleri büyük oranda yetersiz kalmaktadır. Mevcut altyapılar korunarak kapasite artışının sağlanabilmesi amacıyla geleneksel ACSR (Çelik Çekirdekli Alüminyum) iletkenlerin yeni nesil ACFR (Karbon Fiber Çekirdekli Alüminyum) iletkenlerle değiştirilmesi etkin bir çözüm sunmaktadır. ACFR iletkenleri, merkezlerinde bulunan karbon fiber çekirdek sayesinde çeliğe göre çok daha hafiftir ve aynı zamanda daha yüksek taşıma kapasiteleri sunabilmektedir. Trapezoidal alüminyum teller kullanılarak yapılan ACFR iletkenler, yuvarlak alüminyum teller kullanılan ACSR iletkenlere kıyasla mevcut enerji nakil sistemlerinin kapasitelerinin iyileştirilmesine olanak tanımaktadır. Bu çalışmada, ACSR Hawk iletkeninin yerine kullanılabilir ACFR iletkeninin boyutsal hesaplamaları sonlu elemanlar yöntemi kullanılarak analiz edilmiştir. Elde edilen sonuçlardan, ACSR Hawk iletkeninin 2,67 mm çapındaki çelik telleri yerine ACFR iletkeninde 2,3 mm çapında karbon fiber tellerin kullanılabilirliği belirlenmiştir. Bu değişiklik, iletkenin daha hafif bir yapıya kavuşmasını sağlamakta ve aynı zamanda daha fazla alüminyum kesit alanı sunarak enerji taşıma kapasitesini artırmaktadır. Sonuç olarak, ACFR iletkeninin mukavemet açısından ACSR iletkenine etkili bir alternatif olarak nasıl sunulabileceği gösterilmiştir.

Anahtar Kelimeler: Havai Hat İletkeni, Karbon Fiber Çekirdek, Sonlu Elemanlar Yöntemi, ACSR, ACFR

Abstract

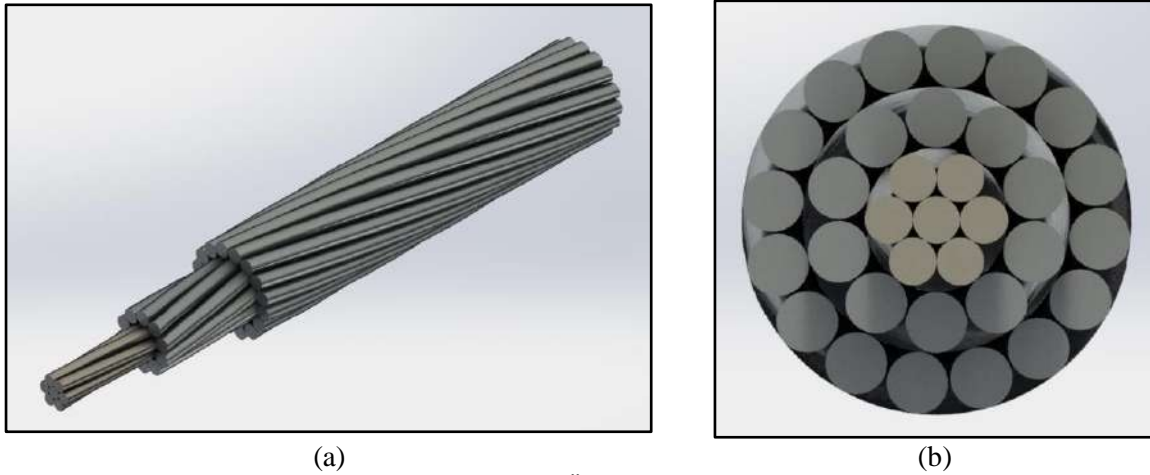
As a result of the increasing demand for electrical energy, the capacities of existing power transmission lines become insufficient nowadays. In order to achieve capacity expansions with preserving the current infrastructures, replacing of traditional ACSR (Aluminum Conductor Steel Reinforced) conductors with next generation ACFR (Aluminum Conductor Fiber Reinforced) conductors presents an effective solution. ACFR conductors are significantly lighter than steel due to their carbon fiber core and can offer higher carrying capacities. ACFR conductors made of trapezoidal aluminum wires allow to the enhancement of the capacities of existing power transmission systems when compared to ACSR conductors made of round aluminum wires. In this study, the dimensional calculation of ACFR conductors which also can be used as ACSR Hawk conductors were analyzed by using the finite element method. The results indicate that carbon fiber wires with a diameter of 2,3 mm can be used in the ACFR conductors instead of the 2,67 mm diameter steel wires in the ACSR Hawk conductors. This modification provides a lighter conductor structure and simultaneously increases the energy carrying capacity by providing a larger aluminum cross-sectional area. Consequently, it was demonstrated that

how the ACSR conductors can effectively be presented as an alternative to ACSR conductors in terms of strength.

Keywords: Overhead Line Conductor, Carbon Fiber Core, Finite Element Method, ACSR, ACSR

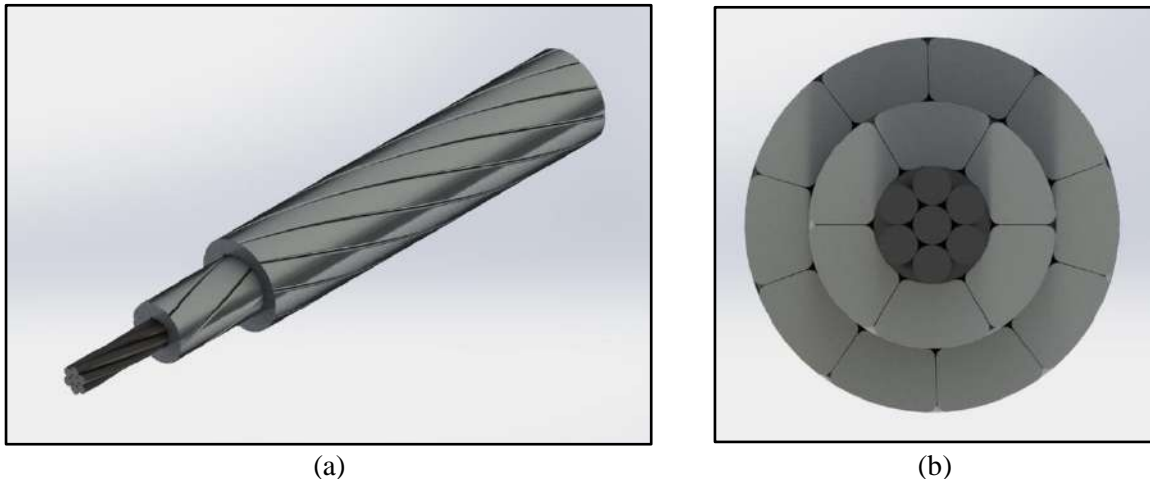
GİRİŞ

Yüksek gerilim enerji iletim hatları, elektrik şebekelerinin temel unsurlarından birisidir ve bu hatlarda genellikle Şekil 1 ile gösterilmiş olan ACSR iletkenleri kullanılmaktadır (Liu et al., 2020). ACSR iletkenler, yapısındaki çelik çekirdek nedeniyle yüksek termal genleşme katsayısına sahip olup korozyona karşı dirençleri düşüktür. Çelik çekirdeğin ağır olması ve sınırlı çalışma sıcaklığı nedeniyle bu iletkenler günümüzde verimli bir şekilde kullanılamamaktadır. Bu sorunlar düşük akım taşıma kapasitesi, artan yük ve fazla sarkma gibi problemlere yol açmaktadır. Bu durumun üstesinden gelebilmek için daha büyük kesitli iletkenler tercih edilmektedir veya mevcut hatların yanına ek iletim hatları eklenmektedir. Daha büyük kesitli iletkenlerin kullanımı, iletkenlerin ağırlığını artırmaktadır ve bu ek ağırlığı taşıyabilmek için direkler arasındaki mesafe kısaltılmakta ya da daha dayanıklı ve büyük direkler kullanılmaktadır. Ayrıca, yeni iletim hatlarının eklenmesi durumunda, hem kamulaştırma işlemleri hem de yeni hat inşaatı yapılması gerekmektedir (Gürek, 2021).



Şekil 1. ACSR havai hat iletkeni: a) Üç boyutlu görünüm, b) Kesit görünümü.

Alternatif bir yaklaşım olarak, yeni nesil ACSR iletkenlerin kullanımı da tercih edilebilmektedir. Şekil 2 ile gösterilmiş olan ACSR iletkenler hafiflik ve yüksek dayanıklılık özellikleri ile öne çıkmaktadırlar (Akgöl, Kıstı, Karaaslan, & Ünal, 2018; Ohki, 2017; Sato, 2002).



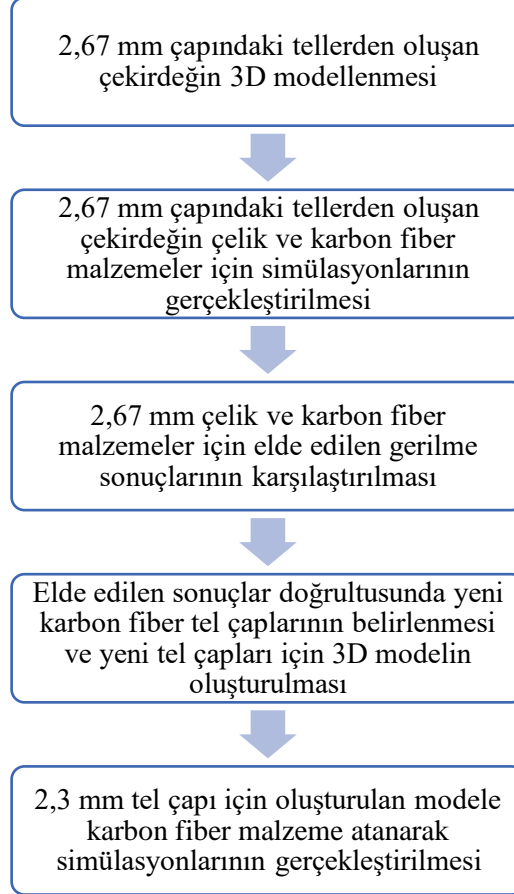
Şekil 2. ACSR havai hat iletkeni: a) Üç boyutlu görünüm, b) Kesit görünümü.

ACSR iletkenleri, 180 °C sıcaklıklara kadar çalışabilirken ve herhangi bir termal bozulma riski taşımazken, ACSR iletkenleri sadece 90 °C'ye kadar dayanabilmektedir (Alawar, Bosze, & Nutt, 2005;

Ryuta, 2018). Bu çalışmada, ACSR Hawk iletkeninin yerine tercih edilebilen ACFR iletkeninin çekirdeğini oluşturan karbon fiberin boyutsal yapısının sonlu elemanlar yöntemi ile belirlenmesine yönelik analizler gerçekleştirilmiştir.

MATERYAL – METOT

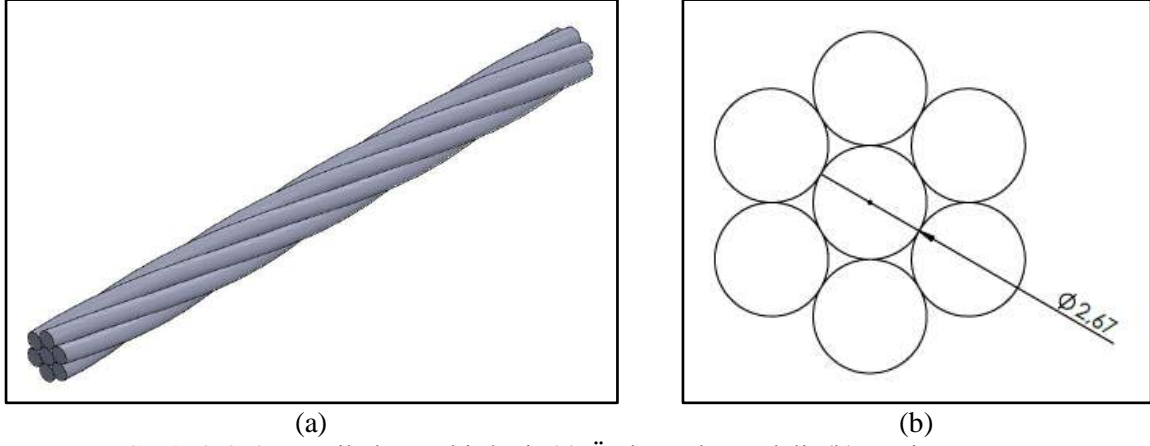
Karbon fiber çekirdekli ACFR iletkeninin, çelik çekirdekli ACSR Hawk iletkenine benzer mukavemet koşullarında çalışabilmesi ve trapezoidal şeklindeki alüminyum teller sayesinde daha fazla enerji iletimi sağlayabilmesi amacıyla karbon fiber çekirdek için optimal yapısal boyut değerleri sonlu elmanlar yöntemi kullanılarak analiz edilmiştir. Analizler aşağıda Şekil 3 ile gösterilmiş olan akış şemasına göre gerçekleştirilmiştir.



Şekil 3. Akış şeması.

Sayısal Modelin Oluşturulması

Sonlu elemanlar yöntemini temel alan analizlerde ilk olarak 2,67 mm çapında tellerden oluşan iletken çekirdeğinin üç boyutlu modeli ve kesit görünümü Şekil 4’te gösterildiği gibi elde edilmiştir.



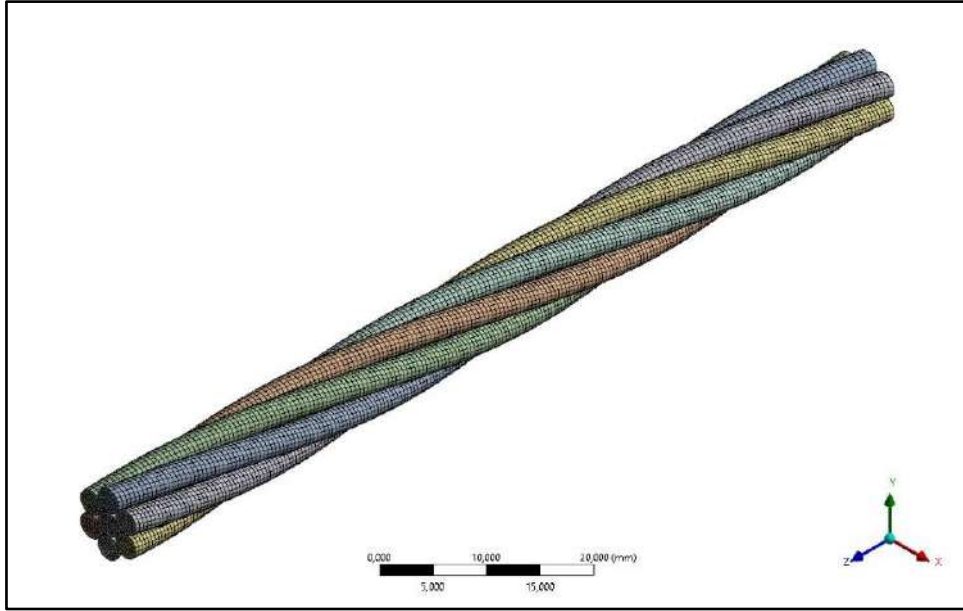
Şekil 4. 2,67 mm iletken çekirdeği; (a) Üç boyutlu modeli, (b) Kesit görünümü.

ACSR Hawk iletken çekirdeği 2,67 mm çapa sahip yedi adet çelik telden oluşmaktadır. Merkezde bulunan bir adet telin üzerine diğer 6 tel sağ yönlü olarak bükülmüştür. Bu kapsamda, ACSR Hawk iletkeninin yapısı referans alınarak 100 mm uzunluğa sahip üç boyutlu bir model hazırlanmıştır. Tablo 1’de verilmiş olan verilerin kullanılmasıyla ağ yapısı oluşturulmuş ve yapısal analizler gerçekleştirilmiştir.

Tablo 1. Tanımlanan malzemelerin teknik özellikleri.

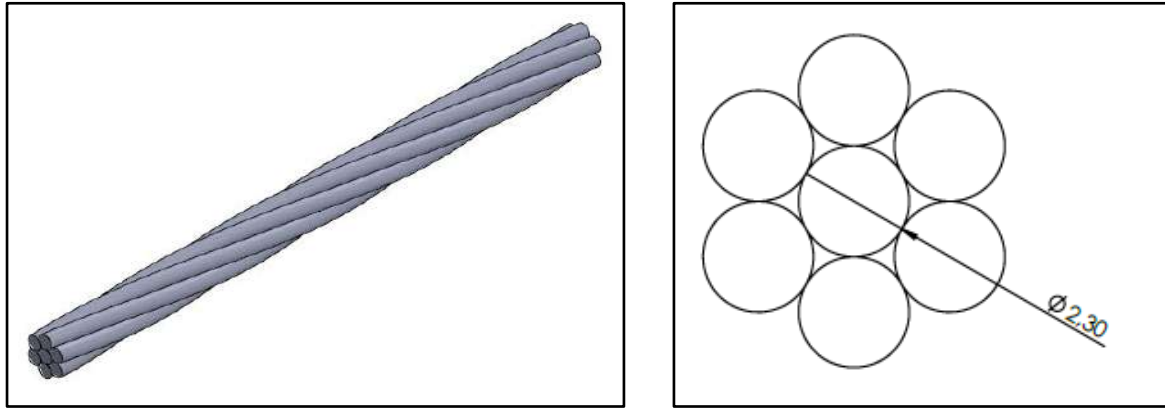
Özellik	Çelik (Levin et al.; Li et al., 2021)	Karbon Fiber (Akgöl et al., 2018; Alawar et al., 2005)
Yoğunluk (kg/m ³)	7780	1600
Elastik Modülü (MPa)	200000	130000
Poisson Oranı	0,3	0,1
Bulk Modülü (MPa)	1,667x10 ⁵	5,417x10 ⁴
Shear Modülü (MPa)	7,692x10 ⁴	5,909x10 ⁴

Şekil 5’te gösterilmiş olan ağ yapısı 0,5 mm eleman boyutundan, 242965 düğüm noktasından ve 50981 elemandan oluşmaktadır.

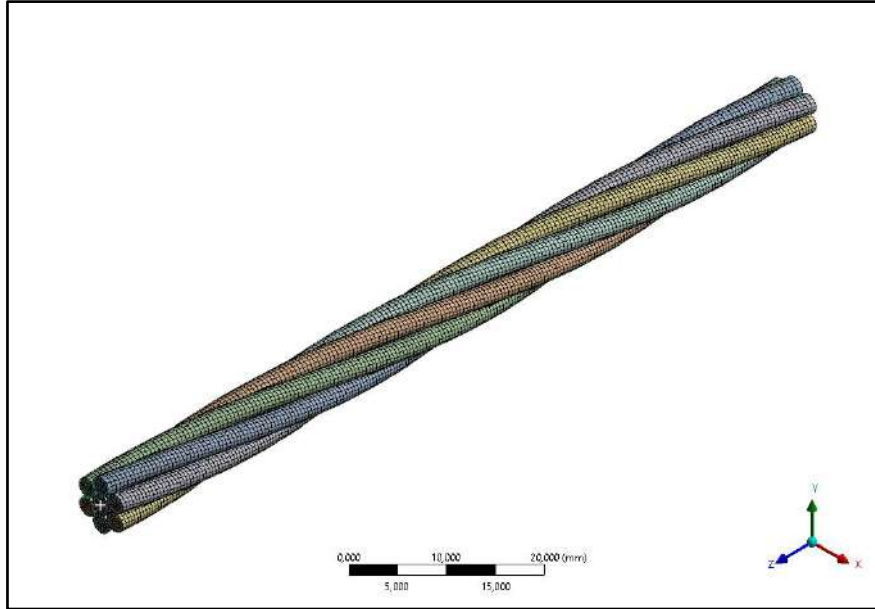


Şekil 5. 2,67 mm iletken çekirdeği için oluşturulan ağ yapısı.

Şekil 4’te gösterilmiş olan model aynı zamanda 2,67 mm karbon fiber çekirdek içinde kullanılmış ve analizler sadece malzeme değişikliği yapılarak gerçekleştirilmiştir. Diğer analiz çalışmalarında ise yeni çekirdek modelleri oluşturulmuştur. Karbon fiber çapı olarak kabul edilen 2,3 mm çekirdeğin analizi için oluşturulan geometri modeli ve ilgili ağ yapısı, sırasıyla, Şekil 6 ve Şekil 7’de gösterilmiştir. Şekil 7’de gösterilmiş olan ağ yapısı 0,5 mm eleman boyutu, 229469 düğüm noktası ve 47587 elemandan oluşmaktadır.



(a) (b)
Şekil 6. 2,3 mm iletken çekirdeği; (a) Üç boyutlu modeli, (b) Kesit görünümü.

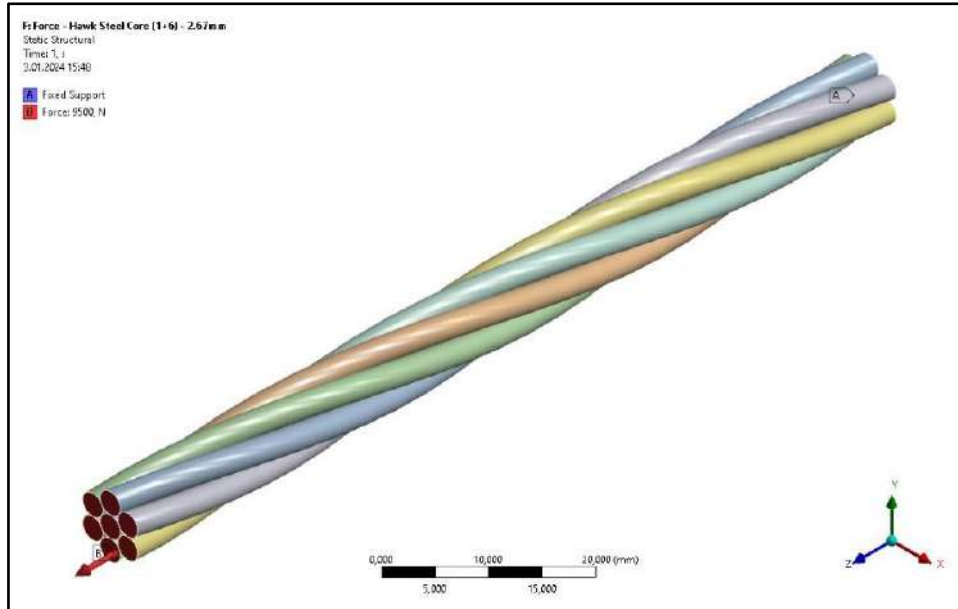


Şekil 7. 2,3 mm iletken çekirdeği için oluşturulan ağ yapısı.

ANALİZLER

Çelik Çekirdek Yapısal Analizi

Öncelikle ACSR Hawk iletkeninin çelik çekirdeğine analiz yapılmıştır. Çelik için oluşturulan sayısal modelin sınır koşulları Şekil 8’de gösterilmiştir.

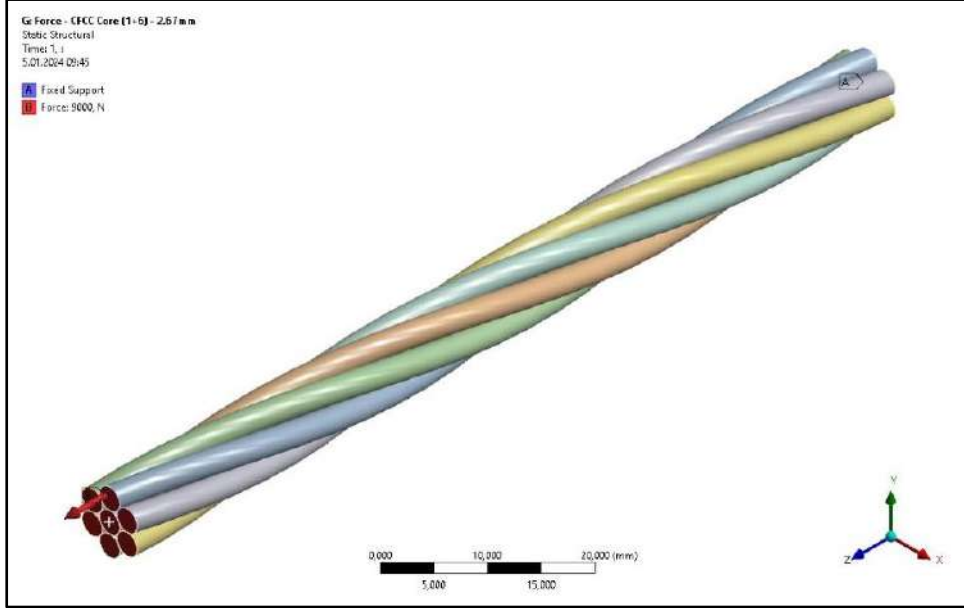


Şekil 8. Çelik çekirdek (2,67 mm) için sınır şartlarının tanımlanması.

Şekil 8’de gösterilen modelde, iletkenin A noktası sabitlenmiştir ve B noktasına (+z) eksenine yönünde 9500 N kuvvet uygulanmıştır. Bu kuvvet değeri iletkenin birim ağırlığı kullanılarak hesaplanmıştır ($g=9,81 \text{ m/s}^2$). ACSR Hawk iletkeninin ağırlığı 970 kg/km olup bu ise yaklaşık 9500 N/km kuvvete denk gelmektedir.

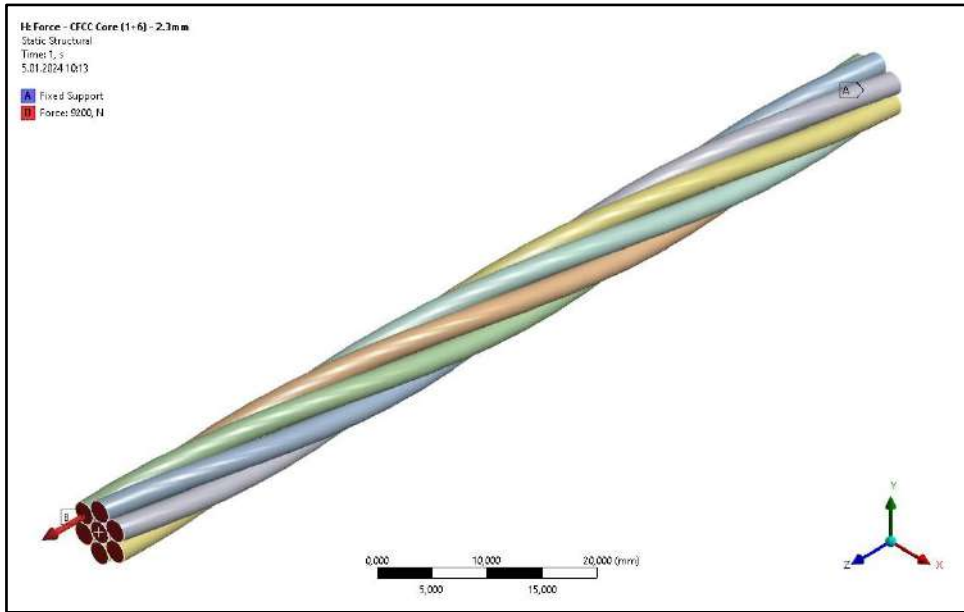
Karbon Fiber Çekirdek Yapısal Analizi

Karbon fiber çekirdek için yapılan analizlerde, başlangıçta çelik çekirdek ile aynı boyutsal şartlar kullanılmıştır ve karbon fiberin uygulanacak kuvvetlere nasıl tepki verdiği ölçülmüştür. Bu süreçte, karbon fiber için oluşturulan sayısal modelin sınır koşulları Şekil 9’da gösterilmiştir.



Şekil 9. Karbon fiber çekirdek (2,67 mm) için sınır şartlarının tanımlanması.

Şekil 9’da gösterilen modelde, iletkenin A noktası sabitlenmiş ve B noktasına (+z) eksen yönünde 9000 N kuvvet uygulanmıştır. Bu kuvvet değeri, benzer şekilde, iletkenin birim ağırlığı kullanılarak hesaplanmıştır ($g=9,81 \text{ m/s}^2$). ACFR iletkeninin ağırlığı 920 kg/km olup yaklaşık 9000 N/km kuvvete denk gelmektedir. Karbon fiber çekirdek için gerçekleştirilmiş olan bir diğer analizde tel çapı 2,3 mm'ye kadar düşürülmüştür ve bu çapa sahip iletkenlerden oluşan karbon fiber çekirdek için sınır koşulları Şekil 10’da gösterilmiştir.

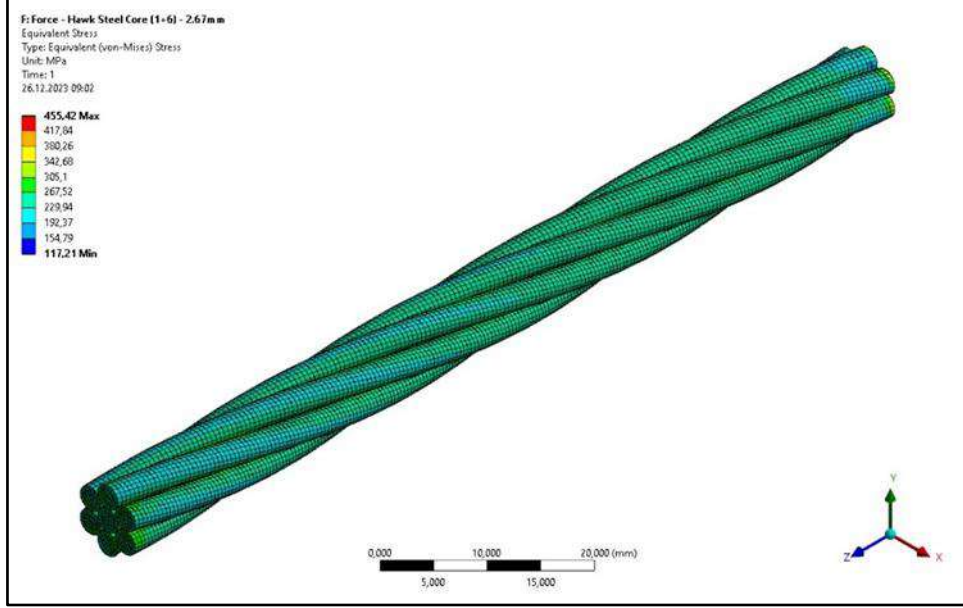


Şekil 10. Karbon fiber çekirdek (2,3 mm) için sınır şartlarının tanımlanması.

Şekil 10’da gösterilen modelde, iletkenin A noktası sabitlenmiş ve B noktasına (+z) eksen yönünde 9200 N kuvvet uygulanmıştır. Bu kuvvet değeri yine iletkenin birim ağırlığı kullanılarak hesaplanmıştır ($g=9,81 \text{ m/s}^2$). ACFR iletkeninin ağırlığı 940 kg/km olup bu ise yaklaşık 9200 N/km kuvvet değerine karşılık gelmektedir.

BULGULAR**Çelik Çekirdek Analiz Sonucu**

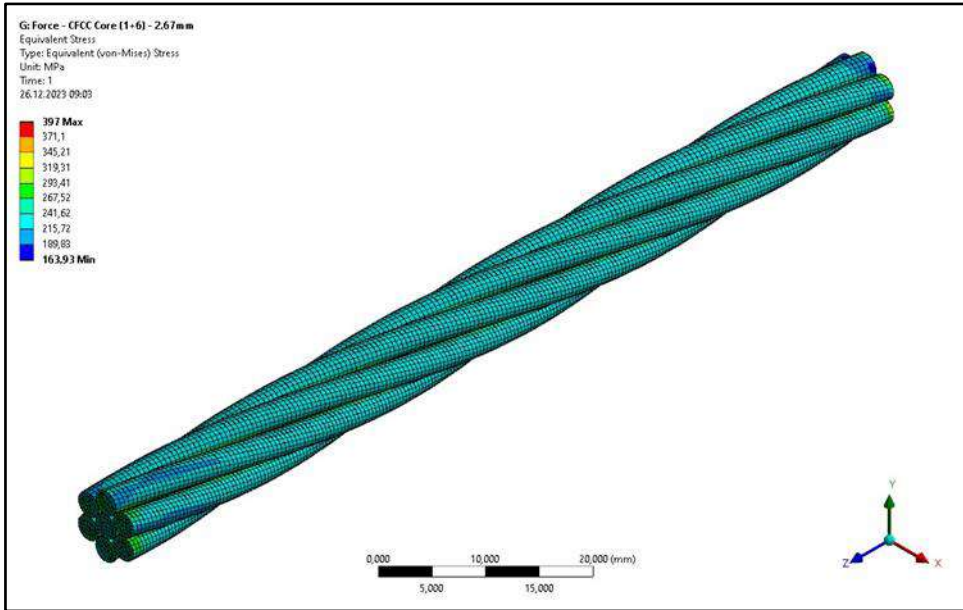
Çelik çekirdek için gerçekleştirilmiş olan sayısal analizlerde elde edilen gerilme sonuçları Şekil 11'de verilmiştir. Bu sonuçlarına göre 100 mm uzunluğunda çelik çekirdekte maksimum 455,42 MPa gerilme tespit edilmiştir ve bu değer karbon fiber tel çapını belirlemek için referans olarak kullanılmıştır.



Şekil 11. Çelik çekirdek (2,67 mm) için gerilme analiz sonuçları.

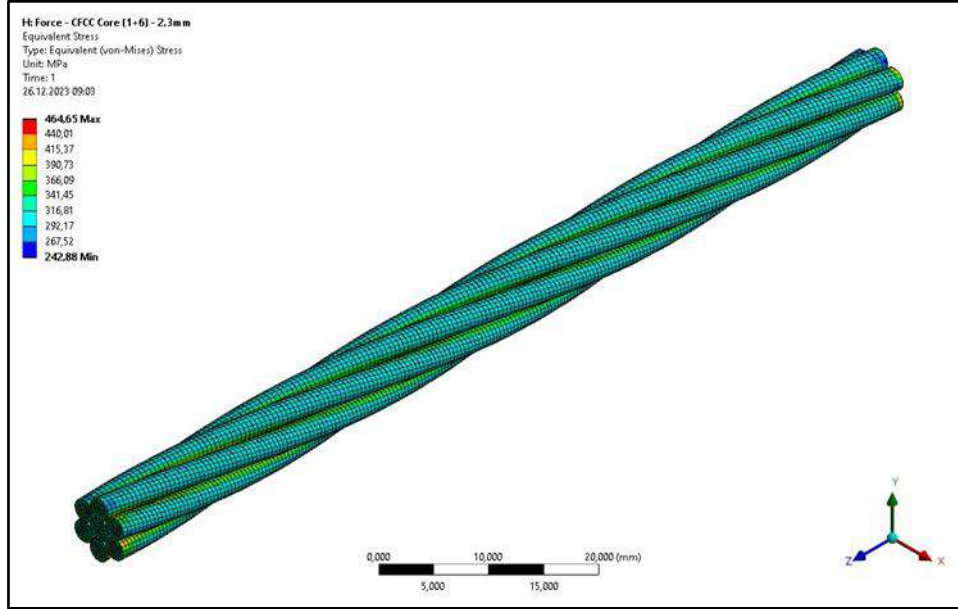
Karbon Fiber Çekirdek Analiz Sonucu

Tel çapı 2,67 mm olan karbon fiber çekirdek için elde edilen sayısal analiz sonuçları Şekil 12'de gösterilmiştir. Gerilme sonuçlarına göre 100 mm uzunluğunda ve 2,67 mm çapında karbon fiber çekirdekte maksimum 397 MPa gerilme olduğu görülmüştür. Bu gerilme değerini iyileştirmek amacıyla karbon fiber çekirdek tel çapı 2,3 mm değerine küçültülmüş ve analizler gerçekleştirilmiştir.



Şekil 12. Karbon fiber çekirdek (2,67 mm) için gerilme analiz sonuçları.

Tel çapı 2,3 mm'den oluşan karbon fiber çekirdek için yapılan sayısal analizlerin sonuçları ise Şekil 13'te verilmiştir. Elde edilen sonuçlardan, 100 mm uzunluğundaki ve 2,3 mm çapındaki karbon fiber çekirdekte maksimum 464,65 MPa gerilme olduğu görülmektedir.



Şekil 13. Karbon fiber çekirdek (2,3 mm) için gerilme analiz sonuçları.

Çelik ve karbon fiber çekirdekler için yapılan analizlerin gerilme sonuçları ile trapezoidal telin kullanılmasıyla (sadece ACFR için) 21,8 mm çapında bir iletken tasarımı yapıldığında elde edilen alüminyum kesit alanları ve analiz sonuçları Tablo 2’de gösterilmiştir.

Tablo 2. Kesit alanları ve analiz sonuçları.

Ürün Adı	Çelik / Karbon Fiber Tel Çapı (mm)	İletken Dış Çapı (mm)	Alüminyum Kesit Alanı (mm ²)	Uygulanan Kuvvet (N)	Açığa Çıkan Gerilme (MPa)
ACSR Hawk	2,67	21,8	242	9500	455,42
ACFR	2,67	21,8	322	9000	397
ACFR	2,3	21,8	336	9200	464,65

SONUÇ

Bu çalışmada, 2,67 mm çapındaki ACSR Hawk iletkeninin çelik çekirdeğinde oluşan 455,42 MPa gerilme değeri referans alınarak iki farklı çap değeri için ACFR iletkenlerin performans analizleri gerçekleştirilmiştir. 2,67 mm çapındaki karbon fiber çekirdek için maksimum gerilme değerinin daha düşük çıktığı ve buna bağlı olarak karbon fiber çekirdek tel çapının küçültülebileceği görülmüştür. Buna göre, 455,42 MPa gerilme değerine %2'ye kadar sapma izni verilerek tel çapı azaltılmış ve oluşan boşluk alüminyum ile doldurularak enerji iletim miktarı artırılmıştır. 2,3 mm çapa sahip karbon fiber iletkenlerde yapılan analizler sonucunda ortaya çıkan maksimum 464,65 MPa gerilme değerinin ise toleranslar içinde kaldığı gözlemlenmiştir. ACSR Hawk iletkeni referans alınarak dış çapı 21,8 mm olan ve 2,67 mm çapında karbon fiber teller kullanılarak yapılan ACFR tasarımında ise yaklaşık 322 mm² kesit alanı ortaya çıkmıştır. Çapı 2,3 mm olan karbon fiber teller kullanıldığında ise alüminyum iletkenin kesit alanı yaklaşık 336 mm² olarak elde edilmiştir. Sonuç olarak, ACSR Hawk iletkeniyle aynı çapa sahip bir ACFR iletkeninin hem daha hafif olduğu hem de daha yüksek enerji taşıma kapasitesi sunduğu gözlemlenmiştir.

TEŞEKKÜR

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KAYNAKÇA

- Akgöl, O., K1st1, E. A., Karaaslan, M., & Ünal, E. (2018). Kompozit Özlü Alüminyum İletkenlerin (ACCC) üretilmesi ve iletkenliğinin yükseltilmesi için yapılan çalışmalar. *Dicle Üniversitesi Mühendislik Fakültesi Mühendislik Dergisi*, 9(2), 657-669.
- Alawar, A., Bosze, E. J., & Nutt, S. R. (2005). A composite core conductor for low sag at high temperatures. *IEEE transactions on power delivery*, 20(3), 2193-2199.
- Gürek, M. (2021). *ACSS/TW havai hat iletkenlerinin tasarımı ve prototip imalatı.*, Erciyes Üniversitesi.
- Levin, A. A., Panfilov, A. G., Lihachev, A. I., Narykova, M. V., Kardashev, B. K., Kadomtsev, A. G., . . . Sultanov, M. M. Structural, microstructural, and elastic-microplastic properties of wires of the aluminum-steel ACSR (AC50/8) cable after 52 years in operation, cut from different places on an overhead-power-line span.
- Li, X., Zhang, J., Wang, H., Liu, C., Liu, Y., & Guo, C. (2021). *Experimental analysis on mechanical properties of aluminum conductor steel-reinforced for transmission line.* Paper presented at the Journal of Physics: Conference Series.
- Liu, J., Yan, B., Huang, G., Mou, Z., Lv, X., & Zhang, H. (2020). Study on mechanical characteristics of conductors with three-dimensional finite-element models. *Royal Society Open Science*, 7(5), 200309.
- Ohki, Y. (2017). Development of a low sag carbon fiber reinforced aluminum conductor for transmission lines [News from Japan]. *IEEE Electrical Insulation Magazine*, 33(6), 54-57.
- Ryuta, O. (2018). Revamped high ampacity low sag stranded carbon fiber composite core–aluminium conductor fiber reinforced conductor (ACFR). *Power Engineer Journal*, 20(2), 4-8.
- Sato, F. (2002). Development of a low sag aluminum conductor Carbon fiber reinforced for transmission lines. *CIGRE SC-22, Paris, 2002.*

ACUTE TOXICITY PROFILE OF NAUCLEA LATIFOLIA LEAF ETHANOLIC EXTRACT IN ALBINO RATS

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Abstract

Nauclea latifolia (African peach in English), is a plant with medicinal properties used in traditional medicine for the treatment of numerous ailments such as malaria, hypertension, prolonged menstrual flow, cough, gonorrhoea, stomach disorders, dysentery, ulcers and liver ailment. The aim of this study was to determine the acute toxicity profile of the *N. latifolia* leaf ethanolic extract in albino rats. Leaves of *Nauclea latifolia* were harvested, washed with water, air-dried at room temperature, and then processed into fine particles. Cold maceration method of extraction was used. Two hundred grams (200 g) of *N. latifolia* fine powdered sample was extracted with 1000 mL of ethanol for 72 hours in sterile conical flask. The extract was filtered using Whatman No.1 filter paper and heated in water bath at 40°C until a solid residue was obtained. Acute oral toxicity study of ethanol extract of *N. latifolia* was carried out in two stages to determine the range of doses producing the toxic effects and the median lethal dose (LD₅₀) of the extract. In each stage, the animals were divided into three groups of three animals. In stage one, the animals were administered with 10, 100, 1000 mg/kg body weight once, while in stage two, another three groups of animals were fed with 1600, 2900 and 5000 mg/kg body weight once respectively of *N. latifolia* extracts. The results of the acute toxicity study revealed that the administration of oral *Nauclea latifolia* ethanol leaf extract at single doses 10, 100, 1000, 1600, 2900, 5000 mg/kg BW in stages one and two did not cause any sign of toxicity or mortality in rats during the 14 days of observation. The oral median lethal dose (LD₅₀) was greater than 5000 mg/kg of the body weight in rats. In conclusion, the ethanolic leaf extract of *N. latifolia* is nontoxic and maybe considered safe at these doses tested.

Keywords: *Nauclea latifolia*, acute toxicity, ethanolic extract, albino rats, lethal dose.

Introduction

Medicinal plants are used worldwide as the source of therapeutic agents (Gupta and Sharma, 2020), and many chemotherapeutic drugs are of plant origin (Chukwudozie and Ezeonu, 2022). There had been belief that some plants had medicinal values, even before the discovery of antibiotics. Even though antibiotics are now available for the treatment of infections, ethnomedicine is still widely used due to its acceptability and affordability, especially amongst the rural and low-income populace (Chukwudozie and Ezeonu, 2022). Also, phytomedicines have multiple beneficial effects on improving health (Nyong *et al.*, 2021), and it can be stored for long time at normal temperature (Gupta and Sharma, 2020).

Herbal medicines are generally considered safe or of low toxicity based on their long history of use by man (Ugwah-Oguejiofor *et al.*, 2019). However, there are indications from researches that some herbal medicines have negative effects. Since safety continues to be a major issue with the use of medicinal plants, conducting toxicity studies on them to determine their safety profile is essential. Therefore, evaluating the acute toxicological effects of any medicinal plant extract intended to be used in animals or humans is an important aspect of its assessment for potential toxic effects.

Nauclea latifolia Smith, (Rubiaceae), called African peach in English is an evergreen, multi-stemmed and straggling shrub with sweet scented flowers. It is well distributed in many parts of Nigeria. It is a medicinal plant that is used for traditional medicinal treatments in East and West African sub-regions, where various extracts of the plant are used for the treatment of malaria, hypertension, prolonged menstrual flow, cough, gonorrhoea, stomach disorders, dysentery, ulcers and liver ailment (Ajayi *et al.*, 2020; Ezeagha *et al.*, 2023.). Leaf decoctions of *Nauclea latifolia* are used in the treatment of typhoid fever. The extracts of different parts of *Nauclea latifolia* in hot water or alcohol are used in forms of

infusions, decoctions or concoctions for different treatments (Okunye *et al.*, 2020). Plate 1 is *Nauclea latifolia* showing leaves, stems, and flowers.



Plate I: *Nauclea latifolia* tree showing leaves, stems, and flowers.

Materials and Methods

Collection and identification of plant material

Leaves of *Nauclea latifolia* were collected from Maikunkele, Bosso LGA, Niger State, Nigeria. The plant leaves were identified and authenticated at the Department of Plant Biology, Federal University of Technology, Minna, Niger State, Nigeria.

Preparation of plant samples

The plant leaves were washed with water, air-dried for one week at room temperature and pulverized into coarse powder by using pestle and mortar. The coarse powder was further processed to fine particles with a laboratory electric blender. The powder obtained was then kept in air-tight containers for future use.

Sample Extraction

Ethanol extract

Cold maceration method of Musa *et al.* (2017) was used with little modification. Two hundred grams (200 g) of *N. latifolia* fine powdered sample was extracted with 1000 mL of ethanol for 72 hours in sterile conical flask. The extract was filtered using Whatman No.1 filter paper and heated in water bath at 40°C until a solid residue was obtained. The solid concentrated filtrate, now the extract was then stored in universal bottles in the refrigerator at 4°C until when it would be used.

Experimental animals

Eighteen Wistar albino rats of both sexes, weighing between 77.4 and 132.3 g, about eight weeks old were purchased from YUSNAF Essentials, Minna, Nigeria, and used for this study. They were fed with pelleted feeds (Vital Feeds, Jos, Nigeria) and tap water *ad libitum*. The animals were housed under standard laboratory environment, and allowed to acclimatize to the laboratory environment (temperature of $28 \pm 3^\circ\text{C}$), relative humidity and naturally illuminated environment of 12/12 h day light/dark cycles) for one week before the commencement of the study.

Acute oral toxicity study

The acute oral toxicity test of ethanol leaf extract of *N. latifolia* was evaluated in albino rats as reported by Olaniyan *et al.* (2015) with little modifications. The study was conducted in two phases. In the first phase, nine rats were grouped into three of three rats each. Following an overnight fast, the rats were weighed and the dose was calculated in reference to their body weight. The ethanol crude extract was suspended in dimethyl sulfoxide (DMSO). Groups 1, 2, and 3 received 10, 100 and 1000 mg/kg body weight of the extract, respectively. The animals were observed for about 30 minutes for any signs of toxicity or mortality. Further observations were made every 8 hours for 24 hours after administration of the extract. The absence of death of any animals in this phase necessitated the conduction of the second phase.

In the second phase, nine rats were also grouped into three of three rats each (Groups 1, 2, and 3). The three groups received ethanol extract at 1600, 2900 and 5000 mg/kg body weight, respectively. The rats were observed for any signs of toxicity or mortality within 24 hours. Further observation of all the animals was made for a period of 14 days.

Results

Acute Toxicity Effect of *Nauclea latifolia* ethanol leaf extract on Albino Rats

The acute toxicity test results at an oral limit doses of 10, 100 and 1000 mg/kg in phase one, and 1600, 2900, and 5000 mg/kg body weight in phase two of the ethanol extract of *N. latifolia* caused no death in the rats (Table 1). No lethal effects were noted throughout the phases one and two of the study. No toxicity signs were observed in the animals throughout the 14 days study period. The oral lethal dose, LD₅₀ is considered greater than 5000 mg/kg in rats since they tolerated up to 5000 mg/kg body weight of the extract orally.

Table 1: Acute Toxicity Test of Ethanol Leaf Extract of *N. latifolia* in Albino Rats

	Group	Dosage (mg/kg BW)	Mortality/No.of Rats
Phase 1	1	10	0/3
	2	100	0/3
	3	1000	0/3
Phase 2	1	1600	0/3
	2	2900	0/3
	3	5000	0/3

Key: mg/kg BW: milligram per kilogram of body weight, No.: number of rats

Discussion

Acute toxicity study involves the determination of the concentration of the extract that will kill 50% of the test animals' population (Udobi *et al.*, 2017). Lethal dose, LD₅₀ figures are frequently used as a general indicator of a substance's acute toxicity. A lower LD₅₀ is indicative of increased toxicity (Uche and Chinyere, 2022).

Acute toxicity study of albino rats after the administration of ethanolic leaf extract of *N. latifolia* showed no mortality or signs of toxicity such as tumour, diarrhoea, vomiting, convulsion, changes in the skin, eyes and fur colour. The LD₅₀ (median lethal dose) of *N. latifolia* ethanolic leaf extract was greater than 5000 mg/kg BW (Table 1). According to the Organization for Economic Co-operation and Development (OECD) Globally Harmonized Classification System, this extract is classified as category 5 of non-toxic substances orally. This result is consistent with the findings of Berinyuy *et al* (2020), who investigated the potential protective effects of the methanolic extract of *N. latifolia* in experimental animals. However, the result disagrees with Udobi *et al.*, (2017), who reported that lethal dose (LD₅₀) of *N. latifolia* extract was 1414.2 mg/kg body weight, thus suggesting that the extract was slightly toxic. This disparity could be due to the time, species, place of collection of the leaves, and different methods of extraction of the extracts.

Conclusion and Recommendations

In conclusion, the results from this study, suggest that *N. latifolia* leaf ethanolic extract is nontoxic at the doses used for this study when orally administered to Albino rats once (acute toxicity study). Therefore, it may be considered safe at these doses tested. It is recommended that ethanol leaf extract of *N. latifolia* should be used for treatment. However, further studies on the subacute toxicity profile of the leaf extract should be carried out to evaluate its effect after a prolonged administration.

References

- Ajayi, O. S., Aderogba, M. A., Akinkunmi, E. O., Obuotor, E. M., Majind, R. R. T. (2020). Bioactive compounds from *Nauclea latifolia* leaf extracts. *Journal of King Saud University – science*, 32(4), 2419-2425.
- Berinyuy E. B., Abdullahi, M. K., Kabiru, A. Y., & Ogbadoyi, E. O. (2020). Comparative Anti-malarial and Toxicological Properties of the Stem Bark Extracts of *Nauclea latifolia* and *Terminalia*

- glaucescens Against Plasmodium berghei-infected mice. *Iranian Journal of Toxicology*, 14(1), 9-18. <http://dx.doi.org/10.32598/ijt.14.1.9>.
- Chukwudozie, I. K., & Ezeonu, I. M. (2022). Antimicrobial properties and acute toxicity evaluation of *Pycnanthus angolensis* stem bark. *Scientific African* 16, e01185.
- Ezeagha, C. C., Ogbuebuna, J. O., Anozie, A. N., Oranu, E. C., & Nedum, C. H. (2023). Determination of the Phytochemical and Antimicrobial properties of *Nauclea latifolia* Root Smith. (Rubiaceae). *GSC Biological and Pharmaceutical Sciences*, 23(2), 182–188.
- Gupta, R., & Sharma, S. (2020). Herbal antibiotics: A Review. *Bulletin of Environment, Pharmacology and Life Sciences*. 9(11), 136-142.
- Musa, D. A., Sunday, G. O., Musa, A., & Nwodo, O. F. C. (2017). Evaluation of in vitro anti-salmonelal effect of combined crude aqueous extracts of *Ficus capensis* and *Nauclea latifolia* used for the treatment of typhoid fever. *Biokemistri*, 29(1), 19–23.
- Nyong, B. E., Etim, A. N., Ita, P. O., & Ucheokoro, A. S. (2021). Antimicrobial properties of alcoholic extract of African peach (*Nauclea latifolia*) leaves. *International Journal of Current Research in Medical Sciences*, 7(9), 1-7.
- Okunye, O. L., Idowu, P. A., & Kolade, T. T. (2020). Antibacterial activity of crude extracts of the leaves of *Nauclea latifolia* Smith (Rubiaceae) and some selected conventional antibiotics on clinical isolates of *Salmonella* Typhi. *Annals of Health Research*, 6(3), 258-264. doi:10.30442/ahr.0603-02-88.
- Olaniyan, J. M., Muhammad, H. L., Makun, H. A., Busari, M. B., & Abdullah, A. S. (2015). Acute and sub-acute toxicity studies of aqueous and methanol extracts of *Nelsonia campestris* in rats. *Journal of Acute Disease*, 5(1), 62–70.
- Uche, M. E. & Chinyere, G. C. (2022). Phytochemical Screening and Sub-Acute Toxicity Studies of Aqueous Leaf Extract of *Ficus aurea* from South-East Nigeria. *World Journal of Pharmaceutical and Medical Research* 8(8), 88-97.
- Udobi, C. E., Umoh, B. E., & Asuquo, E. G. (2017). Effects of the Ethanol Extract of the Stem Bark of *Nauclea latifolia* Smith [Rubiaceae] on Certain Biochemical and Haematological Indices of Swiss Albino Mice. *Asian Journal of Medicine and Health*, 6(1), 1-9.
- Ugwah- Oguejiofor, C. J., Okoli, C. O., Ugwah, M. O., Umaru, M. L., Ogbulie, C. S., Halilu, M. E., & Njan, A. A. (2019). Acute and sub-acute toxicity of aqueous extract of aerial parts of *Caralluma dalzielii* N. E. Brown in mice and rats. *Heliyon*, 5(1), e01179. doi:10.1016/j.heliyon.2019.e01179.

**SAĞLIK KURUMLARINDA ÖRGÜT İKLİMİ VE ÖRGÜTSEL GÜVEN İLİŞKİSİ: BİR
META-ANALİZ ÇALIŞMASI
RELATIONSHIP BETWEEN ORGANIZATIONAL CLIMATE AND ORGANIZATIONAL
TRUST IN HEALTH INSTITUTIONS: A META-ANALYSIS STUDY**

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Özet

Sağlık kurumlarında örgüt iklimi, çalışanların iş ortamına yönelik algılarını şekillendirirken, bu algılar örgütsel güvenin inşasında kritik bir rol oynamaktadır. Bu çalışmada, sağlık kurumlarında örgüt iklimi ve örgütsel güven arasındaki ilişkilerin ortalama etki büyüklüğünün belirlenmesi amaçlanmıştır. Bu amaç doğrultusunda meta-analiz yöntemi kullanılmıştır. Meta-analiz, belirli bir konuda yapılmış birbirinden bağımsız birden çok araştırmanın sonuçlarını birleştirme ve elde edilen araştırma bulgularının istatistiksel analizini yapma yöntemidir. Meta-analize dâhil edilecek araştırmaları belirlemek için bir literatür taraması yapılmıştır. Tarama yapılırken makaleler için Google Akademik ve ULAKBİM Sosyal Bilimler Veri Tabanı, tezler için ise Yükseköğretim Kurulu Ulusal Tez Merkezi kullanılmıştır. Bu veri tabanlarında tarama yapılırken (“örgüt iklimi” VE “örgütsel güven” ve “hastane”), (“organisational climate”, AND “organisational trust” AND “hospital”) anahtar kelimeleri kullanılmıştır. Çeşitli dâhil etme ve dışlama kriterlerinin kullanıldığı çalışmada 2017-2024 tarihleri arasında 39 araştırmaya ulaşılmış olmasına rağmen 8 tanesi meta-analize dâhil edilmiştir. Verilerin analizinde metaHUN programı kullanılmıştır. Bu çalışmayla 8 araştırma bir araya getirilerek 2271 kişilik örneklem grubu elde edilmiştir. Yayınların %50’sinin 2017-2018 yıllarına ait olup İstanbul ve Ankara illerinde yürütüldüğü tespit edilmiştir. Yayınların %62,5’inin Türkçe dilinde ve makale türünde olduğu, makalelerin ise %60’ının TR dizinde indekslendiği belirlenmiştir. Yayınların %37,5’inin örneklem grubunu yalnızca hemşirelerin oluşturduğu saptanmıştır. Elde edilen meta-analiz bulguları, rastsal etkiler modeline göre örgüt iklimi ve örgütsel güven değişkenleri arasında $r=0,76$ ’lık güçlü ve anlamlı bir ilişki olduğunu ortaya koymuştur. Bu bulgu, çalıştıkları kurumlarının örgütsel iklimini olumlu bulan sağlık çalışanlarının örgütlerine karşı daha yüksek bir güven duydukları şeklinde yorumlanabilir. Dolayısıyla sağlık kurumları yöneticilerinin, örgüt iklimini olumlu hale getirmek için çalışanların güvenini artırıcı birtakım stratejiler geliştirmeleri gerekmektedir. Bu kapsamda; açık iletişim kanalları ve şeffaflık, çalışan katılımı, destekleyici liderlik, eğitim ve gelişim gibi uygulamalar hayata geçirilerek örgütsel güvenin iyileşmesine katkı sunulabilir.

Anahtar Kelimeler: örgüt iklimi, örgütsel güven, hastane, sağlık çalışanı, meta-analiz

Abstract

While organizational climate in health institutions shapes employees' perceptions of the work environment, these perceptions play a critical role in the construction of organizational trust. This study aimed to determine the average effect size of the relationships between organizational climate and organizational trust in health institutions. For this purpose, the meta-analysis method was used. Meta-analysis is a method of combining the results of multiple independent studies conducted on a certain subject and performing statistical analysis of the obtained research findings. A literature review was conducted to determine the studies to be included in the meta-analysis. While scanning, Google Scholar and ULAKBİM Social Sciences Database were used for articles, and the Council of Higher Education National Thesis Center was used for theses. While scanning these databases, the keywords (“organizational climate” AND “organizational trust” and “hospital”) were used. Although 39 studies were reached between 2017 and 2024 in the study where various inclusion and exclusion criteria were

used, 8 of them were included in the meta-analysis. The metaHUN program was used in the analysis of the data. In this study, 8 studies were brought together and a sample group of 2271 people was obtained. It was determined that 50% of the publications belonged to the years 2017-2018 and were conducted in Istanbul and Ankara. It was determined that 62.5% of the publications were in Turkish and were in the article type, and 60% of the articles were indexed in the TR index. It was determined that 37.5% of the publications consisted of only nurses as the sample group. The meta-analysis findings obtained revealed that there was a strong and significant relationship of $r=0.76$ between the organizational climate and organizational trust variables according to the random effects model. This finding can be interpreted as that healthcare professionals who find the organizational climate of the institutions they work in positive have higher trust in their organizations. Therefore, managers of healthcare institutions need to develop some strategies to increase the trust of employees in order to make the organizational climate positive. In this context; Implementing practices such as open communication channels and transparency, employee participation, supportive leadership, training and development can contribute to the improvement of organizational trust.

Keywords : organizational climate, organizational trust, hospital, healthcare worker, meta-analysis

GİRİŞ

Rekabet, sağlık sektörü dâhil olmak üzere her alanda kaçınılmaz bir gerçeklik haline gelmiştir. Uzun vadede temel hedefi sürdürülebilirliğini korumak ve sektör ortalamasının üzerinde kazanç sağlamak olan işletmeler için yalnızca teknoloji ve diğer kaynaklara yatırım yapmak yeterli olmamaktadır. Bu nedenle, işletmelerin aynı zamanda insan kaynaklarına da gereken önemi vermesi bir zorunluluk haline gelmiştir (Gün ve Söyük, 2017).

Bireylerin çalıştıkları ortama dair algıları, tutum ve davranışlarını şekillendirmektedir. Çalışma ortamı ve şartlarına yönelik olumlu algılar, bireylerin davranışları üzerinde olumlu etkiler yaratmaktadır. Bu nedenle, çalışma ortamının koşullarını tanımlayan örgüt iklimi üzerine yapılan araştırmalar son yıllarda giderek artış göstermiştir (Akbulut ve Kutlu, 2016).

Örgüt iklimi, yaratıcılık ve verimliliğin ortaya çıktığı bir alan olarak öne çıkar ve bireysel düzeyde, örgütsel durumun bilişsel bir yorumu olarak kabul edilir. Bu çerçevede, örgüt iklimi “psikolojik” ya da “algısal” iklim olarak da değerlendirilebilir (Doğan ve Üngören, 2009). Ögeve ve Sütü (2018)’ye göre ise örgüt iklimi, örgütte bulunan bireylerin yarattıkları ve içinde buldukları hava olarak tanımlanmaktadır.

Örgüt ikliminin şekillenmesinde bireysel, örgütsel ve dış çevreye ait faktörler etkili olup, bu faktörlerden herhangi birinde yaşanacak bir aksaklık, örgüt iklimini olumsuz yönde etkileyebilir. Hastanelerde verilen hizmetlerin doğası gereği, güçlü bir örgüt ikliminin varlığı çalışanlar üzerinde olumlu etkiler yaratmakta, bu da hizmet kalitesinin artmasına ek olarak sağlık personelinin örgütsel güven düzeylerinin iyileşmesine katkı sağlamaktadır (Horuz ve Ünal, 2024).

Yapılan çalışmalar, örgüt ikliminin çalışanların iş tatmini (Salgado ve Giacomozzi, 2019), motivasyonu ve performansları (Berberoğlu, 2018) üzerinde önemli bir etkisi olduğunu ortaya koymaktadır. Ayrıca, olumlu bir örgüt iklimine sahip olan kurumlarda çalışanlar, örgütlerine daha bağlı olmakta (Seyyedmoharrami vd., 2019), işten ayrılma oranları düşmekte ve işlerine daha büyük bir tutkuyla yaklaşmaktadırlar (Hwang ve Chang, 2009). Bu durum, çalışanların motive bir şekilde görevlerini yerine getirmelerine olanak tanırken, aynı zamanda örgüt iklimi üretkenlik ve verimliliği de olumlu yönde desteklemektedir. Söz konusu bu olumlu etkilerden bir diğeri de örgütsel iklimin çalışan güveni üzerindedir. Bu bağlamda çalışma kapsamında ele alınması gereken bir diğer değişken örgütsel güven kavramıdır.

Genel anlamda güven, bireylerin başkalarına ne kadar güvenme eğiliminde olduklarının ve onlara karşı kendilerini ne kadar açık ve savunmasız hale getirdiklerinin bir göstergesi olarak kabul edilmektedir (Uğurluoğlu vd., 2015). Örgütsel güven, çalışanların yönetime olan güven düzeyleri ve yönetimin verdikleri bilgilere duydukları inanç olarak ifade edilmektedir. Bu doğrultuda, örgütsel güvenin temeli, üst düzey ve orta düzey yöneticilerin sergilediği davranışlarda yatmaktadır (Halıcı vd., 2015).

Sağlık çalışanlarının örgütsel güvenlerinin yüksek olması, işlerine daha iyi odaklanmalarına katkı sağlamaktadır. Ancak, güven eksikliği yaşadığını hisseden çalışanlarda motivasyon, iş tatmini ve yaratıcılık düzeyleri düşüş gösterebilmektedir. Örgütlerine karşı güvensizlik hisseden sağlık çalışanları,

değişime daha fazla direnç gösterebilmekte ve örgüt içinde sinik tutumlar sergilemeye daha yatkın hale gelmektedir (Gültekin ve Ulusoy, 2022).

Sağlık kurumlarında örgüt iklimi ve örgütsel güven arasındaki ilişki, sağlık hizmetlerinin kalitesi ve etkinliği üzerinde belirleyici bir faktör olarak önem kazanmaktadır. Örgüt iklimi, çalışanların kurum içindeki ortak algıları, değerleri ve davranış biçimlerini ifade ederken, örgütsel güven ise bireyler arası ilişkilerdeki karşılıklı güven ve işbirliği düzeyini yansıtmaktadır. Literatürdeki araştırmalar, sağlık kurumlarında güçlü bir örgüt ikliminin, çalışanların örgütsel güvenlerini artırdığını ve bu durumun sağlık hizmetlerinin sunumunda kalite iyileştirmelerine katkı sağladığını göstermektedir. Bu bağlamda, örgüt iklimi ve örgütsel güven arasındaki dinamik ilişki, sağlık yönetimi ve hizmetlerinde stratejik yönetim açısından önemli bir odak noktası oluşturmaktadır.

YÖNTEM

Çalışmanın Amacı, Deseni ve Süreci: Bu araştırma, meta-analiz tasarımı kullanılarak örgüt iklimi ile örgütsel güven arasındaki ilişkinin yönünü ve anlamlılığını incelemeyi amaçlamaktadır. Paul ve Barari (2022)'ye göre meta-analiz, belirli bir konuda yapılan çok sayıda çalışmanın bulgularını bir araya getirerek genel bir özet sunan bir istatistiksel yöntemdir. Meta-analiz çalışmaları, yüksek düzeyde kanıt üretmeye imkân tanıyan ve dağınık verileri düzenleyen özellikleriyle, sağlık hizmeti tüketicilerinin algı ve beklentilerinin daha iyi anlaşılmasına katkı sağlar. Aynı zamanda sağlık yönetimi literatürüne ve sağlık kurumları yöneticilerine de önemli çıkarımlar sunar (Benligül vd., 2022).

Meta-analiz yönteminde, ilişki ve fark analizine dayanan araştırmalar yaygın olarak kullanılır. Bu tür çalışmalarda, özellikle korelasyon temelli araştırmaların amacı, farklı çalışmalardan elde edilen verileri birleştirerek ortalama etki büyüklüğünü ve verilerin homojenliğini tespit etmektir. Bu çalışmada da kullanılan korelasyon katsayısı (r), bir etki büyüklüğü parametresi olarak değerlendirilmiştir (Gedik ve Üstüner, 2017).

Tarama Stratejisi ve Dâhil Etme Kriterleri: İlgili çalışmaların belirlenmesi için Google Scholar ve ULAKBİM Sosyal Bilimler Veri Tabanı makaleler, Yükseköğretim Kurulu Ulusal Tez Merkezi ise tezler için tarama yapılmıştır. Tarama işlemi, 2-6 Eylül 2024 tarihleri arasında gerçekleştirilmiş olup, sistematik derleme aşamasında PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) yönergeleri takip edilmiştir. Tarama sırasında şu anahtar kelimeler kullanılmıştır: ("örgüt iklimi" ve "örgütsel güven" ve "hastane") veya ("organisational climate" AND "organisational trust" AND "hospital").

Çalışmaya dâhil edilme kriterleri şunlardır:

- 2017-2024 yılları arasında yapılmış çalışmalar,
- Örgüt iklimi ile örgütsel güven arasındaki ilişkiye odaklanan yayınlar,
- Yayınların Türkçe veya İngilizce olması,
- Yayınların makale veya tez formatında olması,
- Nicel araştırma türünde olması,
- Pearson korelasyon katsayısı veya standardize edilmiş regresyon katsayısı ile örneklem büyüklüğü değerlerinin raporlanmış olması.

Bu kriterleri karşılayan toplam 8 çalışma meta-analize dâhil edilmiştir.

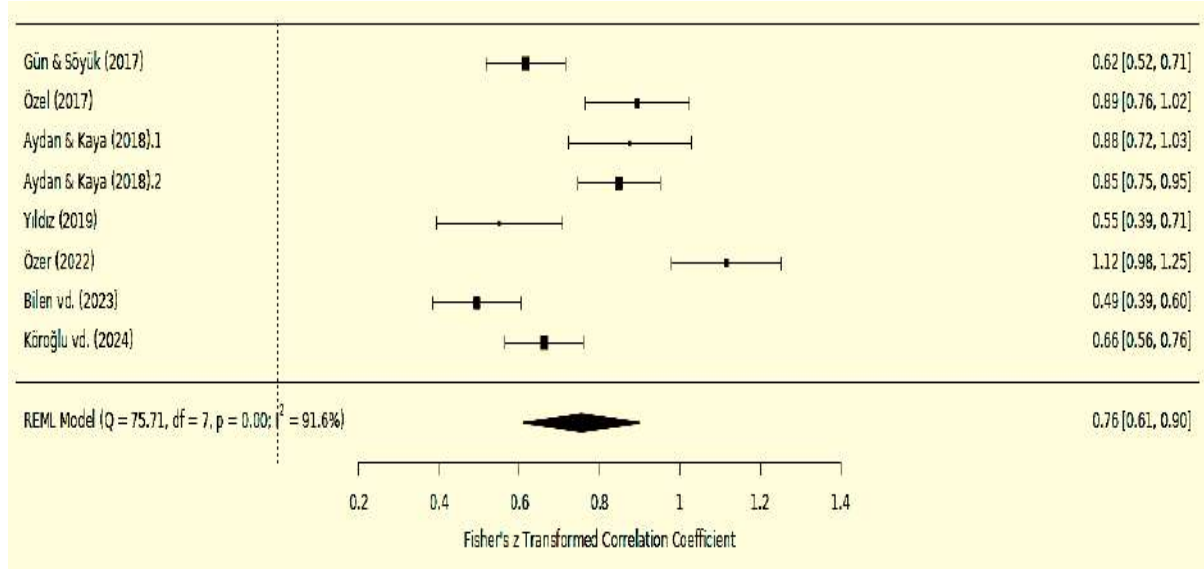
Verilerin Analizi: Veriler metaHUN programı ile analiz edilmiştir. Her çalışmanın yazarları, yayın yılı, korelasyon katsayıları ve örneklem büyüklükleri programa girilmiştir. Program, bu verilere dayalı olarak her çalışma için korelasyonun alt ve üst sınır değerlerini, z ve p değerlerini otomatik olarak hesaplamaktadır. Yapısal eşitlik modeli veya regresyon analizlerinin kullanıldığı çalışmalarda, korelasyon katsayıları yerine standardize edilmiş regresyon katsayıları dikkate alınmıştır.

BULGULAR

Çeşitli dâhil etme ve dışlama kriterlerinin kullanıldığı çalışmada 2017-2024 tarihleri arasında 39 araştırmaya ulaşılmış olmasına rağmen 8 tanesi meta-analize dâhil edilmiştir. Bu çalışmayla 8 araştırma bir araya getirilerek 2271 kişilik örneklem grubu elde edilmiştir. Çalışmaya dâhil edilen yayınların %50'sinin 2017-2018 yıllarına ait olup İstanbul ve Ankara illerinde yürütüldüğü tespit edilmiştir. Yayınların %62,5'inin Türkçe dilinde ve makale türünde olduğu, makalelerin ise %60'ının TR dizinde indekslendiği belirlenmiştir. Yayınların %37,5'inin örneklem grubunu yalnızca hemşirelerin oluşturduğu saptanmıştır.

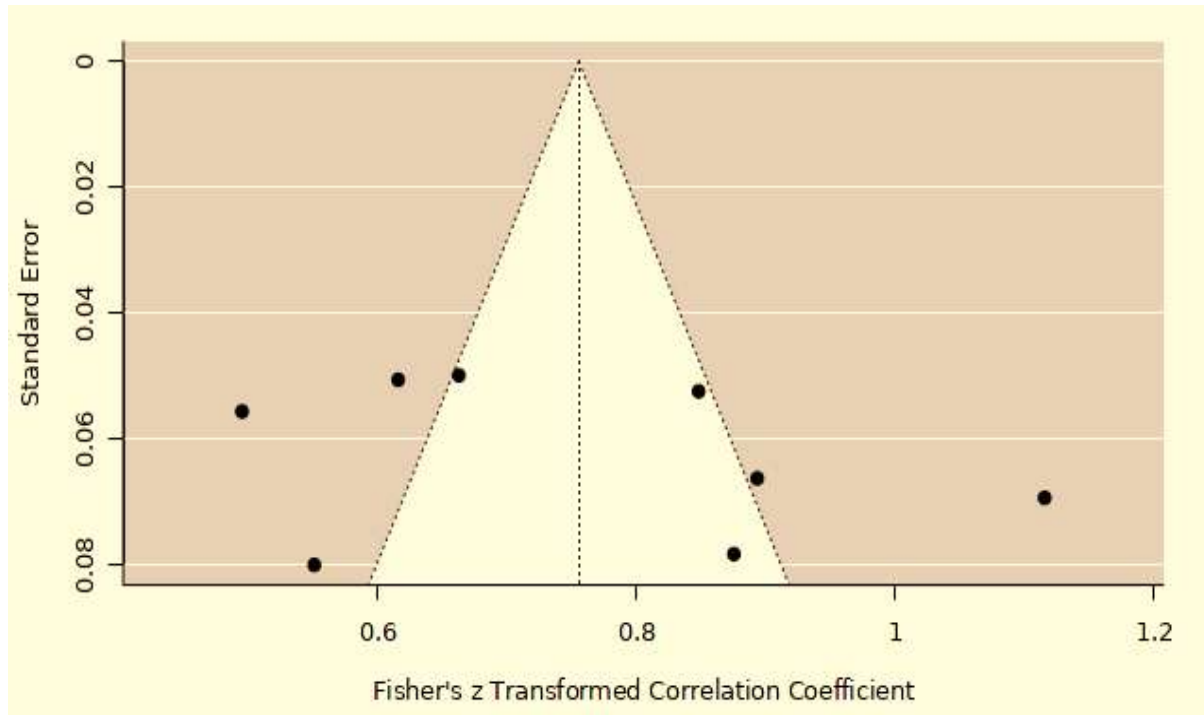
Palamutçu vd. (2016)'ne göre Q istatistiğine ait p değerinin 0,05'ten küçük olması ve I² değerinin en az %70'lik bir değer alması heterojenliğin bir göstergesidir ve rastsal etkinin referans alınmasını gerektirmektedir. Bu doğrultuda, homejenlik sonuçlarını içeren Q (75,710), I² (91,613) ve p(0,000)

değerleri incelendiğinde tüm değişkenlerin yüksek düzeyde bir heterojenlik içerdiği anlaşılmaktadır. Dolayısıyla ortalama etki büyüklüğü ve güven aralığı düzeylerinin değerlendirilmesinde rastsal etki modeli temel alınmıştır. Örgüt iklimi ve örgütsel güven arasındaki ilişkinin ortalama etki büyüklüğüne ve diğer parametrelerine ilişkin değerler Şekil 1’de sunulmuştur.



Şekil 1. Örgüt iklimi ve örgütsel güven arasındaki ilişkinin ortalama etki büyüklüğü

Şekil 1’de yer alan değerler incelendiğinde, örgüt iklimi ve örgütsel güven değişkenleri arasında rastsal etki modeline göre 0,76’lık bir etki vardır. Cohen (1992)’ye göre bu katsayının 0,50 ve üzerinde olması yüksek düzeyde bir etki büyüklüğünü göstermektedir. %95 güven aralığında rastsal etki modelinde etki büyüklüğü 0,61 ile 0,90 arasında değişmektedir. Şekil 2’de, yayın yanlılığı olup olmadığına dair gerçekleştirilen Funnel Plot (Huni Grafiği) yer almaktadır.



Şekil 2. Örgüt iklimi ve örgütsel güven arasındaki ilişkiye ait funnel (huni) grafiği

Şekil 2’de de görüldüğü üzere; çalışmaların büyük bir kısmının şeklin üst kısmında ve birleştirilmiş etki büyüklüğüne yakın bir konumda simetrik olarak yer almaktadır. Bu bağlamda sınırlı da olsa

çalışmalarda yayın yanlılığının olmadığı belirtilebilir. Fakat bu yöntem, yayın yanlılığının tespitinde tek başına yeterli görülmediği için birkaç farklı yöntemle de yanlılık saptamasının teyit edilmesi gerekmektedir. Bu bağlamda yapılacak olan ilk değerlendirme Rosenthal Güvenli N sayısıdır.

Rosenthal (1979)'e göre, $N/5k+10>1$ ise, meta-analiz sonuçları güçlüdür ve yayın yanlılığı yoktur. Formüldeki k, meta analize dâhil edilen çalışma sayısını (k: 8), N ise çalışmaya dâhil edilen tüm yayınların toplam örneklem hacmini (N: 2271) ifade etmektedir. Bu durumda $45,4>1$ sonucuna erişilmekte ve bu durum çalışmalarda yayın yanlılığının olmadığı şeklinde yorumlanabilmektedir.

Yanlılık olmadığına ilişkin bir diğer test yöntemi olan (Begg ve Mazumdar, 1994)'in sıra korelasyon testinde, Kendall testine ait çift kuyruklu p değeri hesaplanır. Eğer p değeri 0,05'den büyük ise yayın yanlılığının olmadığından söz edilebilir. Çalışmadaki Kendall'a ait Tau değerinin 0,142, p değerinin ise 0,719 olduğu göz önünde bulundurulduğunda çalışmalarda yayın yanlılığının olmadığı ifade edilebilir. Huni grafiğin asimetrik olup olmadığına dair diğer parametre ise Egger'in Regresyon Testi sonuçlarıdır. Bu test sonucunda p değeri 0,05 değerinden büyük çıkması, yayın yanlılığı olmadığını teyit etmektedir. Çalışmadaki p değerinin 0,461 olduğu göz önünde bulundurulduğunda çalışmalarda yayın yanlılığının olmadığı ifade edilebilir. Özetle dört farklı yöntemin sonuçları da, bu çalışmada yayın yanlılığının olmadığını net olarak ortaya koymaktadır.

SONUÇ ve ÖNERİLER

Meta-analitik desende bu çalışmada, örgüt iklimi ve örgütsel güven değişkenleri arasındaki ilişkilerin sağlık kurumları kapsamında anlamlılığı ve yönü test edilmiş olup, dâhil edilme kriterlerine uyan toplam 8 adet çalışma bu yöntemle analiz edilmiştir.

Çalışmaya dâhil edilen yayınların yarısının 2017-2018 yıllarında gerçekleştirildiği, yarıdan fazlasının makale türünde ve Türkçe dilinde olduğu ortaya konulmuştur. Makale türündeki yayınların yarıdan fazlasının TR dizin kapsamında indekslendiği, örneklem grubunu teşkil eden katılımcıların büyük çoğunlukla hemşirelerden oluştuğu görülmüştür.

Araştırma sonucunda Rastsal etki modeline göre örgüt iklimi ve örgütsel güven değişkenleri arasında istatistiksel olarak anlamlı, pozitif yönde ve güçlü bir ilişki (r: 0,76) saptanmıştır. Diğer bir ifadeyle, sağlık çalışanlarının kurumlarına yönelik örgütsel iklim ortamı algıları iyileştikçe, örgütlerine dair güven düzeyleri de yükselmektedir.

Bu araştırma sonucuna dayalı olarak, örgüt iklimi ve örgütsel güven arasındaki güçlü, pozitif ilişkiyi desteklemek ve geliştirmek amacıyla aşağıdaki öneriler sunulabilir:

Pozitif Örgüt İklimi Yaratma: Sağlık kurumları, çalışanların örgütsel iklime yönelik olumlu algılarını artırmak için şeffaflık, adalet, destekleyici liderlik ve etkili iletişim gibi unsurları güçlendirmelidir. Çalışanların fikirlerine değer verilmesi, açık bir iletişim kanalı oluşturulması ve adil yönetim uygulamaları, örgütsel güveni güçlendirebilir.

Çalışan Katılımını Artırma: Karar alma süreçlerine çalışan katılımını artırmak, çalışanların örgüte olan bağlılığını ve güvenini pekiştirebilir. Düzenli geri bildirim mekanizmaları ve çalışanların fikirlerini ifade etmeleri için platformlar oluşturulması, olumlu bir örgüt iklimi yaratılmasına katkı sağlar.

Eğitim ve Gelişim Fırsatları: Sağlık çalışanlarının mesleki gelişimlerini destekleyen eğitim ve gelişim fırsatları sunmak, onların kuruma olan güvenlerini artırabilir. Bu tür programlar çalışanların yetkinliklerini geliştirmesine yardımcı olurken, örgüt iklimine dair olumlu algılar da yaratabilir.

Liderlik Gelişim Programları: Yönetici ve liderlerin, çalışanların güvenini kazanmada kritik bir rol oynadığı göz önüne alındığında, liderlik gelişim programları başlatılmalıdır. Güvenilir, adil ve çalışan merkezli bir liderlik tarzı, hem örgüt iklimini hem de güven düzeyini artırabilir.

Destekleyici Çalışma Ortamı: Fiziksel ve psikolojik olarak destekleyici bir çalışma ortamı yaratmak, sağlık çalışanlarının işlerine olan bağlılığını ve güvenini artırabilir. Çalışan refahına yönelik politikaların geliştirilmesi ve iş-yaşam dengesi sağlanması, güveni artıran faktörler arasındadır.

İzleme ve Değerlendirme: Örgüt iklimi ve örgütsel güveni düzenli olarak izlemek ve değerlendirmek amacıyla anketler ve geri bildirim süreçleri uygulanmalıdır. Bu, sorunlu alanların tespit edilmesine ve zamanında iyileştirici önlemler alınmasına olanak tanır.

Bu öneriler, sağlık kurumlarındaki örgüt iklimini ve güven düzeyini artırarak, daha verimli ve memnuniyet odaklı bir çalışma ortamı yaratılmasına katkı sağlayabilir.

KAYNAKLAR

Akbulut, Y., & Kutlu, G. (2016). Örgüt ikliminin belirlenmesi: kamu hastanesi örneği. *Hacettepe sağlık idaresi dergisi*, 19(3), 255-270.

- Begg, C. B., & Mazumdar, M. (1994). Operating characteristics of a rank correlation test for publication bias. *Biometrics*, 50(4), 1088-1101.
- Benligül, E. M., Bektaş, M., & Arslan, G. (2022). Meta-analizi anlamak ve yorumlamak: hemşireler için öneriler. *Dokuz Eylül Üniversitesi Hemşirelik Fakültesi Elektronik Dergisi*, 15(1), 74-86.
- Berberoglu, A. (2018). Impact of organizational climate on organizational commitment and perceived organizational performance: empirical evidence from public hospitals. *BMC health services research*, 18, 1-9.
- Cohen, J. (1992). A power primer. *Psychological Bulletin*, 112(1), 155-159.
- Doğan, H., & Üngüren, E. (2009). Farklı Meslek Gruplarındaki Çalışanların Örgüt İklimi Algılamaları Ve Alanya Başkent Hastanesi'nde Bir Araştırma. *Gazi Üniversitesi İktisadi ve İdari Bilimler Fakültesi Dergisi*, 11(2), 41-58.
- Gedik, A., & Üstüner, M. (2017). Eğitim örgütlerinde örgütsel bağlılık ve iş doyumunu ilişkisi: Bir meta analiz çalışması. *E-Uluslararası Eğitim Araştırmaları Dergisi*, 8(2), 41-57.
- Gültekin, D. ve Ulusoy, H. (2022). Sağlık Çalışanlarında Sanal Kayıt ve Örgütsel Güven Arasındaki İlişkinin Belirlenmesi, *Sağlık Yönetimi ve Liderlik Dergisi*, (1), 70-97
- Gün, İ., & Söyük, S. (2017). Sağlık kuruluşlarında örgüt iklimi ve örgütsel güven arasındaki ilişki. *Acıbadem Üniversitesi Sağlık Bilimleri Dergisi*, (1), 40-48.
- Halıcı, M., Söyük, S., & Gün, İ. (2015). Sağlık Çalışanlarında Örgütsel Güven. *Journal of Management and Economics Research*, 13(3), 180-198.
- Horuz, S. Ş., & Unalan, D. (2024). Hemşirelerde Örgüt İklimi İle Çalışan Sağlığı ve Güvenliği Kültürü Algısı Arasındaki İlişki. *Ebelik ve Sağlık Bilimleri Dergisi*, 7(1), 51-59.
- Hwang, J. I., & Chang, H. (2009). Work climate perception and turnover intention among Korean hospital staff. *International nursing review*, 56(1), 73-80.
- Örgev, C., & Sütü, E. S. (2018). Sağlık çalışanlarının hizmetkâr liderlik algılarının örgüt iklimi ve örgütsel bağlılık üzerine etkileri: Bir kamu hastanesi örneği. *Sağlık Akademisyenleri Dergisi*, 5(1), 47-53.
- Palamutçuoğlu, B. T., Çavuşoğlu, S., & Terzi Palamutçuoğlu, A. (2016). Örgütsel adalet ile iş tatmini arasındaki ilişkiye meta-analitik bir yaklaşım. *Alanya İşletme Fakültesi Dergisi*, 8(2), 203-216.
- Paul, J., & Barari, M. (2022). Meta-analysis and traditional systematic literature reviews— What, why, when, where, and how? *Psychology & Marketing*, 39, 1099-1115.
- Rosenthal, R. (1979). The file drawer problem and tolerance for null result. *Psychological Bulletin*, 86, 638-641
- Salgado, M. A., & Giacomozzi, A. M. (2019). Job satisfaction and organizational climate in primary health care staff of a commune in Chile. *Revista Médica de Risaralda*, 25, 157-166.
- Seyyedmoharrami, I., Dehaghi, B. F., Abbaspour, S., Zandi, A., Tatari, M., Teimori, G., & Torbati, A. G. (2019). The relationship between organizational climate, organizational commitment and job burnout: Case study among employees of the university of medical sciences. *The Open Public Health Journal*, 12(1).
- Uğurluoğlu, Ö., Köse, S. D., & Köse, T. (2015). Sağlık Çalışanlarının Hizmetkâr Liderlik Algılarının Lider-Üye Etkileşimi Ve Örgütsel Güven Üzerindeki Etkisi. *Türkiye Sosyal Araştırmalar Dergisi*, 19(2), 239-262.

SINIF ÖĞRETMENLERİNİN İLKOKUMA YAZMA SÜRECİNDE KARŞILAŞTIKLARI ÖĞRENCİ KAYNAKLI SORUNLARIN İNCELENMESİ

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Bu araştırmada ilkokullarda görev yapan sınıf öğretmenlerinin ilkokuma ve yazma sürecinde yaşadıkları durumları ve karşılaştıkları zorlukları belirlemek amaçlanmıştır. Araştırma, nitel bir araştırma olarak tasarlanmış olup olgubilim (fenomenoloji) deseni kullanılmıştır. Araştırmanın katılımcılarını 2023-2024 eğitim-öğretim yılında Bingöl ilinin Genç ilçesinde resmi okullarda görev yapan 17 sınıf öğretmeni oluşturmaktadır. Araştırmada veri toplama aracı olarak görüşme formu kullanılmıştır. Araştırmaya katılan sınıf öğretmenlerinin yarı yapılandırılmış görüşme formunda yer alan sorulara verdikleri cevaplarla elde edilen veriler içerik analiz tekniği ile analiz edilmiştir. Araştırmadan elde edilen bulgular birinci sınıf öğretmenlerinin ilkokuma yazma sürecindeki öğrencilerden kaynaklanan; sorunlar teması, Türkçe teması, sosyokültürel- ekonomik özellikler teması ve Öğrenci Özellikleri Teması şeklinde dört temaya ayrılmış ve her tema kendi içerisinde kodlamalara ayrılarak bulunan kodlar ilgili kısımlara yazılarak tablolara aktarılmıştır. Öğrencinin okuma ve yazma sürecinde karşılaştığı sorunlar; psikolojik, fiziksel ve çevresel sorunlar, ilkokuma yazma sürecindeki Türkçe teması; Türkçeyi anlama ve Türkçeyi kullanma, sosyokültürel ve ekonomik özellikler teması; Öğrencilerin sosyokültürel ve ekonomik farklılıkların olumlu etkisi ve olumsuz etkisi öğrenci özellikleri teması; öğrenci ilgileri ve öğrenci tutumları şeklinde kategorilere ayrılmış olup verilen yanıtlar ayrıntılı incelenerek uygun olan kodlar oluşturularak analiz edilmiştir. Bulgulardan yola çıkılarak sonuçlar oluşturulmuş, literatürde yapılan araştırmalarla sonuçlar tartışılmıştır. Araştırmada ulaşılan sonuçlar dikkate alınarak öneriler yapılmıştır. Anahtar Sözcükler: Birinci Sınıf, İlkokuma Yazma, Öğrenci

This study aimed to determine the situations and difficulties experienced by primary school classroom teachers in the basal reading and writing process. The research was designed as a qualitative research and the phenomenology design was used. The participants of the research consisted of 17 classroom teachers working in public schools in the Genç district of Bingöl province in the 2023-2024 academic year. An interview form was used as the data collection tool in the research. The data obtained from the answers given by the classroom teachers who participated in the research to the questions in the semi-structured interview form were analyzed using the content analysis technique. The findings of the research were divided into four themes as the theme of problems arising from students in the basal reading and writing process of first grade teachers, the theme of Turkish language, the theme of sociocultural-economic characteristics and the theme of student characteristics and each theme was divided into codes within itself and the codes found were written in the relevant sections and transferred to the tables. The problems encountered by the students in the reading and writing process; psychological, physical and environmental problems, the theme of Turkish in the basal reading and writing process; understanding and using Turkish, the theme of sociocultural and economic characteristics; The positive and negative effects of sociocultural and economic differences on students were divided into categories as student characteristics theme; student interests and student attitudes, and the answers given were analyzed in detail and appropriate codes were created. Conclusions were created based on the findings, and the results were discussed with the research conducted in the literature. Suggestions were made considering the results reached in the research.

Keywords: First Grade, Primary Reading and Writing, Student

1.GİRİŞ

Araştırmanın bu bölümünde; problem durumu, araştırmanın amacı, alt amaçları, araştırmanın önemi, varsayımları, sınırlılıkları ve tanımlarına yer verilmiştir.

1.1. Problem Durumu

İlkokuma ve yazma dersi çocuğun ilkokulda aldığı en temel derslerden biridir. Çocuk ufak tefek başarıma duygularını tadarak harften heceye, heceden kelimeye kelimeden de cümleye ulaşır. Bu ulaşma ve başarıma duygularını tadınca etrafındaki her şeyi okumaya başlar. Bu bazen bir yemek tarifi olur bazen de bir gazete sayfası. Çocuğun İlkokuma yazma dersinde öğrenmesi gereken şey sadece harfleri birleştirmek değildir. İyi geçen bir okuma ve yazma süreci çocuğun belki de tüm eğitim hayatını etkileyecektir. Öğrencilerin çoğu ilk kırılmayı İlkokuma ve yazma dersinde yaşıyor. Bu sebeple ders çok önemli olup, öğretmenin üzerine düşen sorumluluğun önemi bir hayli fazladır. Bu sorumluluk beraberinde birçok sorunu da getirmektedir. Bu çalışmayla öğretmenlerimizin yaşadığı sorunların bir kısmını belirleyip bunlara çözüm önerileri geliştirdim.

Dil becerilerinin oluşumu insanlarda doğuştan başlayan ve ömür boyu devam eden bir süreci kapsamaktadır. Çocuk, doğduğu andan itibaren dil oluşumunda önemli bir etken olan dinleme, anlamlı veya anlamsız sesler çıkarma ile birlikte çevresini gözlemleyerek görsel okuma yapar. Çocuğun dil oluşumu süresince; dinleme, konuşma ve görsel okuma faaliyetleri kendiliğinden oluşan ve bir sisteme dayanmayan, gelişigüzel bir biçimde devam eder (Bayraktar ve Girgin, 2021). Nitekim ilkokuma ve yazma bireyin eğitim hayatının özünü oluşturur (Aktürk ve Mentiş 2011). Temelleri okul öncesi döneme dayanan ilkokuma ve yazma süresinde öncelikle çocuğun dinleme ve görsel okuma sayesinde bilgi, duygu aynı zamanda düşünce evreni inşa edilir ve büyür (Bayraktar ve Girgin, 2021).

Çocuğun ilkokula başlamasıyla birlikte çevresinin genişlemesi onun ihtiyaçlarının, bilgilerinin, yaşamışlıklarının ve hepsinden önemlisi de kendini ifade etme gücünün gelişmesine olanak tanır. İlkokul döneminde özellikle Türkçe dersi kapsamında verilen eğitim ile bu gelişmeler sistemli bir şekilde hızlanır. Bu sistemin oluşması ile de ilkokuma ve yazma süreç planlı programlı bir şekilde devam eder (Sağırlı, 2015).

Calp (2013) göre, “*Öğrenciler öğrenme, planlı çalışma, görev ve sorumluluk üstlenme, kendi kendine iş yapma ve başarıma, yeteneklerini geliştirme gibi temel beceri ve alışkanlıkları öğrencilik dönemlerinin ilk yıllarında, özellikle, birinci sınıfta kazanırlar.*” İlkokuma ve yazma da bu en temel beceriler arasında yer almaktadır.

İlkokuma yazma eğitimi, okuma ve yazma şeklinde gruplandırılabilir. Sınıfa uyum noktasında yeterliliğini sağlayan öğrencilerin her iki faaliyeti de eş zamanlı olarak uygulayabilme becerisine sahip olması gerekmektedir (Bayraktar ve Girgin, 2021).

Okuma kavramının tanımını Akyol (2021), “*Ön bilgilerin kullanıldığı, yazar ve okuyucu arasındaki etkili iletişime dayalı, uygun bir yöntem ve amaç doğrultusunda, düzenli bir ortamda gerçekleştirilen anlam kurma süreci*” olarak ifade etmektedir. Yazma kavramı ise “*Düşüncelerimizi tanımlamak amacıyla gerekli olan sembollerle işaretleri motor beceriler olarak oluşturabilmek*” olarak tanımlamaktadır (Akyol, 2013).

İlkokuma yazma kavramı çocuğun sözlü dil ile beraber yazılı dile geçtiği yeni bir aşama olarak değerlendirilmektedir. Oluşan bu yeni aşamada yazı dilinin sembollerini seslendirmeyi öğrendiği aynı zamanda duygu ve düşüncelerini yazabildiğini gördüğü döneme “ilkokuma ve yazma” denir (Ferah, 2007). Ayrıca, ilkokula başlayan bir öğrenci, ilk okuma yazma sürecini başarıyla tamamlayabilirse bu başarıyı ileriki dönemlerde sürdürme olasılığı oldukça yüksektir. Zira ilkokul döneminde çocuğun okuma ve yazma faaliyetlerini başarıyla yerine getirmesi beklenir. “*Okumadan beklenen asıl sonuç düşünce ve duygu aktaran yazıları anlamaktır. Bu anlama etkinliği gerçekleştiği zaman okuma başarılı ve amacına ulaşmış olur*” (Ege, 2011).

İlkokuma ve yazma kavramının başarıyla yerine getirilmesi için sınıf öğretmeninin birinci sınıf dönemini dikkatlice yönetmesi ve öğrencilere kapsamlı bir eğitim sunması gerekir (Akyol, 2005). Çünkü akademik başarı, ilk adımların doğru atılmasıyla sağlanır ve bu da öğrencilerin gelecekteki öğrenim süreçlerini etkiler. Eğitim, bireylerin kişisel ve entelektüel gelişimine önemli katkıda bulunan hayati bir süreçtir. İlkokuma yazma becerilerinin kazanılması, bu eğitim sürecinde temel bir kilometre taşı olarak kabul edilmektedir. Sınıf öğretmenleri, bu önemli dönemde öğrencilerin dil becerilerini geliştirmek, yazma ve okuma alışkanlıklarını kazandırmak gibi kritik bir rol üstlenmektedir (Akyol, 2007). Ancak sınıf öğretmenleri, ilkokuma yazma sürecinde çeşitli öğrenci profilleriyle karşılaşarak farklı sorunlarla karşılaşabilmektedir.

İlkokuma yazma süreci, öğrencilerin dil gelişimi, bilişsel yetenekleri ve öğrenme tarzları açısından çeşitli zorlukları beraberinde getirebilir. Bu zorluklar, sınıf öğretmenlerini çeşitli stratejiler geliştirmeye, bireysel öğrenci ihtiyaçlarına uygun öğretim yöntemleri belirlemeye ve pedagojik becerilerini daha da güçlendirmeye yönlendirmektedir (Arslan, 2007). Bu bağlamda, sınıf öğretmenlerinin karşılaştığı sorunlar, ilkokuma yazma sürecinin etkin bir şekilde sürdürülmesini engelleyici nitelikler kazanmasını sağlar.

Sınıf öğretmenin ilkokuma ve yazma eğitiminin başlangıç aşamasında çocuğun dikkatini çekmek, motivasyonunu sağlamanın yanı sıra dersle olan ilgisini artırmak amacıyla çeşitli uygulamalar yapılmasını zorunlu kılmaktadır. Bu sebeple öğretmenlerin ders sürecinde çocukların birden fazla duyu organına hitap eden ve onların ilgisini çeken materyaller kullanması, öğretilmek istenen konunun kalıcılığını arttıran faktörler arasında yer almaktadır (Güneş vd., 2016). Ancak karşılaşılan sorunlar sadece öğretmenin yöntem ve teknik kullanımdan kaynaklanmamakta olup farklı sorunların da var olduğu bilinmektedir. Bu araştırmanın problem cümlesi, bu sorunların neler olduğunu belirlemeye yönelik belirlenmiştir.

2.YÖNTEM

Bu bölümde araştırma deseni, evren ve örneklem, araştırmanın katılımcılarına ait betimsel istatistiksel ifadeleri, verilerin analizi ve verilerin toplanması hakkında bilgiler ifade edilmiştir.

3.1. Araştırma Modeli

Araştırma kapsamında nitel araştırmalardan olgubilim (fenomenoloji) deseni kullanılmıştır. Bu desenle öğretmenlerin deneyimlerini derinlemesine anlamak ve analiz etmek hedeflenmiştir. Olgubilim deseninin doğasına en uygun veri toplama aracı görüşme formu, araştırmada veri toplama aracı olarak tercih edilmiştir. Yıldırım ve Şimşek'e (2016) göre olgubilim deseni, var olan durumların farkında olunmasına rağmen, bu durumların derinlemesine ve detaylı bir şekilde araştırılarak ifade edilmesi sürecini içeren bir desendir. Bu yönüyle, sınıf öğretmenlerinin ilkokuma ve yazma süreçlerinde karşılaştıkları durumların derinlemesine incelenmesi amaçlanmıştır. Ersoy (2019) ise olgubilim deseninin, kişilerin davranışları veya ifadelerinin tüm yönleriyle araştırıldığı en iyi yöntem olduğunu belirtmektedir.

Araştırmada gerçekleştirilen olgubilim deseninin amacı, olayın derinlemesine incelenmesidir. Bu desenin tercih edilmesindeki sebep, ilkokuma ve yazma sürecindeki olguyu daha iyi tanımlaması ve bu konuda bir bakış açısı kazandırması açısından uygun olduğunun düşünülmesidir.

3.2. Katılımcılar

Sınıf öğretmenlerinin ilkokuma ve yazma sürecinde karşılaşmış oldukları durumların incelendiği bu araştırmanın katılımcı grubunu Bingöl'de görev yapan sınıf öğretmenleri oluşturmaktadır. Bu araştırmada nitel araştırma yöntemi için seçilmiş 17 öğretmen yer almaktadır. Araştırmada seçilen örnekleme metodu amaçlı örnekleme metodudur. Amaçlı örnekleme bir alanda ya da çalışmadaki grubun bilgisel ya da yaşanmış deneyimi olarak bir konu hakkındaki derinlemesine incelemenin gerçekleşeceği durumlarda tercih edilmektedir (Büyüköztürk, Çakmak Kılıç, Akgün, Karadeniz ve Demirel, 2012). Bu sebepten dolayı araştırmanın olgubilim desenine en uygun örnekleme metodu olan amaçlı örnekleme metodu seçilmiştir.

3.2.1.Araştırmanın Katılımcılarına Ait Bazı Demografik Bilgiler

Araştırmanın doğasına uygun olarak amaçlı örnekleme metodu ile oluşturulan örneklem grubuna ait bazı bilgiler aşağıda ifade edilmiştir. Buna göre 2023-2024 eğitim öğretim yılında Bingöl ilindeki merkez ve ilçelerde görev yapan sınıf öğretmenleri katılımcı grubunu oluşturmaktadır. Araştırmada sınıf öğretmenlerinin kadrolu öğretmen olması ve resmi devlet okullarında görev yapmasına dikkat edilmiştir. Araştırmaya katılan katılımcılara ait veriler Tablo 1'de yer almaktadır.

Tablo 1.*Katılımcılara Ait Demografik Bilgiler*

Değişken	f	%
Cinsiyet		
Erkek	7	41,18
Kadın	10	58,82
Kıdem yılı		
1-5	7	41,17

6-10	7	41,17
10 üstü	3	17,66
Deneyim durumu		
Deneyimli	11	64,71
Deneyimsiz	6	35,29
Sınıf Düzeyi		
1.Sınıf	3	17,64
2.Sınıf	2	11,76
3.Sınıf	2	11,76
4.Sınıf	3	17,64
Birleşmiş sınıflar	7	41,17
Görev Yeri		
Merkez	5	29,11
İlçe	4	23,52
Belde	4	23,52
Köy	4	23,52
Görev Yılları		
1-10	2	11,76
10-20	8	47,05
20 üstü	7	41,17

3.3.Verilerin Toplanması Süreci

Araştırmadaki katılımcılarla görüşmeler 2023-2024 eğitim öğretim yılında farklı zamanlarda Mart-Nisan-Mayıs aylarında gerçekleştirilmiştir. Katılımcılar ile gerçekleştirilen görüşmeler öncesinde, gerekli izinler alınmış ve katılımlar gönüllülük esas çerçevesinde gerçekleştirilmiştir. Görüşmeler genelde yüz yüze gerçekleştirilmiştir. 2 görüşme zoom uygulaması üzerinden gönüllülük esasına dayanarak kayda alınmıştır. Yapılan görüşmeler daha sonra Google Dökümanlar uygulaması kullanılarak sistemli biçimde yazıya dökülmüştür. Katılımcıların görüşleri şeffaf ve objektif biçimde ifade etmesi için gerekli düzenlemeler görüşme öncesi yapılmış ve görüşme sonrasında da katılımcıların görüşleri kodlama yapılarak ifade edilmiştir.

3.4.Veri Toplama Araçları

Olgubilim araştırmalarında en sık kullanılan veri toplama araçlarından biri görüşme yöntemidir (Kocabıyık, 2016). Bu yöntemde, katılımcıların yaşantıları ve deneyimleri derinlemesine araştırılır ve birden fazla görüşme sonucunda elde edilen veriler genellikle içerik analizi ile değerlendirilir. Araştırmada 5 sorudan oluşan, araştırmacı tarafından hazırlanan yarı yapılandırılmış görüşme formu veri toplama aracı olarak hazırlanmıştır.

3.4.1.Yarı Yapılandırılmış Görüşme Formu

Araştırmada veri toplama aracı olarak önceden hazırlanmış yarı yapılandırılmış görüşme formu tercih edilmiştir. Yarı yapılandırılmış görüşme formu için literatür taraması yapılmış ve olgubilim desenine uygun olduğu tespit edilmiştir. Yarı yapılandırılmış görüşme formunun seçilmesinin bir diğer amacı da derinlemesine bilgilerin analizinde kullanılabilir olması olmuştur. Yıldırım ve Şimşek (2016)'e göre yarı yapılandırılmış görüşmelerde, belli amaç için toplanan katılımcıların olması ve kişilerin kendilerini rahat hissetmeleri sebebiyle objektif ve şeffaf olmalarını sağlaması görüşmelerden elde edilen verilerin derinlemesine analiz edilmesini kolaylaştıracaktır. Yarı yapılandırılmış görüşme soruları belirlendikten sonra pilot uygulama ve uzman görüşü alınmıştır. Uygulama ve uzman görüşünde bir problem çıkmaya da uygulama sırasında 1. ve 2. sorunun benzer sonuçlar içerdiği görülmüştür. Benzer sonuçlar içeren bu iki soru bulgular esnasında tek bir soru altında birleştirilerek tema ve kodlara ayrılmıştır. Yarı yapılandırılmış görüşme formunun ilk aşamasında kişisel bilgi formu yer almış ikinci kısmında ise 5 sorudan oluşan görüşme sorularına yer verilmiştir. Buna göre Yarı yapılandırılmış görüşme formunun içeriği aşağıdaki gibidir:

1. Öğrencilerinizin eğitim öğretimde ilk yılları olduğu için ilkokuma yazma sürecini olumsuz etkileyen sorunlar yaşıyor mu? Cevabı evet ise bu sorunlar nelerdir?
Fiziksel sorunlar, psikolojik sorunlar ve grup çalışmalarında karşılaştığınız sorunlar nelerdir?

2. Öğrencilerinizin ilkokuma yazma için temel becerilerden dinleme-konuşma becerilerinden eksikleri olduğunu düşünüyor musunuz? Cevabınız evet ise bu eksiklikler ilkokuma yazma sürecinde hangi sorunları yaşamınıza neden oluyor?
3. Öğrencileriniz harf öğretim sürecinde Türkçeyi anlama ve kullanma açısından sorunlar yaşıyorlar mı? Cevabınız evet ise bu sorunlar nelerdir
4. Öğrencilerinizin arasındaki sosyokültürel ve ekonomik farklılıkların ilkokuma yazma sürecine nasıl bir etkisi oluyor?
5. Öğrencilerinizin ilkokuma yazma sürecine ilişkin ilgi ve tutumları nasıldı?
Dersi dinleme, sevmeye, ilgi ve motivasyonları nasıldı?

3.5. Veri Toplama Araçlarının Uygulanması

Veri toplama aracı olan yarı yapılandırılmış görüşme formu 2023-2024 yılının bahar yarısında Bingöl ili Genç İlçesinde öğrenim gören 17 öğretmene uygulanmıştır.

3.6. Verilerin Analizi ve Yorumlanması

Bu araştırmanın analiz kısmında da olgubilim deseninin özünde olan derinlemesine araştırmayı sağlamak amacıyla içerik analizi yapılmıştır. Araştırmada gerçekleştirilen analizlerin Yıldırım ve Şimşek'in (2016) nitel araştırma verilerinin analizinde kullanılan içerik analizinin 4 aşamada gerçekleştiğini aşağıdaki şekilde ifade etmiştir;

1. İçerik analizinin ilk aşaması olan verilerin kodlanması aşamasıdır. Buna göre görüşmelerde bir düzen içerisinde bölümlere ayrılarak kodlanması sağlanmıştır. Öğretmenlerin görüşleri bu aşamada kendi içinde bir kavram sözcük ile kodlanmıştır. Araştırmanın bu aşamasında verilerden çıkan kavramlara göre kodlama gerçekleştirilmiştir.
2. Verilerin kodlanması gerçekleştirildikten sonra verilerin temalara ayrılması gerçekleştirilmiş ve temalar oluşturularak kodlamalar temalara dağıtılmıştır.
3. Verilerin kod, tema ve kategorize edilmesi sağlanarak doğru kavram ve ifadelerin bulunduğu sıvanmıştır. Kategorize edildikten sonra verilerin doğru biçimde yer alıp almadığı tespit edilerek ilişkiler kurulmuştur.
4. İçerik analizinin Tema ve Kod boyutu sağlandıktan sonra bulgular sistemli bir biçimde derinlemesine ifade edilmiş ve açıklanmıştır. Bulgular alıntı ve kaynakçalar ile desteklenerek sunulmuştur.



Şekil 1. Öğretmen Görüşlerinin İçerik Analizi Sıralaması

Görüşmeler sonucunda ortaya çıkan verilerin analizinde Eroğlu ve Bektaş'ın (2016) Fen bilgisi öğretmenlerinin stem eğitimi ile ilgili görüşleri çalışması örnek alınmıştır. Verilerin analizinde içerik analizi tercih edilmiştir. Yıldırım ve Şimşek'e göre içerik analizi yöntemi, araştırmalardaki derinlemesine ve detaylı bilgilerin ortaya çıkmasını sağlamaktadır şeklinde tanımlanmıştır. Araştırma sonucunda ortaya çıkan veriler derinlemesine bir biçimde tablolara tema ve kod şeklinde aktarılmıştır. Aktarılan verilere ait görüşleri belirtmek amacıyla öğretmenlerin bazı ifadelerine yer verilmiştir. Araştırmada yer alan öğretmenlerin kimliğinin açığa çıkmasını önlemek amacıyla, katılımcılar "Ö1, Ö2.....vb." şeklinde kodlanarak tablolarda yer verilmiştir. Öğretmenlerin görüşleri önce temalara ayrılmış ve daha sonra kodlama yapılmıştır. Tema ve kodlara ayrılan görüşler sonucunda öğretmenlerin görüşleri bir kavram veya sözcük şeklinde gösterilmiştir.

Araştırma sürecinde, gerekli ölçek değerlendirme uzmanı ve diğer uzman görüşleri alınarak, benzer sonuçlar içeren tablolar birleştirilmiş ve düzenlemeler yapılmıştır. Tema ve kodlamalar, araştırmayı gerçekleştiren araştırmacı dışında, ilgili konuda çalışmalar yapan diğer uzmanlar tarafından da incelenmiş ve gerekli dönütler sağlanmıştır. Yarı yapılandırılmış görüşme formuna katılım gösteren öğretmenlerin bazı görüşleri, olduğu gibi değiştirilmeden gösterilmiştir. Araştırmanın güvenilirlik ve geçerliliğinin sağlanması amacıyla, uyum çalışması yapılmış ve diğer uzmanlarla benzer tema ve kodlamalara ulaşılmıştır.

3.SONUÇ, TARTIŞMA VE ÖNERİLER

Araştırmada elde edilen verilerden oluşan bulgular yukarıda ifade edilmiştir. Bu bağlamda bu bölümde bulgulardan yola çıkarak sonuç, tartışma ve önerilere yer verilmektedir.

5.1.Sonuç ve Tartışma

5.1.1. İlkokuma yazma sürecindeki sorunlara yönelik sonuçlar ve tartışma

Araştırmanın birinci alt problemi doğrultusunda, "Öğrencilerinizin eğitim öğretimde ilk yılları olduğu için ilkokuma yazma sürecini engelleyen sorunlar yaşıyor mu? Cevabı evet ise bu sorunlar nelerdir?" ve "Öğrencilerinizin ilkokuma yazma için temel becerilerden dinleme ve konuşma becerilerindeki eksikliklerin hangi sorunlara yol açtığını düşünüyorsunuz?" şeklinde sorular yöneltilmiş ve bu sorulara yanıt aranmıştır.

İlkokuma yazma sürecindeki sorunlara yönelik görüşlerden elde edilen sonuçlara göre farklı temalar ve kodlar belirlenmiştir. Öğretmenlerin ifadelerinden yola çıkarak ilkokuma yazmada ortaya çıkan sorunlar, psikolojik (f:23), fiziksel (f:19) ve çevresel (f:22) temasında incelenmiştir. Psikolojik sorunlar temasında, öğretmenler; özsaygı düşüklüğü, stres ve bunalım, yetersizlik ve başarısızlık, motivasyon ve ilgi eksikliği, dikkatsizlik, öğrenme güçlüğü ve hazırbulunuşluk gibi faktörlere değinmişlerdir. Fiziksel sorunlar temasında ise ince motor becerileri, gelişimsel kas bozuklukları, beslenme ve sağlık konuları ön plana çıkmıştır. Çevresel sorunlar temasında ise uzaklık, sosyoekonomik ve kültürel çevre, iletişim ve uyum, aile baskısı, öğrenme düzeyleri, akranlar arası etkileşim, rol model alma, şiddet ve travmalar ile aile sevgisi gibi unsurlar vurgulanmıştır. Erbasan Ö. ve Erbasan Ü. (2020), Sınıf öğretmenlerinin ilkokuma Yazma Öğretimi Sürecinde Karşılaştığı Sorunları incelenmiş ve öğretmen görüşleri araştırılmıştır. Araştırma sonuçları ile benzer fiziksel sorunların yer aldığı, ince motor becerileri ve gelişim gibi benzer sonuçlara ulaşılmıştır.

İlkokuma yazmada karşılaşılan sorunların birçoğunun dinleme ve konuşma becerilerindeki eksikliklerden de kaynaklandığı ifade edilmektedir. Bu sonuçlar, yine psikolojik, fiziksel ve çevresel faktörlere bağlı olarak değerlendirilmiştir. Literatürde öğretmenlerin benzer sorunlarla karşılaştıkları görülmektedir. Özellikle psikolojik sorunlar boyutunun üzerinde durulmakta ve araştırmanın analiz sonuçlarında da en fazla sorunun psikolojik sorunlardan kaynaklandığı ifade edilmektedir. Bu açıdan araştırma, literatürle olumlu bir korelasyon göstermektedir. Alanyazında, ilkokul öğrencilerinin yazma eğilimlerinin ve okuma alışkanlıklarının değişkenlere göre çeşitli açılardan incelendiği Duran'ın (2018) tezinde, ilkokuma ve yazmada özsaygının ilkokuma ve yazma sürecinde sürecin bir parçası olduğu ve öğrencilerin bundan etkilendiği ifade edilmiştir.

Araştırmalarda, ilkokuma yazma ile ilgili konuşmanın önemi vurgulanmaktadır. Ünal ve Aladağ'ın (2020) gerçekleştirdiği çalışmada, kapsayıcı eğitim uygulamaları bağlamında sorunlar ve çözüm önerileri sunulmuştur. Bu önerilerde konuşmanın ve konuşmadaki iletişimin önemine yer verilmiştir. Çalışma bu bağlamda sınıf öğretmenlerinin görüşleri ile benzer bulgulara ve yorumlara yer vermiştir. Tabak'ın (2021) çalışmasında, ilkokuma yazma sürecinde öğretime etki eden faktörler öğretmen görüşlerine göre incelenmiştir. Bu inceleme doğrultusuna ilkokuma ve yazma sürecinde aile ve okul arkadaşlarının arasında sürekli vakit geçiren öğrencinin çevreden etkileneceği ifade edilmiştir.

5.1.2.İlkokuma ve yazmada öğrencilerin harf öğretim sürecinde Türkçeyi anlama ve kullanma durumlarına ilişkin sonuçlar ve tartışma

Araştırmanın ikinci alt problemi doğrultusunda, "Öğrencileriniz harf öğretim sürecinde Türkçeyi anlama ve kullanma durumları nelerdir?" şeklinde bir soru sorulmuş ve bu soruya yanıt aranmıştır.

İlkokuma yazma sürecinde, sınıf öğretmenlerinin harf öğretim sürecinde öğrencilerin Türkçeyi anlama ve kullanma durumlarına ilişkin farklı tema ve kodlamalar gerçekleştirilmiştir. Öğretmenlerin ifadelerinden yola çıkarak problem durumuna ait temalar; Türkçeyi anlama (f:14) ve Türkçeyi kullanma (f:8) olarak belirlenmiştir. Türkçeyi Anlama Teması; Bu tema kapsamında, okuma yazma, ses-harf ilişkisi kuramama, kritik dönem etkisi ve yabancı uyruklu olma şeklinde kodlamalar yapılmıştır. Türkçeyi Kullanma Teması; Bu tema kapsamında ise, yanlış kullanımlar, farklı dil problemi ve yabancı uyruklu olma şeklinde kodlamalar gerçekleştirilmiştir. Araştırmada yer alan öğretmenlerin görev alanlarında, ağırlıklı olarak ikinci dil olarak Türkçe kullanılmakta ve yabancı uyruklu öğrenciler sınıflarda yer almaktadır. Bu nedenle, problemdeki kodlamaların temeli aslında Türkçenin ikinci dil olarak kullanılması şeklindedir. Türkçeyi anlama ve kullanma durumlarının, ikinci dil olmanın etkisi ve ses-harf ilişkisi üzerinde önemli düzeyde değişikliklere neden olduğu, sınıf öğretmenlerinin görüşlerinde belirtilmiştir. Literatürde aynı durum üzerine birçok çalışma gerçekleştirilmiştir.

Babayiğit ve Erkuş'un (2017) araştırmasında, ilkokuma yazma sürecinde karşılaşılan sorunlara yönelik bir çalışma yapılmıştır. Bu çalışmada, ilkokuma yazma sürecinde öğrencilerin ses-harf ilişkisi kuramaması, ikinci dil etkisi ve kritik dönemde öğrenilmesi gereken dildeki gecikmelere vurgu yapılmıştır. İkinci dil etkisinin ailenin bilincinden de kaynaklanabildiği ifade edilmiştir. Çünkü ailede bilinmesine rağmen Türkçe'nin kullanılmaması öğrencinin okul yaşamının etkilenmesi sonucu ortaya çıkarmaktadır. Bunun sonucunda, Türkçeyi anlama ve kullanma becerilerinin etkilendiği ifade edilmiş ve benzer sonuçlar ortaya konulmuştur.

İlkokuma yazma sürecinde Türkçeyi anlama ve kullanma durumlarının en çok etkilendiği durumun, yabancı uyruklu olma veya Türkçenin ikinci dil olarak kullanılma durumu olduğu ifade edilmiştir. Çalışmanın bu sonucuna göre, literatürde gerçekleştirilen Polat'ın (2019) çalışmasında, yabancılara okuma yazma öğretimi sürecine ilişkin sınıf öğretmenlerinin görüşleri araştırılmıştır. Öğretmenler, çalışmada öğrencilerin ilkokuma yazma sürecinde Türkçeyi kullanma sıklıklarının anlama ve kullanmalarını artırdığını ifade etmiş ve Türkçeyi bilen öğrencilerin sorunlarının daha az düzeyde olduğunu ve hızlı öğrenebildiklerini belirtmiştir. Dolayısıyla hem literatür hem de bu çalışmada, Türkçe dilinin bilinmesinin, ses-harf düzeni sağlama, doğru kullanma ve yabancı dil etkisinden uzak kalma durumlarını olumlu yönde etkilediği sonucuna varılmıştır.

Susar, Özcan ve Şencan'ın (2016) Türkçenin az konuşulduğu bölgelerdeki ilkokuma yazma sürecindeki durumlara ilişkin öğretmen görüşleri incelenmiş ve yabancı uyruklu olma ya da dil farklılığı gibi sebeplerin Türkçe'nin anlam durumuna etki ettiğini belirtmişlerdir. Sınıf öğretmenlerinin de Türkçeyi anlama temasında ifade ettikleri benzer kodlamalara rastlanmaktadır.

5.1.3.İlkokuma yazmada öğrencilerin arasındaki sosyokültürel ve ekonomik farklılıkların ilkokuma yazma sürecine etkisine yönelik sonuçlar ve tartışma

Araştırmanın üçüncü alt problemi doğrultusunda "Öğrencilerinizin arasındaki sosyokültürel ve ekonomik farklılıkların ilkokuma yazma sürecine nasıl bir etkisi oluyor?" şeklinde soru sorulmuş ve yanıt aranmıştır.

İlkokuma yazma sürecinde, sınıf öğretmenleri öğrenciler arasındaki farklılıkların sosyokültürel ve ekonomik sebeplerden kaynaklandığını farklı tema ve kodlamalarla ele almışlardır. Öğretmenlerin ifadelerinden yola çıkarak belirlenen temalar; olumlu(f:13) ve olumsuz(f:17) olarak sınıflandırılmıştır. Sosyokültürel ve ekonomik farklılıkların olumlu yönde etkili olduğu temada, okuma anlama düzeyi yüksek, akademik başarı, hızlı öğrenme, materyal varlığı ve aile desteği gibi kodlamalar yapılmıştır. Olumsuz yönde etkili olan temada ise dışlanma-öz denetim, geç okuma, materyal eksikliği, aile/akran baskısı ve olumsuz davranışlar sergileme gibi kodlamalar yer almıştır. Araştırmada, sosyokültürel çevre ile okulun veya ailenin ekonomik olanaklarının yüksek olmasının öğrencilerin başarılarına etkisi olduğu ifade edilmiştir. Örneğin, köy okullarında görev yapan öğretmenlerin görüşlerinde, sosyokültürel ve ekonomik etkilerin olumsuz sonuçları vurgulanmakta ve bu bağlamda şehir merkezindeki okullarda daha etkili öğrenmelerin gerçekleştirildiği sonucuna ulaşılmıştır. Sonuç olarak, yaşanan yer ve ekonomik çevrenin, öğrenciler arasındaki farklılıkları artırdığı ifade edilebilir. Çetinkaya'nın (2021) çalışmasında ilkokuma ve yazmada öğretim ile ilgili çalışmalar gerçekleştirmiştir. Bu çalışmada ailelerin sosyoekonomik durumlarının kırsalda yaşayan ailelerdeki öğrencileri olumsuz etkilediğini ifade ederek benzer sonuçları vurgulamıştır. Öğretmenlerin buradaki sosyokültürel ve ekonomik farklılıkların öğrencilerin dezavantajlı olmasına; geç öğrenme, sosyal yönden kendini geliştirememesi gibi özellikleri beraberinde getirdiğini belirtmiştir.

Yazanoğlu'nun (2011) ilgili araştırmasında, ilkokumayazmada ilkokul birinci sınıftaki öğrencilerin kelime dağarcığına sosyoekonomik faktörlerin etkisi araştırılmıştır. Araştırma bulgu ve sonuçlarında öğrencilerin çevrelerinden olumlu olumsuz yönde etkilenebileceği vurgulanmıştır. Öğrencilerdeki etkilerin sosyoekonomik düzeyi yüksek olanlarda akademik yönden ve kelime dağarcığı yönünden yüksek düzeyde hazırbulunuşluk sahibi oldukları, sosyoekonomik yönden geride kalan öğrencilerin çoğunluğunun akademik başarısının düşük ve geç öğrenmeler gerçekleştirildiği ifade edilmiştir. Araştırmada ulaşılan sonuçların benzerler ilgili araştırmada olumlu ve olumsuz temalar başlığı altında verilmiştir.

Bozkurt'un (2019) araştırmasında ilkokuldaki 1. Sınıf düzeyinde okuma becerilerinin geliştirilmesine yönelik yapılan araştırmada sosyokültürel ve ekonomik durumları belirtmiş ve benzer ifadeler kullanmıştır. Sosyoekonomik durumların olumlu ve olumsuz etkileri ifade edilmiştir. Bu ifadelerle göre sosyoekonomik düzeyi yüksek öğrencilerin daha kolay ve hızlı öğrendikleri belirtilirken, geç öğrenen öğrencilerin ise sosyoekonomik özelliklerinin düşük olduğu ve olumsuz etkilendiği ifade edilmektedir.

Araştırmada da sınıf öğretmenleri benzer ifadelerde bulunmuş ve kodlamalarda derinlemesine biçimde ifade edilmiştir. Kankural' ın (2022) yaptığı araştırmada ise ilkökul 1. Sınıf öğrencilerinin okuduğunu anlama becerileri incelenmiş ve sosyokültürel ve ekonomik durumların süreçte etkili olduğu olumlu olumsuz sonuçlarının olabileceği ifade edilmiştir.

5.1.4. Öğrencilerinin ilkökuma yazma sürecine ilişkin ilgi, tutumlarına yönelik sonuçlar ve tartışmalar

Araştırmanın dördüncü alt problemi doğrultusunda “Öğrencilerinin ilkökuma yazma sürecine ilişkin ilgi ve tutumları nasıldır?” şeklinde soru sorulmuş ve yanıt aranmıştır.

Sınıf öğretmenlerinin ilkökuma yazma sürecinde, öğrencilerin ilkökuma ve yazmaya ilişkin ilgi ve tutumları tema ve kodlamalar ile ifade edilmiştir. Öğretmenlerin ifadelerinden yola çıkarak belirlenen temalar; ilgi (f:16) ve tutum (f:23) olarak sınıflandırılmıştır. Öğrencilerin ilkökuma ve yazmadaki ilgi ve tutumlarının farklı süreçlerden ve sorunlardan etkilendiği diğer problem durumlarında belirtilmiştir. Bu problem durumunda, öğrencilerin ilkökuma yazmadaki ilgi teması; oyunlaştırma, pozitif ilgi, merak/istek ve hoşlanma şeklinde kodlanmıştır. Öğretmenlerin görüşlerinden yola çıkarak, öğrencilerin sergiledikleri tutumlar teması ise dikkatsizlik, ders sonuna doğru ilgisiz davranışlar, sorumlu-sorumlu davranışlar, ödül-ceza, alışkanlıklar ve yeni bir işe başlayamama şeklinde kodlanmıştır. İlkokuma yazma sürecinde, sınıf öğretmenleri, öğrenciler arasındaki farklılıkların sosyokültürel ve ekonomik sebeplerden kaynaklandığını çeşitli tema ve kodlamalarla ele almışlardır.

İlkokuma yazmada Sınıf Öğretmenlerinin ifadelerine göre öğrencilerin ilgi ve tutumlarının derslerde değişkenlik gösterdiğini, sosyokültürel yapıya göre derslerdeki uygulamaların ve öğrencinin dikkatini derse çekme durumlarının sürece katkı sağladığını belirtmişlerdir. Sınıf öğretmenleri, ilkökuma yazma sürecinde öğrencilerin tutumlarının ve ilgilerinin okuma ve yazmayı etkilediğini ifade etmiş; öğrencilerin ilgi ve tutum düzeylerinin artırılması gerektiğini vurgulamışlardır. Literatürde sınıf öğretmenlerin görüşlerine göre öğrencilerin ilgi ve tutumlarının Türkçeyi anlama, kullanma, dinleme, konuşmalarına etkisinin olduğu ifade edilmiştir. Şahin'in (2021) araştırmasında, ilkökuma yazma sürecinde müziğin etkisi araştırılmıştır. Öğrencilerin derslerde müzikle öğrenime yönelik geliştirdikleri ilgi ve tutumların, bu araştırmayla benzerlik gösterdiği ifade edilebilir. Çünkü öğrenciler, derslerde müzikle öğrenme gerçekleştirirken oyunlaştırma etkinliği ile öğrenmektedir. Bu açıdan, sınıf öğretmenlerinin öğrencilerin ilgisini artırmak için kullandığı yöntemlerde oyunlaştırma kodlamasına rastlanmıştır. Öğrencilerin ders sırasında sıkıcı ve ilgisiz tutumlarının oluştuğunu ifade eden Şahin (2021) araştırmada müzikle öğrenim sağlanması durumunda ortadan kalkarak derse sevgi duymaya başladıklarını belirtmiştir.

Karabulut' un (2022) ilkökuma yazmada karşılaşılan durumların etkisi, öğretmen görüşlerine göre incelenmiştir. Öğretmen görüşleri doğrultusunda sınıf ortamında öğrencilerin ilgilerinin sürece etki ettiği ve ilgilerin yüksek olduğunda ilkökuma yazmanın verimli geçeceği şeklinde ifade edilmiştir. Araştırmada da sınıf öğretmenlerinin bazı görüşlerinde ilgilerin yüksek olması için etkinlikler ve oyun saatleri yaparak öğrencinin ilgisini üst düzeye çıkararak maksimum verim elde ettiklerini ifade etmiştir. İlkokuma yazmada öğretiminde görsel hikayeli heceler kullanarak bir yöntem kullanılmıştır. Sönmez'in (2022) araştırmasında ilkökuma yazma öğretiminde öğrencilerin tutumlarının olumlu etki yaratabileceği belirtilmektedir. Bu doğrultuda derse yönelik geliştirilen olumlu tutumların derse etki edeceği belirtilmiştir.

5.2.Öneriler

Gerçekleştirilen araştırma sonucunda elde edilen veriler analiz edilip bulgular tartışılmıştır. Bu bağlamda bu bilgilerden yola çıkarak problem durumlarına ilişkin sonuçlar ortaya konup son öneriler şu şekilde aşağıda gösterilmiştir.

1. İlkokuma yazma sürecinde ilgili öğretmenlerin görev yerlerindeki ikinci dil probleminin çözülmesi önerilmektedir. Bunun çözülmesi için ailelere akran ve çevre etkisine yönelik eğitimler verilmesi ve teşvikler sunulması gereklidir.
2. İlkokuma yazmada etkili olabilmek adına öğrencilerin psikolojik ve sosyal açıdan okula hazır olması için okul öncesi eğitimlerin zorunlu olması önerilebilir. Okulöncesi eğitim kurumlarında psikolojik danışman zorunluluğu getirilebilir veya kurum psikologlarından dönem içerisinde seminer alınabilir.
3. İlkokuma yazma sürecinde öğrencilerin ilgi ve tutumlarını geliştirici etkinliklerin ulusal ve yerel düzeyde takip edilmesi planlanması sağlanmalıdır.

4. Öğretmen adaylarının sosyokültürel ve ekonomik farklılıklara uyum sağlayabilmeleri için öğretmen yetiştirme sürecinde adaylara farklı deneyimler kazandırılmalıdır.
5. Belirli aralıklarla sistemli şekilde sürekli veli ve okul işbirliği sağlanmalıdır.
6. Öğretim programları ve ders kitaplarının, öğrencinin ilgi ve tutumlarına göre düzenlenmesi gerekmektedir. Türkiye'nin farklı bölgelerinde yaşayan öğrencileri yerel ihtiyaçlarına göre kitaplar farklı etkinliklerle düzenlenirse öğrencilerin ilgi ve tutumları olumlu yönde değişebilir.
7. Öğrencilerde olumlu tutum oluşması için derste oyunlaştırılmış içerikler ve web2 araçları kullanılmalıdır.
8. Çocukların teknoloji kullanımı konusunda Türkçe kullanma ve anlama kategorisine dayanarak sınırlandırılma getirilmesi için veliler bilgilendirilmeli. Bu doğrultuda poster afişler hazırlanıp okullarda kullanılmalıdır.

KAYNAKLAR

- Aktürk, Y. ve Mentiş Taş, A. (2011). İlk okuma-yazma öğretiminde Ses temelli cümle yönteminin uygulanmasına ilişkin öğretmen görüşleri (Şanlıurfa/Viranşehir örneği). *Adnan Menderes Üniversitesi Eğitim Fakültesi Eğitim Bilimleri Dergisi*. 2(1). 27-37.
- Akyol, H. (2013). *Yeni programa uygun Türkçe öğretim yöntemleri*. Pegem Yayıncılık.
- Akyol, H. (2021). *Türkçe İlk Okuma Yazma Öğretimi*. (19. Baskı). Pegem Yayıncılık.
- Akyol, H. (2007). Türkçe Öğretim Programı: Yenilikler ve Sorunlar. *İlköğretmen Eğitimci Dergisi*. 6. 32-36.
- Arslan, M. (2007). Ses Temelli Cümle Yöntemi ve Uygulaması. *İlköğretmen Eğitimci Dergisi*.
- Bozkurt, M. (2019). *İlkokul Birinci Sınıf Öğrencilerinin Okuma Becerilerinin Çok Yönlü Desteklenmesine Yönelik Bir Eylem Araştırması*. Yayımlanmamış Doktora Tezi, Bursa Uludağ Üniversitesi Eğitim Bilimleri Enstitüsü, Bursa.
- Büyüköztürk, Ş., Çakmak Kılıç, E., Akgün, Ö. E., Karadeniz, Ş., ve Demirel, F. (2012). Örneklem yöntemleri.
- Calp, M. (2013). Yazma problemi olan bir öğrenciye bitişik eğik yazı öğretimi (Bir eylem araştırması). *E-International Journal of Educational Research*. 4(1). 1-28.
- Çetinkaya, S. (2021). Sınıf öğretmenleri anlatıyor: İlkokuma yazma öğretimi. *Ondokuz Mayıs Üniversitesi Eğitim Fakültesi Dergisi*. 40(1), 80-106. 10.7822/omuefd.840185
- Ferah, A. (2007). İlkokuma Yazma Göstergelerinin İncelenmesi
- Ege, P. (2011). Çocuklarda okuryazarlık gelişimi. (Ed. S.S. Topbaş). Dil ve kavram gelişimi Kök Yayıncılık, ss. 171-190.
- Erbasan, Ö. ve Erbasan, Ü. (2020). Sınıf Öğretmenlerinin İlk Okuma Yazma Öğretimi Sürecinde Karşılaştığı Sorunlar. *Ana Dili Eğitimi Dergisi*. 8(1). 113-125.
- Ersoy, A. F. (2019). Fenomenoloji, A. Saban ve A. Ersoy. (Editörler). Eğitimde nitel araştırma desenleri. 3. Baskı. Ankara: Anı Yayıncılık, ss. 81-138.
- Güneş, F., Uysal, H. ve Taç, İ. (2016). İlkokuma Yazma Öğretimi Süreci: Öğretmenim Bana Okuma Yazmayı Öğretir Misin? *EKUAD JETPR*, 02(02). 23-33.
- Kankural, H. (2022). İlkokul birinci sınıf öğrencilerinin okuduğunu anlama becerilerine etki eden faktörlere ilişkin öğretmen görüşleri. *Pamukkale Üniversitesi Eğitim Bilimleri Enstitüsü Dergisi*.
- Kocabıyık, O. O. (2016). Olgubilim ve gömülü kuram: Bazı özellikler açısından karşılaştırma. *Trakya Üniversitesi Eğitim Fakültesi Dergisi*, 6(1). 55-66.
- Polat, A. (2019). *Yabancılarla (Suriyeli Göçmen Çocuklara) Okuma Yazma Öğretimi Sürecine İlişkin Sınıf Öğretmenlerinin Görüşleri*. Yayımlanmamış Yüksek Lisans Tezi, Necmettin Erbakan Üniversitesi Eğitim Bilimleri Enstitüsü, Konya.
- Sağırılı, M. (2015). İlkokuma yazma öğretiminin önemi, amacı ve birinci sınıf öğretmenliği, Ömer Yılar (Editörler). İlkokuma ve yazma öğretimi içinde. Ankara. Pegem Yayıncılık, ss. 1-36.
- Sönmez, A. (2022). *İlk okuma yazma öğretiminde görsel hikayeli heceler yönteminin etkililiği (Yeni bir model önerisi)*, Yayımlanmamış Doktora Tezi, Bursa Uludağ Üniversitesi Eğitim Bilimleri Enstitüsü, Bursa.

- Susar, F. K., Özcan, E., & Şencan, D. (2016). Türkçenin az konuşulduğu bölgelerde ilk okuma yazma sürecinde karşılaşılan sorunlara ilişkin öğretmen görüşleri. **Uluslararası Türkçe Edebiyat Kültür Eğitim (TEKE) Dergisi**, 5(1), 412-445.
- Şahin, B. (2021). *Müzikle Eğitimin İlk Okuma Yazma Öğretimine Etkisi*. Yayımlanmamış Yüksek Lisans Tezi, Eskişehir Anadolu Üniversitesi Eğitim Bilimleri Enstitüsü, Eskişehir.
- Tabak, B. T. (2021). *İlk Okuma Yazma Öğretimine Etki Eden Temel Faktörlerin Öğretmen Görüşlerine Göre İncelenmesi*. Yayımlanmamış Doktora Tezi, Marmara Üniversitesi, İstanbul.
- Ünal, R., ve Aladağ, S. (2020). Kapsayıcı eğitim uygulamaları bağlamında sorunlar ve çözüm önerilerinin incelenmesi. *Journal of Interdisciplinary Education: Theory and Practice*, 2(1), 23-42.
- Vatansever, H., & Girgin, S. (2021). *Kuramdan Uygulamaya İlkokul Eğitiminde Güncel Öğrenme ve Öğretim Konuları* (Cilt 1).
- Yazanoğlu, G. (2011). *İlköğretim Birinci Sınıf Öğrencilerinde Kelime Dağarcığı Gelişiminin İlkokuma Yazma Başarısı Ve Sosyoekonomik Düzey İle İlişkisi*. Yayımlanmamış Yüksek Lisans Tezi, Bursa Uludağ Üniversitesi Eğitim Bilimleri Enstitüsü, Bursa.
- Yıldırım, A., ve Şimşek, H. (2016). *Sosyal bilimlerde nitel araştırma yöntemleri*. Seçkin Yayıncılık.

FARKLI SİYAH BOYALARIN SIR YÜZEYİNE ETKİSİ
THE EFFECT OF DIFFERENT BLACK PIGMENTS ON GLAZE SURFACES

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Abstract

Ceramic glazes are essential components to enhance ceramic surfaces' aesthetic and functional properties. In the present work, the effects of black pigments containing iron oxide (Fe_3O_4), manganese oxide (MnO_2), and chromium oxide (Cr_2O_3), which are commonly used in ceramic production, on the glaze surfaces were examined. Black pigments not only impart characteristic colours to glazes but also influence properties such as surface texture and gloss. This study provides a detailed analysis of how these pigments affect the surface properties of the glaze.

In the experimental studies, each pigment was added to the glaze mixtures in specific proportions and fired at approximately 1210°C. After the firing process, the resulting glaze surfaces were evaluated in terms of colour, gloss, surface roughness, and homogeneity. The melting behaviour of the glazes was observed using thermal microscopy, the distribution and composition of elements within the glazes were determined through X-ray fluorescence (XRF), and the crystal structures were analysed in detail using X-ray diffraction (XRD). As a result of these analyses, samples containing iron oxide exhibited dark and matte surfaces, while those with manganese oxide produced glazes with metallic gloss. Chromium oxide imparted greenish tones to the glaze surface, negatively affecting the colour homogeneity.

The findings indicate that each black pigment creates different effects on the glaze surface. Iron oxide increased the matte appearance of the glaze, whereas manganese oxide significantly enhanced the gloss values. Chromium oxide, on the other hand, caused undesirable colour variations on the glaze surface. Examinations performed using a microscope supported these differences, providing valuable insights into how the chemical composition of pigments influences glaze performance. Moreover, XRD and XRF analyses revealed changes in the microstructure and crystal phase of the glaze induced by the pigments, which play a critical role in determining firing temperatures and colour characteristics.

This study underscores the importance of selecting the appropriate black pigment in ceramic glazes to achieve desired aesthetic and colour properties, based on a comprehensive analysis of their effects. Additionally, the findings serve as a guide for optimising pigment usage in various ceramic production processes, thereby contributing to innovation and sustainability in the ceramics industry.

Keywords: Black pigments, Ceramic glazes, Surface properties.

Özet

Seramik sırları, seramik yüzeylerinin hem estetik hem de fonksiyonel özelliklerini iyileştirmek için kullanılan temel bileşenlerdir. Bu çalışmada, seramik üretiminde yaygın olarak kullanılan (Fe_3O_4), mangan oksit (MnO_2) ve krom oksit (Cr_2O_3) içeriğine sahip siyah boyaların sır yüzeyine olan etkileri incelenmiştir. Siyah boyalar, sırlara karakteristik renkler kazandırmakla kalmayıp aynı zamanda yüzey dokusu ve parlaklık gibi özellikleri de etkileyebilmektedir. Çalışmada, bu boyaların sırnın yüzey özelliklerine olan etkileri detaylı bir şekilde analiz edilmiştir.

DeneySEL çalışmalarında, her bir reçete için belirli oranlarda değişken olarak boya eklenmiş ve yaklaşık $1210^{\circ}C$ 'de pişirim işlemi gerçekleştirilmiştir. Pişirme işlemi sonrası oluşan sır karakteristikleri (yüzeyler, renk değişimi, parlaklık, yüzey pürüzlülüğü ve homojenlik) detaylı bir şekilde incelenmiştir. Isı mikroskobu ile sırların ergime davranışları gözlemlenmiş, X-Işını Floresans (XRF) ile sır içindeki elemental ve kimyasal kompozisyon belirlenmiş, X-Işını Difraksiyonu (XRD) ile ise kristal yapılar detaylı olarak incelenmiştir. Bu analizler sonucunda, demir oksit kullanılan numune yüzeylerinde koyu ve mat bir yüzey oluşurken, mangan oksit ile ise metalik parlaklığa sahip sırlar elde edilmiştir. Krom oksit, sır yüzeyinde yeşilimsi tonlar bırarken, sır renk dağılım homojenliğini olumsuz yönde etkilemiştir. Elde edilen sonuçlar, her bir siyah boyanın sır yüzeyinde farklı etkiler yarattığını göstermektedir. Siyah demir oksit, sırnın matlık seviyesini artırırken, mangan oksit sırnın parlaklık değerlerini önemli ölçüde yükseltmiştir. Krom oksit ise sır yüzeyinde istenmeyen renk değişikliklerine neden olmuştur. Mikroskop yardımıyla yapılan incelemeler de, bu farklılıkları desteklemiş ve boyaların kimyasal yapısının sır performansını nasıl etkilediği hakkında önemli bilgiler sunmuştur. Ayrıca, XRD ve XRF analizleri, boyaların sırnın mikro yapısında ve kristal fazında yarattığı değişiklikleri de ortaya koymuştur. Böylece sırnın pişme sıcaklığının belirlenmesi ve renk özellikleri açısından kritik rol oynadığı belirlenmiştir.

Bu çalışma, farklı siyah boyaların seramik sırları üzerindeki etkilerini geniş bir analiz aracı yelpazesi ile değerlendirerek, seramik sanayisinde doğru boya seçiminin sır estetiği ve istenilen renk özelliklerinin elde edilmesi üzerindeki önemini vurgulamaktadır. Ayrıca, bu bulgular, farklı seramik üretim süreçlerinde boyaların nasıl optimize edileceği konusunda yol gösterici nitelikte olup, seramik endüstrisinde inovasyon ve sürdürülebilirliği destekleyebilir.

Anahtar kelimeler: Siyah Boya, Seramik Sır, Yüzey Özellikleri

1. GİRİŞ

Seramikler genellikle estetik görünümünün yanı sıra fiziksel ve kimyasal avantajları nedeniyle seçilir ve bu da onları evler, ofisler, ticari binalar, endüstriler, oteller ve restoranlar gibi çeşitli ortamlarda aranan bir seçenek haline getirir. Ekonomik, çevresel ve estetik faktörler, seramik karo süsleme tekniklerinin evriminde çok önemli bir rol oynamakta ve bu da son zamanlarda önemli gelişmelere neden olmaktadır [1-2].

Seramik sanayiinde kullanılan sırlar, ürünlerin hem estetik görünümünü hem de işlevsel performansını doğrudan etkileyen önemli unsurlardır. Siyah boyalar, seramik sırlarına renk vermekle kalmayıp yüzey pürüzlülüğü ve parlaklık gibi özellikleri de değiştirir. Demir oksit (Fe_2O_3), mangan oksit (MnO_2), ve krom oksit (Cr_2O_3) gibi metal oksit içeren boyalar, sır yüzeyinde çeşitli fiziksel ve kimyasal değişimlere yol açmaktadır. Literatürde, özellikle demir oksitlerin sırnın mat görünümünü artırdığı, mangan oksitlerin parlaklığı olumlu etkilediği ve krom oksitlerin istenmeyen renk değişikliklerine neden olduğu vurgulanmaktadır [3-4].

Seramik estetik/dekorasyon sistemlerinde, siyah seramik pigmenti, temel bir renk olarak kullanılmakta olup, desen renginin tonunun açıklığını ayarlamak gibi rollere sahip çok önemli bir unsurdur. Co/Cr/Ni içeren metalik oksit bazlı pigmentler (ör: $CoFe_2O_4$ ve $Cr-Fe_2O_3$) son zamanlarda sıklıkla kullanımı araştırılmaktadır [6].

Co/Cr/Ni içeren metalik oksit bazlı siyah pigmentler pahalı ve potansiyel bir çevresel tehdit nedeniyle eleştirilmiştir. Daha ciddi olarak, metalik oksit bazlı siyah pigmentlerin renk özellikleri, baz sırnın kimyasal bileşimine duyarlıdır, bu nedenle seramik sırnın saf siyah bir renk tonu sağlamak zordur. Kısacası, yüksek renk performansı, ucuz ve çevre dostu bir siyah seramik pigmenti geliştirmek son derece anlamlıdır [6].

2. MATERYAL VE METOD

Bu çalışmada, her bir siyah boya, sırt karışımına belirli oranlarda eklenerek 1210°C'de pişirilmiştir. Pişirme işlemi sonrası numuneler, parlaklık, renk, yüzey pürüzlülüğü ve homojenlik açısından değerlendirildi. Benzer çalışmalar, sırların yüzey özelliklerinin pişirme sıcaklığına ve bileşimdeki metal oksitlerin oranına bağlı olarak değiştiğini göstermektedir [7]. Bu analizlerin sonuçları XRF ve XRD yöntemleri kullanılarak elde edilmiştir. XRF analizleri, her numunenin kimyasal kompozisyonunu belirlerken, XRD analizleri kristal yapı üzerindeki etkileri incelemiştir.

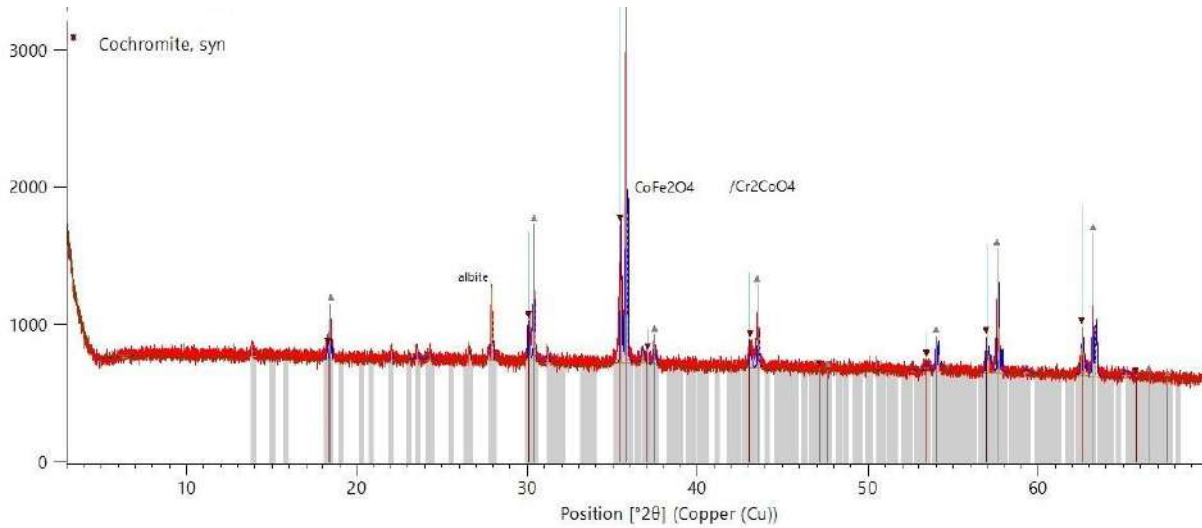
3. SONUÇLAR

3.1. Boyalara Ait XRD Analizleri

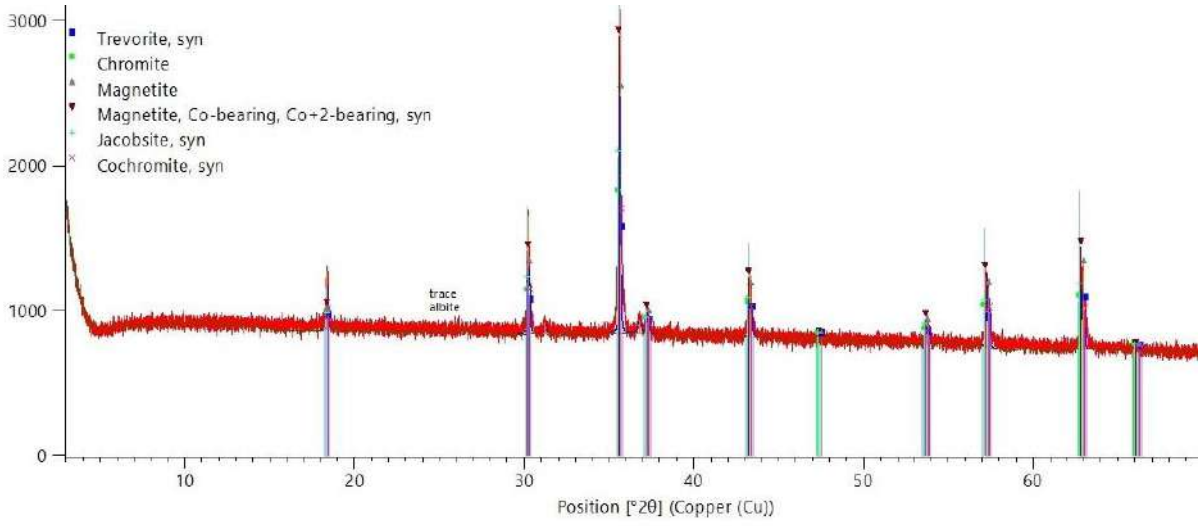
Sırt içindeki kobalt, krom, demir oksit gibi bileşenler, yüzeyin rengini ve parlaklığını önemli ölçüde etkiler. Örneğin, CoFe_2O_4 ve Cr_2CoO_4 gibi kobalt ve krom bazlı oksitler, sırda koyu mavi veya yeşil tonlarında bir renk yaratabilir ve metalik bir parlaklık sağlayabilir [8]. Ayrıca, kromit içeren bileşenler, sırt yüzeyinde matlaşma ve opaklık oluşturabilir, çünkü kromit gibi oksitler düşük erime noktalarına sahiptir ve sırtın akışkanlığını sınırlar [9]. Demir oksitler ise, sırtın hem rengini hem de opaklık seviyesini etkiler; demir bileşikler özellikle oksitleyici ortamda kahverengi ve kırmızı tonlarını üretir (Rhodes, 2015).

Bileşenler sadece sırtın rengini değil, aynı zamanda sertlik, dayanıklılık gibi fiziksel özellikleri de etkiler. Örneğin, albite gibi feldispat içeren bileşenler sırtın camsı yapısını artırarak sırtın yüzeyde daha düzgün yayılmasını sağlar (Norton, 1970). Bu durum sırtın homojenliğini iyileştirir ve sırt yüzeyinde istenmeyen çatlakların oluşumunu engeller [9].

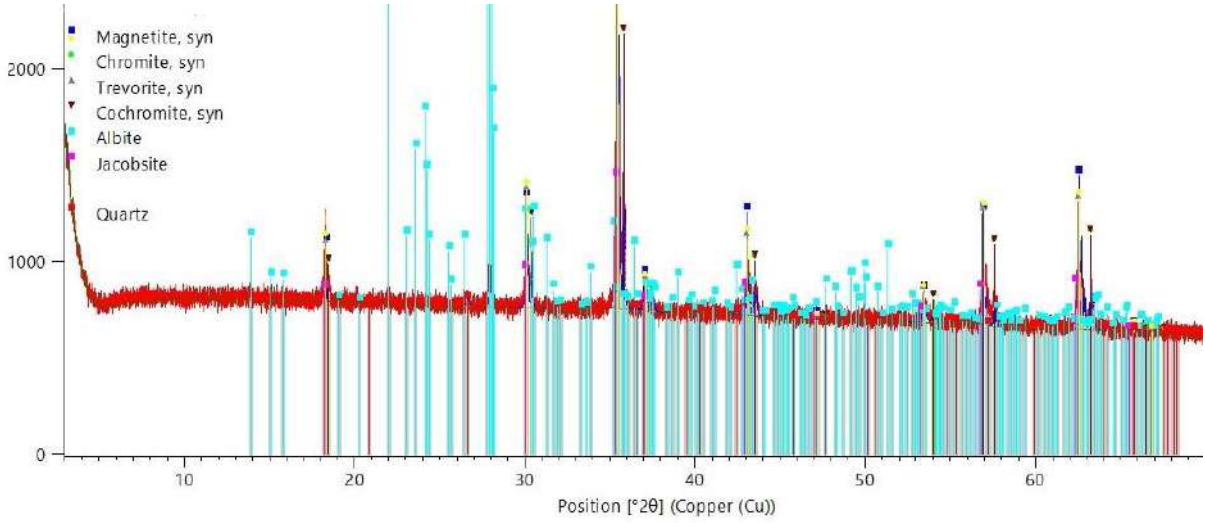
Bu kapsamda, A, B ve C olarak kodlanarak hazırlanan sırt kompozisyonlarına ait XRD analizleri Şekil 1-3'te verilmiştir. A numunesi, B numunesi ve C numunesine ait faz yapıları incelendiğinde benzer faz içerikleri görülmektedir. Renk pigmenti olarak kullanılan katkıların ait pikler, XRD paternlerinde gözükmemektedir.



Şekil 1. A Numunesine Ait XRD Analizi



Şekil 2. B Numunesine Ait XRD Analizi



Şekil 3. C Numunesine Ait XRD Analizi

3.2. Parlaklık ve Yüzey Kalitesi

A, B, C ve D numunelerine ait sırlı plaka resimleri Şekil 4'te verilmiştir. Parlaklık ve yüzey kalite sonuçları incelendiğinde, A numunesinin en yüksek parlaklık değerine (7) sahip olduğunu ve yüzey düzgünlüğü açısından en iyi performansı sergilediğini göstermiştir. Literatürde, demir oksitlerin yüksek konsantrasyonlarda kullanıldığında sırn parlaklığını azaltarak mat bir görünüm oluşturduğu belirtilmektedir. B ve C numuneleri ise yüzey bozuklukları ve yanık izleriyle öne çıkmış, bu durum metal oksitlerin homojen bir şekilde dağılmamasıyla ilişkilendirilmiştir [12].



Şekil 4. Farklı Kodlu Boyalardan Hazırlanan Sır İle Sırlanmış Plaka Görselleri

3.3. Kimyasal Analizler

Demir oksit (Fe_2O_3), A numunesinde en yüksek oranlarda tespit edilmiştir ve bu da sır yüzeyinde koyu ve mat bir görünüm oluşturmuştur. Mikroskobik analizler, demir oksidin sırın matlaşmasına katkıda bulunduğunu desteklemektedir [13]. Manganez oksit (MnO_2), C numunesinde yüksek oranlarda bulunmuş ve sırın parlaklık seviyesini artırmıştır. Literatürde, manganez oksitlerin sır yüzeyinde metalik parlaklık etkisi oluşturduğu vurgulanmaktadır [14]. Buna karşılık, krom oksit (Cr_2O_3) içeren boyalar, sır yüzeyinde istenmeyen renk değişikliklerine ve homojenlik sorunlarına neden olmuştur.

Tablo 1. Boya İçeriklerinin Kimyasal Analizi (% ağı.)

Numune	A	B	C
SiO_2	13,51	1,05	7,22
Al_2O_3	8,16	6,36	2,42
Fe_2O_3	24,633	22,754	30,164
Cr_2O_3	24,27	32,26	29,89
MnO	3,37	7,74	10,16
Co_2O_3	3,96	16,18	1,9

3.4. Renk ve Homojenlik

A boyası, homojen ve düzgün bir yüzey oluştururken, B ve C numunelerinde yanık izleri ve yüzey bozuklukları gözlemlenmiştir. Özellikle B numunesinde, krom oksidin neden olduğu yeşilimsi tonlar istenmeyen bir görünüm yaratmıştır. Literatürde, krom oksitlerin seramik sırlarında renk değişimlerine yol açtığı ve homojenliği olumsuz etkilediği rapor edilmiştir [15].

Tablo 2. Boya Kodlarına Göre Renk ve Yüzey Özellikleri

Boya Kodu	L	a	b	dL	da	db	dE	Gloss	Açıklama
A	32,36	0,75	-0,3	1,93	-0,34	-1,65	2,56	7	Yüzey düzgün
B	30,72	0,29	-0,19	0,29	-0,8	-1,54	1,76	5,3	Yüzey bozuk, yanık
C	31,41	1,6	0,77	0,98	0,51	-0,58	1,25	7,6	Yüzey bozuk, yanık
D	29,98	0,1	0,14	-0,45	-0,99	-1,21	1,63	7,2	Yüzey Düzgün

4. SONUÇLAR

Bu çalışmada, farklı siyah boya renklerinin seramik sır yüzeyine olan etkileri detaylı bir şekilde incelenmiştir. Elde edilen bulgular, demir oksidin sır matlığını artırdığı, manganez oksidin parlaklığı olumlu yönde etkilediği ve krom oksidin sır yüzeyinde istenmeyen renk değişikliklerine ve homojenlik kayıplarına neden olduğunu göstermektedir. Bu sonuçlar, seramik sanayiinde doğru boya seçiminin ürünlerin estetik ve işlevsel özelliklerinin optimize edilmesinde kritik bir rol oynadığını kanıtlamaktadır [3, 7]. Ayrıca alternatif pigment çalışmalarının mevcut siyah pigment opsiyonlarını artırdığı ve daha yüksek kalitesine, istenen parlaklıklara ve renk homojenizasyonuna ulaşılabilirdiği görüldü.

KAYNAKÇA

1. Varisli S.O., Umit E et al. The influence of raw material changes on gamut colour volume of a matt ceramic glaze, *Ceramics International*, Volume 50, Issue 20, Part B, 15 October 2024, Pages 39193-39201
2. Reinosa J.J., Enríquez E., Fuertes V., Liu S., Menéndez J., Fernández J.F., The challenge of antimicrobial glazed ceramic surfaces, *Ceramics International*, Volume 48, Issue 6, 15 March 2022, Pages 7393-7404.
3. Smith, J. (2019). *Ceramic Glazing Techniques*. Springer.
4. Q. Chang et al. Encapsulated carbon black prepared by sol-gel-spraying: a new black ceramic pigment, *J. Eur. Ceram. Soc.* (2014).
5. T. Chen et al. Preparation of plant derived carbon and its application for inclusion pigments, *Adv. Powder Technol.* (2018)
6. Wang, Q., Lai F., et al., Synthesis and color properties of MnTiO₃ black ceramic pigment, *Materials Chemistry and Physics*, Volume 296, 15 February 2023, 127310
7. Chen, Y. & Zhao, M. (2021). Black Pigments in Glazing. *Journal of Ceramics*, 29(4), 351-359.
8. Carter, C. B., & Norton, M. G. (2013). *Ceramic Materials: Science and Engineering*. Springer.
9. Kingery, W. D., Bowen, H. K., & Uhlmann, D. R. (1976). *Introduction to Ceramics*. John Wiley & Sons.
10. Rhodes, D. (2015). *Clay and Glazes for the Potter*. Krause Publications.
11. Norton, F. H. (1970). *Elements of Ceramics*. Addison-Wesley Publishing.
12. Li, X. & Wang, H. (2017). Effect of Metal Oxides on Glaze Properties. *Ceramics International*, 43(5), 2764-2772.
13. Johnson, M. (2020). The Role of Metal Oxides in Glazing. *Journal of Ceramic Science*, 12(3), 175-189.
14. Smith, L., & Lee, T. (2022). *Advances in Ceramic Pigments*. Elsevier.
15. Zhao, R., & Liu, Y. (2020). Chromium Oxides in Glaze Composition. *Materials Science Journal*, 18(1), 63-70.

IDENTIFICATION AND RATIFY OF MISBEHAVIOR ATTACK IN WIRELESS MOBILE AD HOC NETWORKS

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Abstract – Wireless Mobile Ad hoc Network (MANET) has become one of the most important wireless communication mechanisms among all, unlike traditional network. MANET does not have a fixed infrastructure. Every single node in the MANET works as both receiver and transmitter. Each node directly communicates with others when they are both within their communication ranges. All nodes work as routers and take path in discovery and maintenance of routes to other nodes in the network. In this paper proposed a new routing algorithm named Enhanced Adaptive 3 Acknowledgement (EA3ACK) using EAACK specially designed for MANET. This hybrid cryptography a two key method namely MARS4 which is a combination of RSA and MAJE4 employed to reduce the routing overhead. The proposed EA3ACK algorithm provides efficient secured transmission compare to existing EAACK algorithm.

Keywords: EA3ACK, IDS, Security, MANET, Throughput.

1. INTRODUCTION

As shown in the fig 1 nodes of a MANET do not have a centralized administration mechanism. It is known for its routable network properties where each node act as a “router” to forward the traffic to other specified node in the network. MANET were wireless multi-hop networks without any fixed infrastructure and centralized administration, in contrast to today’s wireless communications, which is based on fixed, pre-established infrastructure. All networking functions, such as determining the network topology, multiple accesses, and routing of data over the most appropriate paths, must be performed in a distributed way. These tasks are particularly challenging due to the limited communication bandwidth available in the wireless channel.

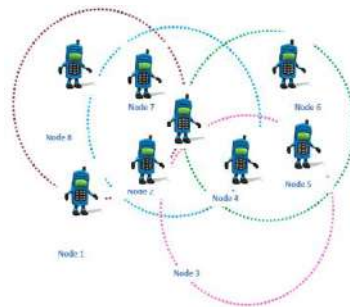


Figure 1 Mobile Ad hoc Networks

2. BACKGROUND

Routing Protocol: A routing protocol specifies how routers communicate with each other, disseminating information that enables them to select routes between any two nodes on a computer network. Routing algorithms determine the specific choice of route. Each router has a priori knowledge only of networks attached to it directly. A routing protocol shares this information first among immediate neighbors, and then throughout the network. The two main types of routing: Static routing and dynamic routing. Generally, there are two different stages in routing; they are route discovery and data forwarding. In route discovery, route to a destination will be discovered by broadcasting the query. Then, once the route has been established, data forwarding will be initiated and sent via the routes that have been determined. The power consumption, route relaying load, battery life, and reduction in the frequency of sending control messages, optimization of size of control headers and efficient route reconfiguration should be considered when developing a routing protocol. **Proactive:** approach every node generates routing information periodically to maintain and construct routing tables

even if there is no data traffic to deliver. Information contained in routing tables, is updated when the topology changes. Thus, every node maintains routing information to every other node in the network. Proactive routing protocols may use either hop-by-hop or source routing strategies to forward data traffic. The performance of the network degrades due to the exchange of control traffic messages, but the packets experience less latency because the routes are always constructed and maintained for eventual data traffic. Proactive protocols work better in networks with low mobility. **Reactive:** routing protocols discovery and maintenance of routes are delayed until necessary. When a given node needs to send a packet to any other node in the network, the sender node initiates the process to construct a path to reach the destination. To discover a route, a node floods the route request messages through the network. When a node with a route to the destination (or the destination itself) is reached, a route reply message is sent back to the source node. Reactive protocols can be classified into two categories: source routing and hop-by-hop routing. **Hybrid** routing protocol is a combination of proactive and reactive routing protocol. Zone-based Hierarchical Link State (ZHLS) is a typical example. According to ZHLS routing protocol, the entire network is divided into several non-overlapping zones. If the source and destination nodes are within the same zone, ZHLS works as a passive routing protocol. **Cryptography:** Cryptography technique has a long and fascinating history. Completed in 1963, the Kahn's book covers the most important history of cryptography technique. From 4,000 years ago by the Egyptians, to the two world wars in the twentieth century, the cryptography technique has been widely served as a tool to protect secrets. With the development of Internet, the security of communication has become more important than ever. Many researchers and scientists have contributed their countless time and efforts in this area since then. Among all of them, it is believed the most significant development was in 1976 when Diffie and Hellman published the paper "New Directions in Cryptography", in which they first introduced the concept of public-key cryptography. Although no practical implementation was provided along with the paper, the idea had since then attracted various attentions and interests. Two years later, in 1978, Rivest, Shamir and Adleman proposed the first practical public-key encryption and signature scheme, which we now referred to as RSA. Later after that, the 1980s has witnessed much more advancement in this area but none of them rendered RSA as insecure. ElGamal in 1985, found another class of powerful and practical public-key schemes. These are also based on the discrete logarithm problem.

3. PROPOSED SYSTEM

MARS4: Now MAJE4 and RSA can be combined to have MARS4 as a very efficient security solution. Assume that A is the sender of a message and B is the receiver. MARS4 is designed to work as follows.

- a. A encrypts the original message (PT) with the help of MAJE4 and the symmetric key (K1) and forms the cipher text (CT).
- b. Encrypt K1 (CT) to (K2) of B using RSA.
- c. B now uses the RSA algorithm and its private key (K3) to decrypt K1.
- d. Then B uses K1 and the MAJE4 algorithm to decrypt the CT for the original plain text (PT).

FLOW DIAGRAM

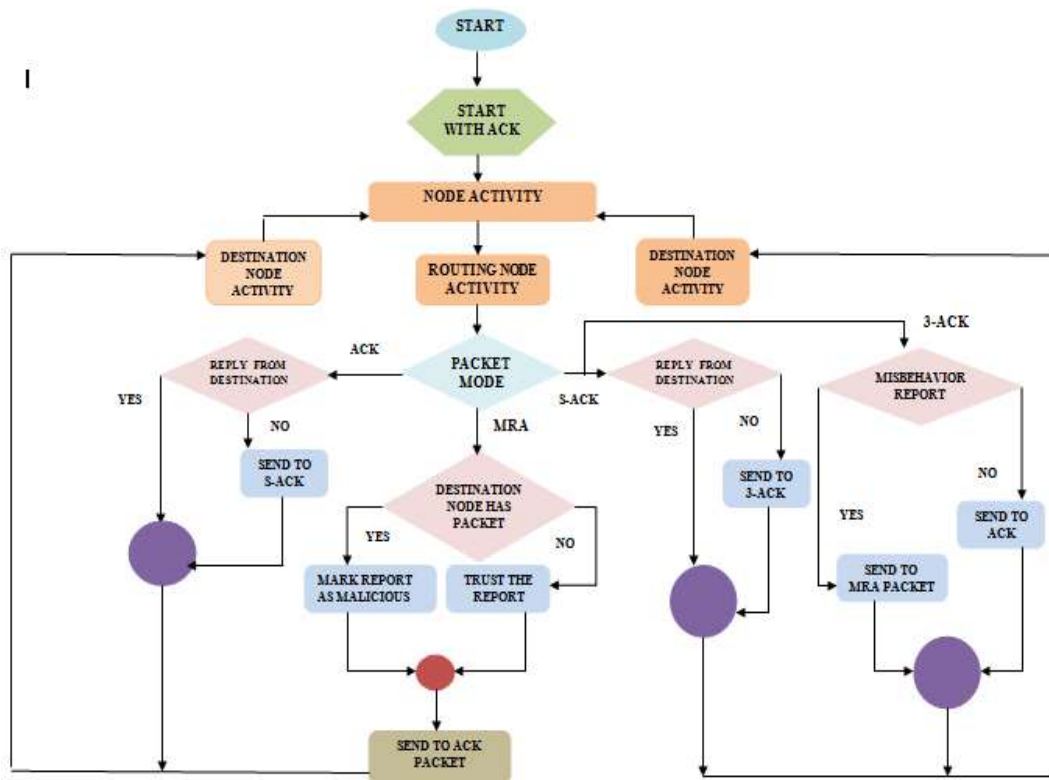


Figure 2 Flow diagram for EA3ACK

In this section, we describe our proposed EA3ACK scheme in detail. The approach described in this research paper is based on previous work (2), where the backbone of EA3ACK was proposed and evaluated through implementation. We extend it with the introduction of MARS4 Hybrid cryptography to prevent the attacker from forging acknowledgment packets. EA3ACK is consisted of four major parts, namely, ACK, secure ACK (S-ACK), 3-ACK and misbehaviour report authentication (MRA). In order to distinguish different packet types in different schemes In EA3ACK, we use 3 b of the different types of packets. Details are listed in Fig 2 presents a flowchart describing the EA3ACK scheme. Please note that, in our proposed scheme, we assume that the link between each node in the network is bidirectional. Furthermore, for each communication process, both the source node and the destination node are not malicious. Unless specified, all acknowledgment packets described in this research are required to two different keys (public and private) by its one key for sender and verified another key by its receiver.

4. RESULT AND DISSCUSSION

Simulation Configurations: In this section, we evaluate the performance of routing protocol of MANETs in an open environment. The simulations were carried out using network simulator (NS 2.34). We are simulating the mobile ad hoc routing protocols using this simulator by varying the number of nodes. The IEEE 802.11 distributed coordination function (DCF) is used as the medium access control protocol. The traffic sources are UDP. Initially nodes were placed at certain specific locations. The simulation parameters are specified in Table 1.

Parameters	Values
Simulation area	1,000 m * 1,000 m
Number of nodes	60
Average speed of nodes	0–25 meter/second
Mobility model	Random waypoint
Number of packet senders	40
Transmission range	250 m
Constant bit rate	2 (packets/second)

Packet size	512 bytes
Node beacon interval	0.5 (seconds)
MAC protocol	802.11 DCF
Initial energy/node	100 joules
Antenna model	Omni directional
Simulation time	500 sec

Table 1 Simulation parameters

In this section, malicious nodes drop all the packets that pass through it. Fig 3 and Table 2 shows the simulation results that are based on PDR.

Packet Delivery Ratio					
Routing / Malicious Node	0%	10%	20%	30%	40%
DSR	1	0.82	0.73	0.68	0.66
WATCHDOG	1	0.83	0.77	0.70	0.67
AACK	1	0.96	0.96	0.93	0.92
TWOACK	1	0.97	0.96	0.92	0.92
THREEACK	1	0.96.5	0.96	0.91	0.92
EAACK(RSA)	1	0.96	0.97	0.92	0.92
EEACK(DSA)	1	0.96	0.97	0.93	0.91
EA3ACK	1	0.97	0.97	0.96	0.95
Routing Overhead					
Routing / Malicious Node	0%	10%	20%	30%	40%
DSR	0.02	0.023	0.023	0.022	0.02
WATCHDOG	0.02	0.025	0.025	0.023	0.023
AACK	0.03	0.23	0.32	0.33	0.39
TWOACK	0.18	0.4	0.43	0.42	0.51
THREEACK	0.19	0.43	0.45	0.42	0.50
EAACK(RSA)	0.16	0.3	0.37	0.47	0.61
EEACK(DSA)	0.15	0.28	0.35	0.44	0.58
EA3ACK	0.14	0.26.5	0.32	0.40	0.55
Throughput					
Routing / Malicious Node	0%	10%	20%	30%	40%
EAACK(RSA)	0	0.25	0.38	0.50	0.54
EEACK(DSA)	0	0.27	0.40	0.53	0.57
EA3ACK	0	0.37	0.50	0.63	0.58
Energy					
Routing / Malicious Node	0%	10%	20%	30%	40%
EEACK	1	0.95	0.89	0.80	0.76
EA3ACK	1	0.92	0.84	0.76	0.72

Table 2 Performance Comparison

In Fig 3 and Table 2 we observe that all acknowledgment-based IDSs our proposed scheme EA3ACK surpassed EAACK performance by above 95% when there are 30% and 40% of malicious nodes in the network. From the results, we conclude that acknowledgment-based schemes, EA3ACK, are able to detect misbehaviors with the presence of receiver collision, limited transmission power and partial dropping.

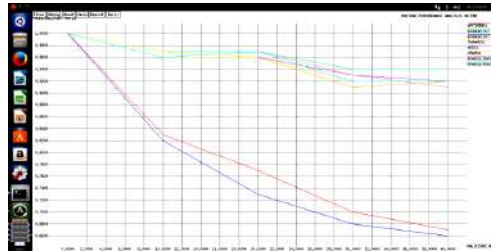


Figure 3 PDR vs. Malicious Nodes

Simulation results are shown in fig 4 and table 2. We observe that DSR scheme achieves the best performance, as it does not require an acknowledgment scheme to detect misbehaviors. For the rest of the IDSs, EA3ACK has the lowest overhead when there are 10% to 30%.

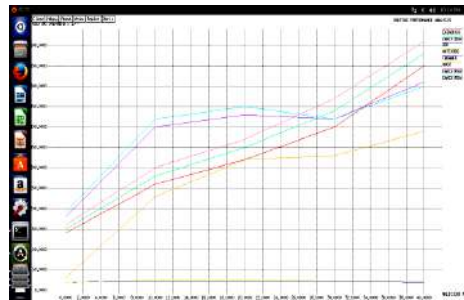


Figure 4 Routing Performance vs. Malicious Nodes

Simulation results are shown in fig 5 and table 2, which shows a comparison of the EAACK with corresponding RSA and DSA algorithms since, along with EA3ACK, it shows that throughput increases with an increase in the number of malicious nodes at 30% and 40%.

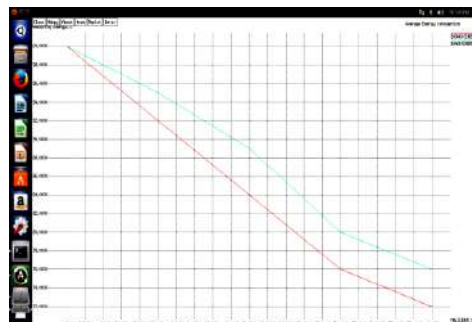


Figure 5 Average Energy Consumption vs. Malicious Nodes

Simulation results are shown in fig 6 and table 2, which shows that our proposed EA3ACK decreases the remaining energy with increasing malicious nodes compared to the existing algorithm.

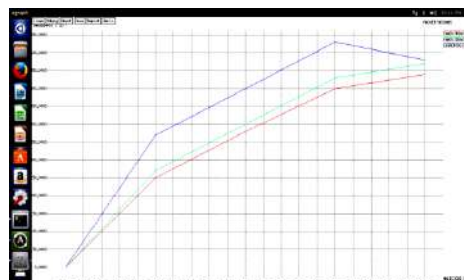


Figure 6 Packer per/sec vs. Malicious Nodes

Simulation results are shown in all the above figures and Table, which shows that the comparison of the EAACK with corresponding RSA and DSA algorithms since, along with EA3ACK, with hybrid

cryptography where it shows the throughput is increase with increase in the number of malicious nodes on while.

5. CONCLUSION

In the recent research year there has been a lot of interest within the field of cryptography in MANET. Because during the transmission drop (or) attack the packet without the acknowledgement. So acknowledge based transmission is very safe and high security. The motivation for our work is to develop an Intrusion Detection System (IDS) scheme able to detect misbehaving node in case of collision, limited transmission power and false misbehavior report. We demonstrated the performance of our proposed scheme named EA3ACK with hybrid cryptography using EAACK through an evaluation in the network simulator environment. This EA3ACK provide better performance compare to existing EAACK routing protocol and also improved packet delivery ration, improved throughput, and reduced routing overhead compare to existing EAACK routing protocol. Finally EA3ACK shows that the result of proposed scheme is effective in detecting misbehaving nodes in MANET.

REFERENCES

- [1] Thamizhmaran, R. Santosh Kumar Mahto, and V. Sanjesh Kumar Tripathi, "Performance Analysis of Secure Routing Protocols in MANET," *International Journal of Advanced Research in Computer and Communication Engineering*, vol. 1, no. 9, pp. 651-654, November 2012.
- [2] Thamizhmaran Krishnamoorthy, Akshaya Devi Arivazhagan, "Energy Efficient Routing Protocol with Ad hoc On-demand Distance Vector for MANET", *IEEE Sponsored 9th International Conference on Intelligent Systems and Control (ISCO) 2015*.
- [3] K.Thamizhmaran,Akshaya Devi Arivazhagan, M.Anitha "Co-operative analysis of Proactive and Reactive Protocols Using Dijkstra's Algorithm" *IEEE Sponsored 9th International Conference on Intelligent Systems and Control (ISCO)2015*.
- [4] Vennila, K., and K. Thamizhmaran. 2017. Implementation of multilevel thresholding on image using firefly algorithm. *International Journal of Advanced Research in Computer Science* 8 (3):373–78
- [5] Akshayadevi Arivazhagan, K.Thamizhmaran and N.Thamilselvi (2015) "Performance Comparison of on Demand Routing Protocols under Back whole For MANET", *Advance Research in Computer science and software Engineering*, Vol. 5, No. 3, pp. 407 – 411.
- [6] K. Thamizhmaran (2016) "Performance Evaluation of EA3ACK in different topology's Using EAACK for MANET, I - Manager Journal of information technology , Vol. 5, No. 4, pp. 5-10.
- [7] K.Thamizhmaran, M.Anitha and Alamelunachippan (2017) "Comparison and Parameter Adjustment of Topology Based (S-EA3ACK) for MANETs", *International Journal of Control Theory and Application*, Vol. 10, No. 30, pp. 423-436.
- [8] K.Thamizhmaran, M.Anitha and Alamelunachippan (2017) "Performance Analysis of On-demand Routing Protocol for MANET Using EA3ACK Algorithm", *International Journal of Mobile Network Design and Innovation (Inderscience)*, Vol. 7, No. 2, pp. 88-100.
- [9] K. Thamizhmaran (2017) "Modified ABR (M-ABR) Routing Protocol with Multi-cost Parameters for Effective Communication in MANETs, *IJARCS*, Vol. 8, No. 1, pp. 288-291.
- [10] K.Thamizhmaran, M.Anitha and Alamelunachippan (2018) "Reduced End-To-End Delay for MANETS using SHSP-EA3ACK Algorithm", *Journal on Communication Engineering and System*, Vol. 7, No. 3, pp. 8-15.
- [11] K.Thamizhmaran (2020) "Acknowledgement based Topology Control using Hybrid Cryptography for MANETs", *i-manager's Journal on Information Technology*, Vol. 9, No. 2, March - May 2020, pp. 36-4
- [12] K.Thamizhmaran (2020), "Cluster based Data Collection Scheme for VANET", *i-manager's Journal on Software Engineering*, Vol. 14, No. 4, pp. 37-40
- [13] R.Pushpavani, K.Thamizhmaran and T.Ravichandaran (2017) "Fast Handover Algorithm for Mobility Management in VANETs", *IJARCS*, Vol. 8, No. 3, pp. 860-863. (0.7)
- [14] K.Vennila and K.Thamizhmaran (2017) "Multilevel image segmentation based on firefly algorithm", *International Journal of Biometrics and Bioinformatics, CIIT*, Vol.9, N0. 3, pp. 57-60. (0.361)

- [15] K.Thamizhmaran, Dr. K. Prabu (2017) “Trust Based Dynamic Source Routing Protocol by Exclusion of Black-Hole Attack for MANETs”, International Journals of Computer Science Trends and Technology, Vol. 5, No. 2, pp. 486-490. (1.91)
- [16] K.Thamizhmaran, Dr. K. Prabu (2017) “Trust Based DSR Routing Protocol by Exclusion of Black Hole Attack of Through for MANET”, Computational Methods, Communication Techniques and Informatics, 202
- [17] K.Thamizhmaran “Secure Three Acknowledgements Based Quality Routing Protocol for WSN”, Journal of Optoelectronics and Communication (HSBR), Vol. 2, No. 3, pp. 1-5, 2020. <https://doi.org/10.5281/zenodo.4042916>
- [18] K. Thamizhmaran (2017) “Comparison of Reactive Routing protocols in MANET using IDS system”, IJARCS, Vol. 8, No. 3, pp. 13-15. (0.7)
- [19] K.Thamizhmaran and M.Anitha, “A Survey of Routing Protocols in Mobile Ad-hoc Network”, International Journal of Applied Engineering Research, Vol. 10, No. 1, pp. 490-496, 2015. (1.8233)
- [20] K. Prabu and K.Thamizhmaran, “Cluster head Selection based energy Aware Routing Protocol for MANET”, Journal of Network Security Computer Networks, Vol. 3, No. 1, pp. 9-14, 2017.
- [21] K.Thamizhmaran, (may 2021), “Face Recognition Thourgh Simulation”, Journal of Advanced Research in Instrumentation and Control Engineering, Vol. 8, No. 1, pp. 12-17, 2021.
- [22] K.Thamizhmaran “Efficient Dynamic Acknowledgement Scheme for MANET”, Journal of Advanced Research in Embedded System, Vol. 7, No. 2, pp. 1-6, 2020. <https://doi.org/10.24321/2395.3802.202005>
- [23] K.Thamizhmaran (may 2021), “Signature Verification Through Simulation”, Journal of Advanced Research in Electronics Engineering and Technology, Vol. 8, No. 1, pp. 19-22.
- [24] K.Thamizhmaran (Oct 2020), “Developed QoS using S-EA3ACK Algorithm for MANETs”, Journal of Advanced Research in Electronics Engineering and Technology, Vol. 7, No. 3 & 4, pp. 1-5. <https://doi.org/10.24321/2456.1428.202002>
- [25] K.Thamizhmaran, (may 2021) “RFID for Library Management System”, Journal of Advance in Communication System, Vol. 4, No. 1, pp. 1-18. <http://doi.org/10.5281/zenodo.4787338>
- [26] K.Thamizhmaran (June 2020), “Network Privacy Reflection using Internet of Thinks”, HBRP Publication on Recent Trend in Control and Converter, Vol. 3, No. 3, pp. 1-11. <http://doi.org/10.5281/zenodo.4477853>
- [27] K.Thamizhmaran, (may 2021) “Image Segmentation using Edge Detection through Simulation” Journal of Sensor Research and Technology, Vol. 3, No. 1, pp. 1-10. <http://doi.org/10.5281/zenodo.4738452>
- [28] K.Thamizhmaran, “A Review of Vehicular Ad hoc Network Broadcasting Techniques”, Journal of Sensor Research and Technologies, Vol. 2, No. 3, pp. 1-10, 2020. <https://doi.org/10.5281/zenodo.4222093>
- [29] K.Thamizhmaran, “Enhanced Secure Technique for Detecting Attacks in Network”, Journal of Advancement in Electronics Design, Vol. 3, No. 3, pp. 1-6, 2020. <https://doi.org/10.5281/zenodo.4223718>
- [30] K.Thamizhmaran “Analyses of Secure Hybrid Routing Protocol for MANET”, Journal of Advancement Signal Processing and its Application (HSBR), Vol. 3, No. 2, pp. 1-9, 2020. <https://doi.org/10.5281/zenodo.4010274>
- [31] K.Thamizhmaran “Design Secure Routing Protocol for MANET”, Journal of Research and Advancement in Electrical Engineering (HSBR), Vol. 3, No. 2, pp. 1-9, 2020. <https://doi.org/10.5281/zenodo.4008889>
- [32] K.Thamizhmaran (Jan 2020 - June 2020), “EE-ATPSP – Evaluation Node Life Time for WSNs”, i-manager’s Journal on Wireless Communication Network Vol. 8, No. 4, pp. 27-35.
- [33] K.Thamizhmaran, “Issues in Wearable Electronics Devices for Wireless Sensor Network”, i-manager’s Communication System and Engineering,, Vol. 9, No. 1, pp. 34-38, 2020.
- [34] K.Thamizhmaran (2018) “Performance Comparison of ABR using EPKCH In MANET”, I - Manager Journal of Information Technology, Vol. 7, No. 2, pp. 23-28. (0.725)

- [35] A.Kayalvizhi, K.Thamizhmaran and G.Ramprabu (2017) “Implement PAPR Reduction in OFDM System Using SAS DCT with Commanding”, IJARCS, Vol. 8, No. 3, pp. 922-925. (0.7)
- [36] K. Thamizhmaran (2017) “EEQRP-Energy Efficient Quality Routing Protocol for Wireless Sensor Networks, Journal of Signal Processing, Vol. 3, No. 1, pp. 1-6.
- [37] K.Thamizhmaran (2019) “Markovian Implementation Methods using Mobile Ad hoc Networks”, Journal of Wireless Communication, Network and Mobile, Vol. 4, No. 2, pp. 21-29.
- [38] K.Thamizhmaran, “Performance Analysis of TS-AODV and MTS-AODV Routing Protocols in MANET”, Journal of Computer Science Engineering and Software Testing, Vol. 3, No. 1, pp. 1-8, 2017.
- [39] K.Thamizhmaran (2018) “Comparison of AODV and M-AODV IN MANET”, IOSR Journal of Engineering, Vol. 8, No. 5, pp. 11-14.
- [40] K.Thamizhmaran and G.Girishkumar (2019) “ACO of Energy Efficient Clustering Routing Method”, Journal of gujarat research society, Vol. 21, No. 7, pp. 66-71, Nov 2019.
- [41] K.Thamizhmaran, “Survey on Cluster Head with Cluster Head Selection Techniques and algorithm for MANET”, Journal of Applied Sciences Research, Vol. 11, No. 23, pp. 43-46, 2015.
- [42] K.Thamizhmaran, “Performance Comparison of Proactive and Reactive Routing Protocol under Wormhole for MANET”, International journal of applied engineering research, Vol. 10, no. 46, 32193-32198, 2015. (1.8233)
- [43] K.Prabu and K.Thamizhmaran, “Cluster Head Selection Techniques and Algorithm for Mobile Ad-hoc Networks (MANETS)”, Advance Research in Computer science and software Engg, Vol.6, No. 7, pp. 169-173, 2016. (2.5)
- [44] K.Thamizhmaran, A.Akshyadevi and Dr.M.Anitha “Energy Efficient Routing Protocol with Ad hoc on-demand Distance Vector for MANET” WEAST, Vol. 2, No. 8, pp. 1-6. (1.5)
- [45] K.Thamizhmaran (2019) “IOT - Fundamentals and Applications” International Journal of Advance Research and Review, Vol. 4, No. 3, pp. 10-13.
- [46] K.Thamizhmaran “Security Attacks in Wireless Sensor Networks – A Study”, i-manager’s Journal on Information Technology, Vol. 9, No. 1, December 2019 - February 2020, pp. 35-43.
- [47] K.Thamizhmaran “IOT supported security considerations for network” WSEAS Transactions on Communications, Vol.19, pp. 113-123, 2020. <https://doi.org/10.37394/23204.2020.19.14>.

A COMPREHENSIVE CHARACTERIZATION AND ENERGY POTENTIAL ANALYSIS OF MUNICIPAL AND VEGETABLE WATES FOR SUSTAINABLE BIOENERGY PRODUCTION IN NORTHERN NIGERIA

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ABSTRACT

Developing countries are struggling to meet the continuous energy demand, as the result of farming practices and population in Northern Nigeria, high number of Biomass is produced as a waste material, waste management is becoming more challenging. However, the biomass produced have the potential of producing alternative and sustainable source of energy; in this research Vegetable and Municipal waste are selected based on the availability and are characterized to check the energy production potential in them. The samples were prepared by cyclone milling to 2mm. Sieve analysis was used to obtain the distribution of particle size with more than 70% passing sieve of size 2.36mm and less than 20% passing the sieve size 850 μ m. Proximate analyses including Total Solids, Volatile Contents, Ash contents in percentage of the individual samples and density in g/ml were conducted and compared between the materials. Calorific values of the energy contents of the materials were obtained as 17.64MJ/kg for Vegetable waste and 16.24MJ/kg Municipal wastes. Fiber content analysis was conducted; lignin cellulose and hemicellulose contents of the materials were evaluated and compared. The analyses indicate the feasibility of generating Biogas from the biomass through Anaerobic Digestion.

Key words: Anaerobic Digestion, Biogas, Biomass, Energy Demand, Northern Nigeria.

INTRODUCTION

Global energy crisis and the global warming threats have made it necessary to divert from the utilization of fossil fuels. It has been realized that lack of alternative means of energy would result into endless energy shortage and hence the environment will continue to be at risk (Simeon *et al.*, 2021). Another challenge is poor waste management which leads to environmental pollution (Dabrowska, 2019). (Van *et al.*, 2020) presumed that in 2025, 2.2 billion metric tons of municipal solid waste (MSW) will be produced on earth, management of which is difficult in Nigeria despite the government and private effort, this result from growth of many Nigerian cities (Okoro *et al.*, 2018). (Gielen, D. *et al.*, 2019) reported that: in the total primary energy supply, the share of renewable energy will rise from 14% in 2015 to 63%, where bioenergy from biomass resources alone would take approximately two-thirds in 2050. In Nigeria, the available biomass resources include grasses, trees, residues, aquatic waste, agricultural waste, municipal waste and industrial waste (Elum Z and Mjimba V. 2020) which can sum up to 144 million tons per annum according to (Ben-Iwo *et al.*, 2016)

Despite the increase in biogas industry worldwide, Energy potential by these agricultural wastes has not yet been exploited (Adepoju T *et al.*, 2016)

Municipal wastes are the non-homogeneous mixture of residential, industrial and commercial wastes. (Sowunmi A.A., 2019) The solid waste generation rate depends on the peculiar characteristics of the city (Simeon *et al.*, 2020) so is the composition of the waste in Nigeria as compiled in different studies. Organic constituent has the highest contribution as they take up to 78% of MW, (Yusuf R. *et al.*, 2019) therefore, MW can be incinerated or degraded anaerobically to generate methane. Hence, the energy potential of municipal solid waste needs to be analyzed. Nevertheless, the potential cannot be harnessed unless proper waste management is practiced.

The first step to comprehending and characterizing the bioenergy of carbonations biomass is though bioenergy potential estimation of the materials (Huiling L. *et al.*, 2013) the quantitative characterization can be categorized as proximate and ultimate analysis; the proximate analysis consists Total solids, Volatile solids, Moisture Contents and calorific value estimations; the ultimate analysis involves elemental analysis (C, H, N, S) (Anthony N. M. *et al.*, 2018) Energy contained in biomass can be

estimated through Higher and lower heating values (HHV and LHV) which are used when calculating energy potential in biomass.

Northern Nigeria takes the most of the agricultural practices and hence produces highest number of biomasses like Vegetable as agricultural waste; it is the most populous and yields highest number of municipal wastes (Daniel O. et al., 2022) there is a need for selecting and analyzing energy potential of the most commonly produced Lignocellulosic biomass as well as estimating the relative proportion of the lignin, cellulose and hemicellulose in them.

MATERIALS AND METHODS

All the collection and preservations were in accordance with the Waste Management Standard ASTM D5231-92 (2008). The samples are Vegetable wastes and Municipal Waste obtained from waste dumping areas. Uniform replicate samples were collected to determine the physical and chemical composition of the sample. The samples were air dried, reduced in the cyclone cutting mill. Personal protective equipment (PPE) was required to minimize exposure to occupational hazard during the research.

The particle size using Sieves of size 2.36mm, 2mm, 1.18mm 900 μ m and 850 μ m was conducted, for each sieve, the samples of known weights were sieved in duplicates, the retained samples were weighed as ($m_{retained}$ in g) recorded and added up as (m_{total} in g), Percentage retained ($\%Retained$) and percentage passing ($\%Passing$) were calculated as:

$$\%Passing\ sieve\ y = \left(\frac{m_{retained\ on\ sieve\ y}}{m_{total}} \right) \times 100 \quad (1)$$

$$\%Retained\ on\ sieve\ y = \%Passing\ x - \%Passing\ x \quad (2)$$

Appropriate (PPE) were worn during the color and odour assessment. The assessment was conducted as per (ISO 13301: 2018) General guidance for measuring odor, flavor and taste detection thresholds by a three-alternative forced-choice (3-AFC) procedure.

Total Solids (TS), Volatile Solids (VS) and Ash Contents (AS) was conducted based on Loss of Ignition Method

Density of the samples was obtained using Mass to Volume ratio

$$Density = \frac{Mass\ of\ the\ sample}{Volume\ of\ the\ container} \quad (3)$$

The Calorific Value CV of the substrates was determined by oxygen bomb calorimeter (*GDY-IA*) according to (ASTM E711-87 2004).

Amylase-Treated Neutral Detergent Fibre (aNDF) content was determined, EDTA and $Na_2B_4O_7 \cdot 10H_2O$, distilled water, sodium lauryl sulfate 2-ethoxy ethanol (*Ethylene glycol monoethyl ether*), Na_2HPO_4 were used to make NDF solution in accordance with BS EN (ISO 16472:200).

Acid Detergent Fibre (ADF) and Acid Detergent Lignin (ADL) contents were determined in accordance with BS EN (ISO 13906:2008)

RESULTS AND DISCUSSION

Particle Size Distribution

The results of sieve analysis were shown in (Figure 1) as a pie chart, the legends indicate the color representation of the sieve sizes in mm

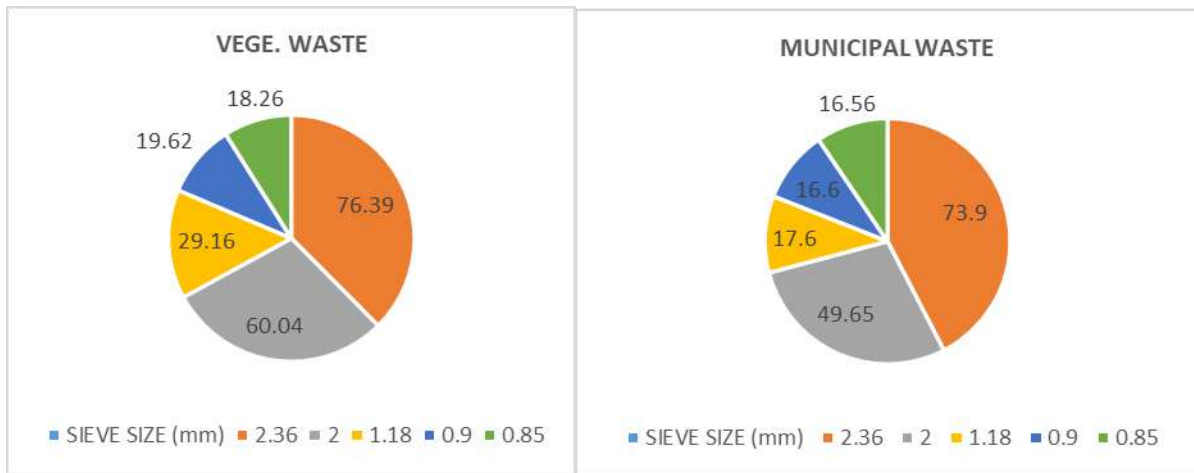


Figure 1: Particle Size Distribution results of the individual samples with percentage passing the sieves in pie chart

(Figure 1) shows the particle size distribution results obtained from sieve analysis using sieve sizes 2.36mm, 2mm, 1.18mm, 0.9mm and 0.85mm, for Vegetable wastes, the %ge Passing the sieves is at the range of (76.39% - 18.26%) through sieve 2.36mm and sieve 850µm respectively; municipal waste have (73.90%-15.56%).

Color and Odour Assessment

Color and odour analysis of the sample is presented in (Table 1) the materials exhibit different characteristics in color and odour, municipal wastes mixtures being a mixture, exhibit complex color and odour.

Table 1: Results for Color and Odour Assessment of the individual Materials

SAMPLE	COLOR	ODOUR
Vegetables	Dark brown color with flakes of tan	Earthy smell, with notes of spicy aroma
Municipal Waste	Dark brown	Strong and unpleasant smell with undertone of ammonia

Proximate and Ultimate Analysis:

(Figure 3) and (Table 2) shows the results for the proximate analyses which includes, total solids and volatile solids ash content and density for the samples.

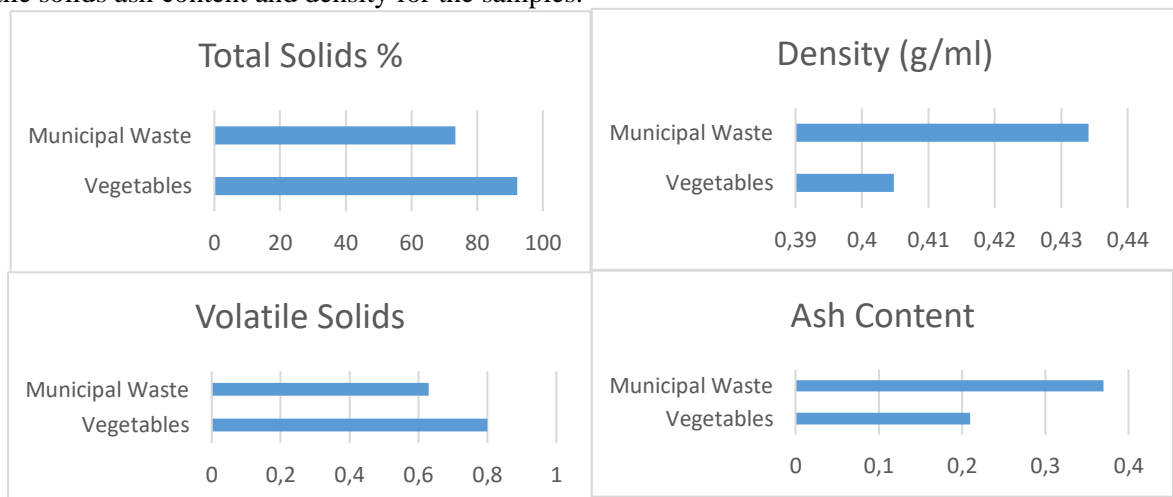


Figure 2: Proximate Analysis results in Bar chart comparison of the samples

The bar charts in (Figure 3) shows the comparison across the weighted percentage of different biomass samples and the Density in (g/ml). From the results, Municipal wastes have higher Density and Ash contents Whereas Vegetable waste have the higher Total and Volatile solids. For clarity, (Table 2) indicates the numerical-value results of the analyses of the samples appropriately.

Table 2: Results for the Proximate Analysis of the Samples

SAMPLE	NDF %	ADF %	ADL %	Lignin	Cellulose	Hemicellulose
Vegetable Waste	52.99	36.73	4.1	9.84	32.63	16.27
Municipal Waste	56.9	30.56	3.9	9.36	26.66	26.34

Energy content

Calorific values of the materials were obtained as (17.64MJ/kg) and (16.24MJ/kg) for Vegetable waste and Municipal wastes respectively, the results indicate a high energy production potential in both of the samples.

Fiber content analysis

Table (3) shows the results for NDF, ADF and ADL of the materials, lignin, cellulose and hemicellulose of the materials as evaluated and. From the fiber content analysis, Vegetable waste has the higher Lignin content of 9.84; Municipal waste have 9.36

Table 3: Results of the Fiber Content Analysis

	Total Solids %	Volatile Solids	Ash Content	Density (g/ml)
Vegetables	92.24	0.80	0.21	0.40
Municipal Waste	73.37	0.63	0.37	0.43

CONCLUSION

Municipal and Vegetable wastes that are readily available in the Northern part of Nigeria can be converted from waste one of into the most important resource (Energy). Our results indicate the feasibility of sustainable energy recovery from Lignocellulosic and carbonaceous Biomass, the energy recovery will improve the environment by reducing carbon emissions, and managing the municipal waste. Comprehensive characterization and energy potential analysis provided a tangible data for modelling, design and optimization of bioenergy from the biomass materials.

REFERENCES

- Adepoju T, Olatunbosun BE, Olawale O (2016) Statistical analysis of biogas production from co-digestion of cornstalk with goat dung using a one factor design. *Chem Res J* 1(4):1–10
- Anthony N M.; Freeman N.; Jane C N, T S.; Caliphs Z.; Cecilia K N.; (2018) Quantitative characterization of carbonaceous and lignocellulosic biomass. *Renewable and Sustainable Energy Reviews* 92 (2018) 9–16 10 <http://dx.doi.org/10.1016/j.rser.2013.05.035>
- ATSM, ASTM D5231-92 (2008) Standard test method for determination of the composition of unprocessed municipal solid waste. (Waste Management Standard). ASTM International; 2008.
- Ben-Iwo J, Manovic V, Longhurst P (2016) Biomass resources and biofuels potential for the production of transportation fuels in Nigeria. *Renew Sust Energ Rev* 63:172–192. <https://doi.org/10.1016/j.rser.2016.05.050>
- BS EN ISO 13906:2008 Animal feeding stuffs — Determination of acid detergent fibre (ADF) and acid detergent lignin (ADL) contents. <http://dx.doi.org/10.3403/30141006U>
- BS EN ISO 16472:2006 Animal feeding stuffs - Determination of amylase-treated neutral detergent fibre content (aNDF) (ISO 16472:2006) <http://dx.doi.org/10.3403/30127855U>
- Daniel O; Thomas M; Kanaha S; Roberta E; Joaquin G; Divinefavor O; Nnaemeka I; Olubayo A; Soufiane H; Thijs D; (2022) Bottlenecks in Nigeria's fresh food supply chain: What is the way forward? <https://www.researchgate.net/publication/361786201>
- E711-87 A, Standard test method for gross calorific value of refuse-derived fuel by the bomb calorimeter (Withdrawn 2004), ASTM International, West Conshohocken, PA www.astm.org 1987.

Elum Z, and Mjimba V (2020) Potential and challenges of renewable energy development in promoting a green economy in Nigeria. *Africa Review*: 1–20. <https://doi.org/10.1080/09744053.2020.1755094>

Gielen, D.; Boshell, F.; Saygin, D.; Bazilian, M. D.; Wagner, N.; Gorini, R. (2019) The Role of Renewable Energy in the Global Energy Transformation. *Energy Strategy Reviews*, 24, 38–50.

Huiling L., Xiaobing L., Hong W., Jingdun J., (2013) A review on Biomass resources and their bioenergy potential estimation. *Renewable and Sustainable Energy Reviews* 26 (2013) 344–352 <http://dx.doi.org/10.1016/j.rser.2013.05.035>

ISO 13301:2018 (E) Sensory analysis — Methodology — General guidance for measuring odour, flavour and taste detection thresholds by a three-alternative forced-choice (3-AFC) procedure. ISO 13301:2018 <https://standards.iteh.ai/catalog/standards/sist/5310d849-514e-4783-8882-1943f2dcdfad/iso-13301-2018>

Okoro E, Igwilo K, Sanni E, Orodu K (2018) A review on waste to biogas sources and its potential in Nigeria. *Int J Eng Technol* 7(4):5960–5966. <https://doi.org/10.14419/ijet.v7i4.24458>

Simeon Olatayo Jekayinfa, Joseph Ifeolu Orisaleye and Ralf Pecenka, (2021) An Assessment of Potential Resources for Biomass Energy in Nigeria. *Resources* 2020, 9, 92; doi: 10.3390/resources9080092 www.mdpi.com/journal/resources

Sowunmi, A.A. (2019) Municipal Solid Waste Management and the Inland Water Bodies: Nigerian Perspectives. In *Municipal Solid Waste Management*; IntechOpen: London, UK.

Van DP, Fujiwara T, Tho BL et al (2020) A review of anaerobic digestion systems for biodegradable waste: configurations, operating parameters, and current trends. *Environ Eng Res* 25(1):1–17. <https://doi.org/10.4491/eer.2018.334>

Yusuf, R.; Adeniran, J.; Mustapha, S.; Sonibare, J. (2019) Energy recovery from municipal solid waste in Nigeria and its economic and environmental implications. *Environ. Qual. Manag.* 28, 33–43. <http://dx.doi.org/10.1002/tqem.21617>

ÇİMLENME SICAKLIĞININ BUĞDAYDA ÇİMLENME PARAMETRELERİNE ETKİSİ EFFECT OF GERMINATION TEMPERATURE ON GERMINATION PARAMETERS IN WHEAT

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Abstract

The temperature requirements of plants vary at all stages of their life cycle. This research was conducted to determine the most suitable temperature level for germination parameters in wheat. In this research, carried out in a controlled temperature incubator under laboratory conditions, the germination rate, germination power and daily germinated seed number of 3 wheat varieties (Altındane, Pandas and Sunco) were tested at 9 different temperatures (4, 8, 12, 16, 20, 24, 28, 32 and 36°C). The experiment was conducted in 5 replications according to the Split Plots Experimental Design in Randomized Blocks. As a result of the research; it was determined that germination speed and germination power were significantly affected by the applied temperature levels. It was determined that Sunco and Altındane wheat varieties reached 100% germination rate at 24 °C, while Pandas wheat variety reached 100% germination rate at 16 °C. In terms of germination power; it was determined that Sunco and Pandas wheat varieties reached the highest germination power values from 16 °C to 36 °C, and Altındane wheat variety from 20 °C to 36 °C. It was determined that the highest value in terms of the number of daily germinated seeds (3.75 pieces/day) was reached at 16 °C in Pandas wheat variety and at 24 °C in Sunco and Altındane wheat varieties. As a result; considering the negative effects of low (below 16 oC) and high (above 32 oC) temperature levels on germination parameters, it can be recommended that early and late plantings should be avoided as much as possible, provided that the soil temperature is controlled.

Keywords: Wheat, Germination temperature, Germination parameters

Özet

Bitkilerin yaşam periyotlarının bütün aşamalarında ihtiyaç duydukları sıcaklık istekleri farklılık arz eder. Bu araştırma; buğdayda çimlenme parametreleri açısından en uygun sıcaklık derecesinin tespit edilmesi amacıyla yürütülmüştür. Laboratuvar koşullarında, kontrollü sıcaklığa sahip inkubatörde yürütülen bu çalışmada, 3 buğday çeşidinin (Altındane, Pandas ve Sunco) çimlenme hızı, çimlenme gücü ve günlük çimlenen tohum sayısı 9 farklı sıcaklık derecesinde (4, 8, 12, 16, 20, 24, 28, 32 ve 36°C) test edilmiştir. Deneme; Tesadüf Bloklarında Bölünmüş Parseller Deneme Desenine göre, 5 tekerrür olarak yürütülmüştür. Araştırma sonucu; çimlenme hızı ve çimlenme gücünün uygulanan sıcak seviyelerinden önemli ölçüde etkilenmiş oldukları tespit edilmiştir. Sunco ve Altındane buğday çeşitleri 24 °C’de, Pandas buğday çeşidi ise 16 °C’de %100 çimlenme hızına ulaştığı belirlenmiştir. Çimlenme gücü bakımından; Sunco ve Pandas buğday çeşitlerinin 16 °C’den itibaren 36 °C’ye kadar, Altındane buğday çeşidinde ise 20 °C’den 36 °C’ye kadar en yüksek çimlenme gücü değerlerine ulaştıkları tespit edilmiştir. Günlük çimlenen tohum sayısı bakımından en yüksek değere (3,75 adet/gün) Pandas buğday çeşidinde 16 °C’de, Sunco ve Altındane buğday çeşitlerinde ise 24 °C’de ulaşıldığı saptanmıştır. Sonuç olarak; çimlenme parametreleri üzerinde düşük (16 °C’in altında) ve yüksek (32 °C’nin üzerinde) sıcaklık seviyelerinin olumsuz etkileri dikkate alındığında, toprak sıcaklığı kontrol edilmek kaydıyla erken ve geç ekimlerden mümkün olduğunca kaçınılması gerektiği tavsiye edilebilir.

Anahtar Kelimeler: Buğday, Çimlenme sıcaklığı, Çimlenme parametreleri

GİRİŞ

Buğday (*Triticum* spp.) gen merkezi Anadolu olan, en eski kültür bitkilerinden birisi olup, Dünya genelinde 140'tan fazla ülkede az ya da çok oranda yetiştirilmektedir. Buğday ayrıca 40'tan fazla ülkenin de beslenme yönünden temel kalori kaynağı durumundadır (Shewry, 2009). Buğdayın, gıda olarak kullanımı çok çeşitlilik arz etmektedir.

Küresel iklim değişikliği ile birlikte, son yıllarda buğday üretiminde dalgalanmalar gözlenmektedir. Bu dalgalanmalar aynı zamanda kalite açısından da ortaya çıkmaktadır. Ekim zamanının erken veya geç yapılması, tohumların çok düşük ya da çok yüksek sıcaklıklara maruz kalmasına, ilerleyen dönemlerde gelişim bozuklukları ile birlikte tane dolumunda bozulmalara yol açabilmektedir. Bu durumun önüne geçebilmek için, bitkilerin ekim sonrasında hızlı çimlenmesi ve hızlıca kök oluşumunu tamamlanması arzu edilir.

Buğday, geniş adaptasyon yeteneğine sahip olmasına karşın, fazla sıcak ve aşırı nemden hoşlanmayan bir serin iklim tahılıdır. Özellikle gelişiminin ilk dönemlerini oluşturan çimlenme ve kardeşlenme dönemlerinde sıcaklığın 8-10 °C ve bağıl nemin %60'ın üzerinde olması yeterlidir. Buğday minimum çimlenme sıcaklığı 3-4 °C dir. Araştırmacılar çimlenme döneminde maruz kalınan yüksek ve düşük sıcaklıkların buğday çimlenmesini düşürdüğünü (Akter ve Islam, 2017), ancak bu düşüşün genotiplere bağlı olarak değişkenlik gösterdiğini rapor etmişlerdir (Toptaş ve ark., 2016; Buriro ve ark., 2011).

Tohumda çimlenme faaliyeti, enzim aktivitesi ile başlar. Enzimler +4 °C sıcaklıkta çalışmaya başladıklarından, çimlenme faaliyeti de minimum bu sıcaklıktan başlamış olur. Enzimler, bir takım besin maddelerinin besi dokudan embriyoya doğru hareketini başlatıp, yeni bitki oluşumunu tetiklerler (Sharma ve ark., 2022). Çimlenme, embriyo gelişmesi ve ilk gerçek yaprakların görülmesi ile tamamlanmaktadır. Çimlenme performansının ölçülebilmesi için yapılan çimlenme testlerinde, çimlenme hızı ve çimlenme gücü ölçü üzerinde durulmaktadır. Çimlenme hızı, stres koşulları altında çimlenebilen tohum sayısını, çimlenme gücü ise en optimum koşullar altında çimlenebilen tohum sayısını ifade etmektedir. Çimlenme ile ilgili bu parametreler, tohum canlılığının ifadesi olan, vigor adı verilen kompleks bir değer hesaplanmasında da kullanılmaktadır (Reed ve ark., 2022). Tohumun canlılığı da çeşit, sıcaklık, olgunluk durumu, dormansi, depolama koşulları gibi birçok faktörden etkilenmektedir. Bu çalışmada, farklı sıcaklık derecelerinin 3 farklı buğday çeşidinin çimlenme parametreleri üzerindeki etkilerini belirlemek amacıyla yürütülmüştür.

MATERYAL VE METOT

Bu çalışmada, Karadeniz Tarımsal Araştırma Enstitüsü'nden temin edilmiş olan Sunco, Pandas ve Altındane ekmeçlik buğday çeşitlerine ait tohumlar kullanılmıştır. Kullanılan bu buğday çeşitlerden Altındane ve Pandas yerli, Sunco ise yabancı orijinli olup, bütün çeşitler yazlık karakterdedir.

Petrilere çift kat kurutma kağıdı yerleştirildikten sonra gazete kağıdı ile 2'şerli gruplar halinde sarılmış ve etüvde 180 °C sıcaklıkta 3 saat süre ile yüzey sterilizasyonuna tabi tutulmuşlardır. Süre sonunda etüvden çıkarılan petri ekim yapılarına kadar sarılı şekilde, buzdolabında +4 °C'de bekletilmişlerdir. Deneme; Tesadüf Bloklarında Bölünmüş Parseller Deneme Desenine göre, 5 tekerrür olarak yürütülmüştür. Tohum ekimi steril kabin içerisinde gerçekleştirilmiştir. Her bir petri içerisine 20 adet tohum, steril cımbız kullanılarak ekilmiştir. Ekim sonrası her bir petri 5 ml steril su ile sulanmıştır. Kapakları kapatılan petri ± 1 °C hassasiyete sahip inkübatör içerisine aktararak çimlenme çalışması başlatılmıştır. Deneme boyunca gözlemler her gün yapılmış olup, çimlenen tohumların sayımı ise dördüncü ve sekizinci günlerde yapılmıştır. Çimlenme hız ve güç değerleri (Bayat ve ark., 2022), ortalama çimlenme hızı (Mohamed ve Pekşen, 2020)'e göre hesaplanmıştır.

İstatistiksel Analiz

Denemeden elde edilen Verilerin analizi SPSS v17.0 programı kullanılarak yapılmış olup, ortalama karşılaştırmasında LSD değerleri kullanılmıştır (Gomez ve Gomez, 1984). Denemeden elde edilen verilere dayalı olarak grafiklerin hazırlanmasında Microsoft Excel Paket Programından yararlanılmıştır.

BULGULAR

Araştırma sonucu; elde edilen verilerin analizi değerlendirildiğinde çimlenme hızı bakımından çeşitlerin, çimlenme sıcaklıklarının ve çeşit x çimlenme sıcaklığı interaksyonunun önemli olduğu ($P \leq 0.01$) tespit edilmiştir (Tablo 1). En yüksek çimlenme hızının 82,56 \pm 4,16 ile Pandas buğday çeşidinden elde edilirken, çimlenme hızı bakımından bu çeşidi sırasıyla Sunco (71,56 \pm 4,90) ve Altındane (55,34 \pm 6,77) çeşitleri takip etmiştir (Tablo1). Çimlenme sıcaklığı bakımından

değerlendirildiğinde; en yüksek çimlenme hızı 24 °C'de (100,00±0,00) elde edilmesine karşın en düşük çimlenme hızı 4 °C'de (18,67±4,01) elde edilmiştir. Çeşit x sıcaklık interaksyonu bakımından değerlendirildiğinde; Sunco çeşidinde en yüksek çimlenme hızına 20 °C'de (100,00±0) ulaşılırken en düşük çimlenme hızı 36 °C'de (17,00±2,00) elde edilmiştir. Pandas buğday çeşidinde en yüksek çimlenme hızı 16 °C'de (100,00±0,00) elde edilmesine karşın en düşük çimlenme hızı 4 °C'de (23,00±2,55) elde edilmiştir. Altındane buğday çeşidinde ise en yüksek çimlenme hızına ilişkin veri 24 °C'de (100,00±0,00) elde edilirken, en düşük çimlenme hızı 12 °C ve daha düşük sıcaklıklarda (0,00±0,00) elde edilmiştir (Tablo 1).

Araştırma sonucu; çimlenme gücü bakımından çeşitlerin, çimlenme sıcaklıklarının ve çeşit x çimlenme sıcaklığı interaksyonunun önemli olduğu ($P \leq 0.01$) tespit edilmiştir (Tablo 1). En yüksek çimlenme gücü 98,33±0,66 ile Pandas buğday çeşidinde elde edilirken, çimlenme gücü bakımından bu çeşidi sırasıyla Sunco (89,67±3,90) ve Altındane (80,91±4,64) çeşitleri takip etmiştir (Tablo 1). Çimlenme sıcaklığı bakımından değerlendirildiğinde; en yüksek çimlenme gücü 20, 24, 28 ve 32 °C'lerde (100,00±0,00) elde edilmesine karşın bu sıcaklık derecelerinin altında ve üstündeki sıcaklık derecelerinde çimlenme gücü azalmıştır. Nitekim, en düşük çimlenme gücü 36 °C'de (65,36±10,24) elde edilmiştir. Çeşit x sıcaklık interaksyonu bakımından değerlendirildiğinde; Sunco ve Pandas çeşitlerinde en yüksek çimlenme gücüne 8 °C'de (100,00±0) ulaşılırken, en düşük çimlenme gücü her iki çeşitte de 36 °C'de (Sunco 17,00±2,00 ve Pandas 92,00±4,36) elde edilmiştir. Altındane buğday çeşidinde ise en yüksek çimlenme gücüne ilişkin veri 20 °C'de (100,00±0,00) elde edilirken, en düşük çimlenme gücü 4 °C'de (15,00±3,16) elde edilmiştir (Tablo 1).

Günlük çimlenen tohum sayısı dikkate alınarak yapılan değerlendirmelerde, çeşitlerin, çimlenme sıcaklıklarının ve çeşit x çimlenme sıcaklığı interaksyonunun önemli olduğu ($P \leq 0.01$) tespit edilmiştir (Tablo 1). Günlük en fazla çimlenen tohum sayısı Pandas buğday çeşidinde (3,29±0,11) elde edilirken, bu çeşidi sırasıyla Sunco (2,91±0,16) ve Altındane (2,34±0,22) buğday çeşitleri takip etmiştir.

Tablo 1. Çeşit, sıcaklık ve çeşit x sıcaklık interaksyonunun buğdayda tohumun çimlenme parametreleri üzerindeki etkilerine ilişkin veriler

Çeşit	Çimlenme Hızı (%)	Çimlenme Gücü (%)	Çimlenme Süresi (adet/gün)
Sunco	71,56±4,90 ^{ab}	89,67±3,90 ^{ab}	2,91±0,16 ^a
Pandas	82,56±4,16 ^a	98,33±0,66 ^a	3,29±0,11 ^a
Altındane	55,34±6,77 ^b	80,91±4,64 ^b	2,34±0,218 ^b
F	74,57**	209,07**	103,97**
Sıcaklık (°C)			
4,00	18,67±4,01 ^d	68,33±10,15 ^b	1,32±0,22 ^c
8,00	28,00±5,71 ^d	80,00±7,61 ^{ab}	1,70±0,23 ^{bc}
12,00	53,67±10,5 ^c	92,33±2,23 ^a	2,50±0,28 ^b
16,00	81,67±7,07 ^{ab}	99,67±0,33 ^a	3,29±0,18 ^a
20,00	84,00±6,1 ^{ab}	100,00±0,00 ^a	3,35±0,15 ^a
24,00	100,00±0,00 ^a	100,00±0,00 ^a	3,75±0,00 ^a
28,00	100,00±0,00 ^a	100,00±0,00 ^a	3,73±0,02 ^a
32,00	100,00±0,00 ^a	100,00±0,00 ^a	3,75±0,00 ^a
36,00	63,93±10,06 ^{bc}	65,36±10,24 ^b	2,25±0,39 ^b
F	134,12**	168,98**	79,23**
Çeşit X Sıcaklık İnteraksyonu			
4 Derece	Sunco	33,00±4,36 ^{def}	94,00±1,00 ^a
	Pandas	23,00±2,55 ^{ef}	96,00±1,87 ^a
	Altındane	0,00±0,00 ^g	15,00±3,16 ^d
8 Derece	Sunco	39,00±4,00 ^{de}	100,00±0,00 ^a
	Pandas	45,00±5,24 ^d	100,00±0,00 ^a
	Altındane	0,00±0,00 ^g	40,00±2,74 ^c

12 Derece	Sunco	76,00±6,00 ^{bc}	96,00±1,87 ^a	3,10±0,15 ^{abc}
	Pandas	85,00±5,48 ^{abc}	97,00±2,00 ^a	3,34±0,14 ^{ab}
	Altındane	0,00±0,00 ^g	84,00±4,3 ^b	1,05±0,05 ^{gh}
16 Derece	Sunco	98,00±1,22 ^{ab}	100,00±0,00 ^a	3,70±0,03 ^a
	Pandas	100,00±0,00 ^a	100,00±0,00 ^a	3,75±0,00 ^a
	Altındane	47,00±8,46 ^d	99,00±1,00 ^a	2,41±0,20 ^{cdef}
20 Derece	Sunco	81,00±10,42 ^{abc}	100,00±0,00 ^a	3,28±0,26 ^{ab}
	Pandas	100,00±0,00 ^a	100,00±0,00 ^a	3,75±0,00 ^a
	Altındane	71,00±13,17 ^c	100,00±0,00 ^a	3,03±0,33 ^{abcd}
24 Derece	Sunco	100,00±0,00 ^a	100,00±0,00 ^a	3,75±0,00 ^a
	Pandas	100,00±0,00 ^a	100,00±0,00 ^a	3,75±0,00 ^a
	Altındane	100,00±0,00 ^a	100,00±0,00 ^a	3,75±0,00 ^a
28 Derece	Sunco	100,00±0,00 ^a	100,00±0,00 ^a	3,75±0,00 ^a
	Pandas	100,00±0,00 ^a	100,00±0,00 ^a	3,75±0,00 ^a
	Altındane	97,00±2,00 ^{ab}	100,00±0,00 ^a	3,75±0,00 ^a
32 Derece	Sunco	100,00±0,00 ^a	100,00±0,00 ^a	3,75±0,00 ^a
	Pandas	100,00±0,00 ^a	100,00±0,00 ^a	3,75±0,00 ^a
	Altındane	100,00±0,00 ^a	100,00±0,00 ^a	3,75±0,00 ^a
36 Derece	Sunco	17,00±2,00 ^{fg}	17,00±2,00 ^d	0,64±0,07 ^{hi}
	Pandas	90,00±4,18 ^{abc}	92,00±4,36 ^a	3,40±0,16 ^{ab}
	Altındane	90,00±8,42 ^{abc}	92,50±5,95 ^a	2,72±0,72 ^{bcde}
F		24,76**	162,45**	16,62**

Aynı sütunda farklı harflerle gösterilen değerler $P \leq 0,01$ düzeyinde istatistiksel olarak farklıdır.

Çimlenme sıcaklığı bakımından değerlendirildiğinde; günlük en fazla çimlenen tohum sayısı $3,75 \pm 0,00$ ile 24, 28 ve 32 °C’lerde elde edilmesine karşın, günlük en az çimlenen tohum sayısı $1,32 \pm 0,22$ ile 4 °C’de kaydedilmiştir. Günlük çimlenen tohum sayısı çeşit x sıcaklık interaksyonu bakımından değerlendirildiğinde; günlük en fazla çimlenen tohum sayısı her üç çeşitte de $3,75 \pm 0,00$ adet olarak kaydedilmiş olup, Pandas çeşidinde 16, 20, 24, 28 ve 32 °C’de, Sunco ve Altındane buğday çeşitlerinin her ikisinde ise 24, 28 ve 32 °C’de elde edilmiştir. Diğer taraftan günlük en az çimlenen tohum sayısı Sunco çeşidinde $0,64 \pm 0,07$ ile 36 °C’de, Pandas çeşidinde $1,78 \pm 0,06$ ile °C’de ve Altındane buğday çeşidinde $0,19 \pm 0,04$ ile 4 °C’de elde edilmiştir (Tablo 1).

TARTIŞMA

Araştırma sonucu gerek çimlenme hızı gerek çimlenme gücünün bilhassa 12 °C’den düşük ve 32 °C’den fazla sıcaklıklarda incelenen buğday çeşitlerine de bağlı olarak diğer sıcaklık derecelerine göre daha düşük olduğu saptanmıştır. İncelenen bütün parametrelerde, düşük sıcaklığın bilhassa Altındane buğday çeşidinde ve yüksek sıcaklığın Sunco buğday çeşidinde diğer buğday çeşitlerine göre hassas bir etki ortaya koyduğu tespit edilmiştir. Daha önce yapılan bazı çalışmalarda da düşük ve yüksek çimlenme sıcaklıklarına buğday çeşitlerinin farklı tepki verdikleri rapor edilmiştir (Gupta ve ark., 2013; Prasad ve Djanaguiraman, 2014). Ayrıca sıcaklık stresinin tohum çimlenmesini düşürdüğü, hücre içi basıncını bozduğu, reaktif oksijen türlerini artırarak fonksiyon bozukluğuna yol açtığı ve yüksek sıcaklığın buğday tohumunun çimlenme aşamasında olumsuzluklara yol açtığı bildirilmiştir (Akter ve Islam, 2017).

Altındane buğday çeşidi, düşük sıcaklık derecelerinde daha düşük çimlenme değerlerine sahiptir. Bu durum incelenen bütün çimlenme parametreleri açısından çeşitlerin genetik yapılarının farklılık gösterebileceğini ifade etmektedir. Nitekim Khan ve ark., (2007), sıcaklığın olumsuz özelliklerinin çeşitler arasında farklı seviyelerde etki ortaya koyabileceğini, Buriro ve ark., (2011), ise buğdayda çimlenme sıcaklığının 10 °C’den 30°C’ye çıkarılmasıyla çimlenmenin önemli ölçüde arttığını, ancak incelenen çeşitlerden bazılarının 30 °C sıcaklıkta çimlenme oranının olumsuz yönde etkilenerek azaldığını bildirmişlerdir. Bu durumu, tohumun sıcaklık toleransı ile kökçük arasındaki ilişkiye dayandırarak, kökçüğün zarar görmesi durumunda çimlenmenin baskılandığı şeklinde açıklanmıştır. Diğer taraftan tohum hacmi ile çimlenme oranı arasında bir ilişkinin olduğu, iri taneli buğday tohumlarında çimlenme oranının daha fazla olduğunu ve 5 °C gibi düşük sıcaklıklarda incelenen bütün

çeşitlerde hiç çimlenme olmadığı tespit edilmiştir (Al-Qasem, 1999). Bu araştırmada da Altındane buğday çeşidinde 12 °C'nin altındaki sıcaklıklarda, bilhassa 4 °C'de günlük çimlenen tohum sayısı yok denecek kadar az (0,19 adet/gün) olduğu, Sunco ve Pandas buğday çeşitlerinde ise kısmen de olsa daha fazla (sırasıyla 2.00 ve 1.78 adet/gün) olduğu tespit edilmiştir. Altındane buğday çeşidinin, tohumları Sunco ve Pandas buğday çeşitlerine göre daha iri yapılı olup, daha yüksek bin tane, protein oranı, hektolitreye ağırlığı ve sedimantasyon değerine sahiptir. Bu durumun düşük sıcaklıklarda çimlenme kapasitesini kısmen de olsa engellemiş olabileceği düşünülebilir.

Çimlenme sıcaklığı 4 dereceden itibaren artırıldığında, incelenen buğday çeşitlerinden Pandas 16 °C'de, Sunco ve Altındane buğday çeşitleri ise 24 °C'de %100 çimlenme hızına ulaştıkları ve bu çimlenme oranını 36 °C'ye kadar korudukları ve bu dereceden itibaren çimlenme hızının bilhassa Sunco buğday çeşidinde bariz bir şekilde (%17) azalmış olduğu tespit edilmiştir. Araştırmada, çimlenme gücü bakımından da benzer bulguların elde edildiği, Altındane buğday çeşidinde çimlenme gücü 20 °C'de %100'e ulaşmış olup bu oranı 36 °C'ye kadar korumuştur. Sunco ve Pandas buğday çeşitlerinde ise her ne kadar 8 °C'de %100 çimlenme gücüne ulaşılmış ise de bu oranı istikrarlı bir biçimde korunamamış ve her iki buğday çeşidinde çimlenme gücü bakımından kararlılığa ancak 16 °C'de sonra ulaşılmış ve 36 °C'ye kadar bu istikrarlı çimlenme gücü korunmuştur. Daha önce yapılan çalışmalarda da çimlenme sıcaklığının çimlenme hızı ve çimlenme gücü üzerinde farklı yönde etki ortaya koyabildikleri rapor edilmiştir. Örneğin; yapılan bir araştırma sonucu, buğdayda çimlenme hızının düşük sıcaklıkta yavaşladığını, 30 dereceye doğru düzenli olarak artış gösterdiği rapor edilmiştir (Khaeim ve ark., 2022). Araştırmada günlük çimlenen tohum sayısının 24 °C'ye kadar istikrarlı bir biçimde artarak devam ettiği ve 3,75 adet/gün ile 24 °C'de en üst sınıra ulaştığı, 32 °C'den sonra azalma eğilimine girdiği belirlenmiştir. Çeşitler açısından değerlendirildiğinde Pandas buğday çeşidinin 16 °C'de, Sunco ve Altındane buğday çeşitlerinin ise 24 °C'de günlük maksimum çimlenen tohum sayısına (3,75 adet/gün) ulaştıkları belirlenmiştir. Diğer taraftan 32 °C'den daha yüksek sıcaklıklarda günlük çimlenen tohum sayısının her üç buğday çeşidinde de azalmış olduğu tespit edilmiştir. Buğday tohumunun yüksek sıcaklığa maruz bırakılması durumunda nişastanın bozulmaya uğradığı, tane içi madde taşınmasının aksadığı, reaktif oksijen türlerinin miktarının arttığı için enzimatik faaliyetlerin bozulduğu, sıcağa toleranslı çeşitlerde birçok genin katılımıyla ortaya çıkan antioksidan enzimlerinin ve sıcaklık şoku proteinlerinin sayesinde bu durumun tolere edilebildiği bildirilmiştir (Essemine ve ark., 2010). Günlük çimlenen tohum sayısı bakımından çeşitler arasında farklılığın olması, beklenen bir durumdur. Zira çeşitlerin genetik potansiyelleri onların çimlenme kabiliyetlerini de, olumsuz koşulları tolere etme yeteneklerini kullanma durumunu da bir şekilde etkilemiş olabilir.

SONUÇ

Araştırmada incelenen buğday çeşitleri dikkate alındığında, incelenen parametreler açısından en uygun sıcaklık derecesinin 20-24 °C olduğu, Pandas buğday çeşidinin Sunco ve Altındane buğday çeşitlerinden daha yüksek performansa sahip olduğu tespit edilmiştir. Çeşitlerin çimlenme açısından 12 °C'den daha yüksek sıcaklığa daha fazla tepki vermeleri, çeşitlerin yazlık karakterde olmasından kaynaklanmış olabilir. Çeşit ve sıcaklık faktörü bir arada değerlendirildiğinde; Sunco ve Pandas çeşitlerinin düşük sıcaklıklarda çimlenme hızlarının daha yüksek olduğu, dolayısıyla erken ekimlerde bu çeşitlerin çıkışlarının daha hızlı olabileceği düşünülebilir. Diğer taraftan yüksek sıcaklıkta Sunco çeşidinin, diğer iki buğday çeşidine göre daha hassas olduğu ve sıcaklıktan zarar görme olasılığının yüksek olduğu dolayısıyla bu çeşidin Pandas ve Altındane çeşitlerine göre daha az toleranslı olduğunu söylenebilir. İlave olarak Pandas buğday çeşidinin hem yüksek hem düşük sıcaklığa diğer çeşitlerden daha toleranslı olduğu, Sunco buğday çeşidinin yüksek sıcaklığa, Altındane buğday çeşidinin ise düşük sıcaklığa daha hassas olduğu kanaatine varılmıştır.

KAYNAKLAR

- Akter N., Islam MR 2017. Heat stress effects and management in wheat. A review. *Agron. Sustain. Dev.*, 37: 1-17.
- Al-Qasem H., Kafawin O., Duwayri M 1999. Effects of seed size and temperature on germination of two wheat cultivars. *Dirasat: Agricultural Sciences*. 26(1): 1-7.
- Bayat E., Koşunkartay H., Kodaz S 2022. Tuzluluk Stresinin Kırık Ekmeklik Buğday *Triticum aestivum* L.) Çeşidinin Çimlenme Parametreleri Üzerine Etkileri. *Avrupa Bilim ve Teknoloji Dergisi*, 41: 246-251.

- Buriro M., Oad F., Keerio I., Tunio S., Gandahi A., Wasem ul Hassan S., Oad S 2011. Wheat Seed Germination Under The Influence Of Temperature Regimes. *Sarhad Journal of Agriculture*. 27(4): 539-543.
- Essemine J., Ammar S., Bouzid S 2010. Impact of Heat Stress on Germination and Growth in Higher Plants: Physiological, Biochemical and Molecular Repercussions and Mechanism of Defence. *Journal of Biological Sciences*. 10(6): 565-572.
- Gomez KA., Gomez AA 1984. Statistics for Agric. Res. (2nd Ed.). John Willey & Sons, New York
- Gupta NK., Agarwal S., Agarwal VP., Nathawat NS., Gupta S., Singh G 2013. Effect of short-term heat stress on growth, physiology and antioxidative defence system in wheat seedlings. *Acta Physiologiae Plantarum*. 35: 1837–1842. .
- Khaim H., Kende Z., Balla I., Gyuricza C., Eser A., Tarnava A 2022. The Effect of Temperature and Water Stresses on Seed Germination and Seedling Growth of Wheat (*Triticum aestivum* L.). *Sustainability*. 14: 1-21.
- Khan I., Khalil IH., Nasir-ud-Din 2007. Genetic parameters for yield traits in wheat under irrigated and rainfed environments. *Sarhad Journal of Agriculture*. 23(4): 1016-4383.
- Mohamed M., Pekşen E 2020. Influence of Zn seed priming and coating on germination and seedling growth in wheat. *Anadolu Tarım Bilimleri Dergisi*, 35(2): 259-267.
- Prasad PVV., Djanaguiraman M 2014. Response of floret fertility and individual grain weight of wheat to high temperature stress: sensitive stages and thresholds for temperature and duration. *Functional Plant Biology*. 41: 1261–1269.
- Reed RC., Bradford KJ., Khanday I 2022. Seed germination and vigor: ensuring crop sustainability in a changing climate. *Heredity*, 128: 450-459.
- Sharma S., Singh V., Tanwar H., Mor V., Kumar M., Punia R., Dalal M., Khan M., Sangwan S., Bhuker A., Dagar C., Yashveer S., Singh J 2022. Impact of High Temperature on Germination, Seedling Growth and Enzymatic Activity of Wheat. *Agriculture*, 12: 1-19.
- Shewry PR 2009. Wheat. *Journal of Experimental Botany*. 60(6): 1537–1553.
- Toptaş İ., Kasap Y., Barutçular C., Koç M., Yıldırım M 2016. Yazlık Ekmeklik Buğdayların Çimlenme Dönemi Yüksek Sıcaklık ve Kuraklığa Duyarlılığı ve Verimle İlişkisi. *Tarla Bitkileri Merkez Araştırma Enstitüsü Dergisi*. 25 (Özel sayı-1): 42-45.

EFFECT OF GERMINATION TEMPERATURE ON GERMINATION PARAMETERS IN COTTON

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Abstract

Especially in cases where abiotic stress conditions occur, the germination and emergence period is of vital importance for the sustainability of plant life. Considering this situation, this research was conducted to determine the most suitable temperature degree in terms of germination parameters in cotton. In this research, which was conducted in a laboratory incubator with controlled conditions (± 1 oC precision), the germination parameters of 2 cotton varieties (May 344 and Candia) were tested at 8 different temperature levels (8, 12, 16, 20, 24, 28, 32 and 36°C). Laboratory experiment was conducted according to the Split Plots Experimental Design in Randomized Blocks with 6 replications. Before germination, 9 cm diameter glass petri dishes containing two pieces of blotting paper were sterilized and the seeds were planted on the drying dishes with the help of forceps. After 25 seeds were planted in each petri dish, the petri dishes were watered with the required amount of sterile water (approximately 25 ml per petri dish), the lids were closed and left to germinate in the incubator. Checks were made daily in the incubator and records were kept. The research result; It was determined that the tested parameters were significantly affected by temperature. The average of both cotton varieties and the highest germination rate for both varieties were obtained at 20 oC. No germination was recorded at 8 oC. In May-344 cotton variety, the germination percentage was 45.17%, the average germination time was 4.06 days and the emergence rate index was 1.89, while in Candia cotton variety, the germination rate was 16.17%, the average germination time was 3.94 days and the emergence rate index was 0.58. Considering the data obtained from this research on germination parameters; 20 oC can be recommended as the most suitable germination temperature for both varieties.

Keywords: Cotton, Germination temperature, Germination parameters

Özet

Özellikle abiyotik stres koşullarının olduğu durumlarda çimlenme ve çıkış periyodu bitki yaşamının sürdürülebilirliği açısından hayati derecede öneme sahiptir. Bu durum dikkate alınarak, bu araştırma; pamukta çimlenme parametreleri açısından en uygun sıcaklık derecesinin tespit edilmesi amacıyla yürütülmüştür. Laboratuvarda, kontrollü koşullara sahip inkubatörde (± 1 °C hassasiyete sahip) yürütülen bu çalışmada, 2 pamuk çeşidinin (May 344 ve Candia) çimlenme parametreleri 8 farklı sıcaklık seviyelerinde (8, 12, 16, 20, 24, 28, 32 ve 36°C) test edilmiştir. Deneme; Tesadüf Bloklarında Bölünmüş Parseller Deneme Desenine göre, 6 tekerrür olarak yürütülmüştür. Çimlenme öncesi, içlerinde iki adet kurutma kağıdı bulunan 9 cm çapındaki cam petri kapları sterilize edilmiş ve tohumlar kurutma kapları üzerine cımbız yardımıyla ekilmiştir. Her bir petri kabına 25 adet tohum ekildikten sonra petri kapları, gerekli miktarda (petri başına yaklaşık 25 ml) steril su ile sulandıktan sonra kapakları kapatılarak, inkubatörde çimlenmeye bırakılmışlardır. İnkubatörde kontroller günlük olarak yapılmış ve kayıt tutulmuştur. Araştırma sonucu; test edilen parametrelerin sıcaklıktan önemli ölçüde etkilendiğini belirlenmiştir. Her iki pamuk çeşidinin ortalaması ve her iki çeşit için ayrı ayrı en yüksek çimlenme oranı 20 °C'de elde edilmiştir. 8 °C'de ise çimlenme kaydedilmemiştir. May-344 pamuk çeşidinde çimlenme yüzdesinin %45,17, ortalama çimlenme süresinin 4,06 gün ve çıkış oranı indeksinin 1,89 olduğu, Candia pamuk çeşidinde ise çimlenme oranının %16,17, ortalama çimlenme süresinin 3,94 gün ve çıkış oranı

indeksinin 0,58 olduğu belirlenmiştir. Çimlenme parametrelerine ilişkin bu araştırmadan elde edilen veriler dikkate alındığında; her iki çeşit için en uygun çimlenme sıcaklığı olarak, 20 °C tavsiye edilebilir. **Anahtar Kelimeler:** Pamuk, Çimlenme sıcaklığı, Çimlenme parametreleri

INTRODUCTION

Cotton (*Gossypium hirsutum* L.) is one of the world's most important industrial crops. It generates income and welfare for over 250 million farmers across the globe. Although, fiber properties of cotton depend on the genetic potential of cotton varieties, its production requires a substantial investment to achieve profitable yields.

Cotton is successful cultivated in the tropical and temperate regions where the frost-free period is less than 180 days. It is mainly grown in areas where abiotic stress such as high temperature, drought, salinity and chemical toxicity are common constraints for the production of the crop (Jing xiang et al., 2023). In the growth of cotton plant, the primary environmental factor influencing growth and maturity is temperature. Temperature directly controls plants on the rate of many chemical reactions including respiration and photosynthesis, indirectly by causing genetic and environmental interactions (Khetran, et al., 2015).

The temperature requirements of the cotton plant vary according to the phenological periods of the plant (Reddy et al., 1992). This difference may vary not only to phenological periods, but also the time of occurrence of the temperature, the physio-morphological and genetic structure of the plant. Cotton development and production depend on a uniform and vigorous initial stand. Emergence uniformity results from high-vigor, healthy seeds with high germination and field emergence rates (Raphael et al., 2017).

Seed germinating percentage under laboratory conditions is the standard measure of seed quality (ISTA, 1976). There are many studies on the influence of temperature on cotton seed germination under laboratory conditions. The results of previous studies show differences related to optimal temperature requirements of the cotton (Burke and Wanjura, 2010; khetran et al., 2015; Raphael et al., 2017; Fiaz et al., 2020). Comparing the results from a cotton seed germination test, it is therefore, concluded that temperature tolerance performances have genotypic variability in cotton.

Most of the available germination and emergence studies with cultivars developed and adapted to mild climate environments shows that cool temperatures may cause chilling injury to seedlings and reduce stand establishment (Bradow and Bauer, 2010). Initial injury starting from the imbibition of cold water and secondary injury can occur after the initiation of germination when temperatures remain below 18°C (Duesterhaus et al., 2000; Lyons, 2005). Simulation of field conditions in a controlled environment with a wider range of temperatures and genotypes will enable a more accurate understanding of the performance of new cultivars, but there are no studies on this. Therefore, the aim of this study is to determine the effects of different temperatures on the germination parameters of different cotton varieties.

MATERIALS AND METHODS

The laboratory experiment was carried out at the biotechnology laboratory, Department of Field Crops, Faculty of Agriculture, Ondokuz Mayıs University. In the study, the treatments were eight temperature regimes (8 °C, 12 °C, 16 °C, 20 °C, 24 °C, 28 °C, 32 °C and 36 °C) and two cotton varieties (MAY 344 and CANDIA). Seeds of each cotton variety was planted in ten petri dishes to provide ten replications. The design was 8 x 2 factorial laid out in a completely randomized design.

Seed Imbibition

150 seeds of each variety were placed in Petri dishes with a diameter of 147 mm and a depth of 22.4 mm, and then soaked in distilled water for an hour (60 mins). The seed imbibed were removed from the distilled water then sent into the sterile cabinet (laminar flow) for planting.

Sterilization of Petri Dishes

Before planting, Petri dishes (9 cm diameter, 19 mm depth) containing filter papers (Whatman 541) were placed in the sterilizing oven at 356 °F (180 °C) for three hours (180 mins). At the end of the time (after three hours) the oven was automatically turned off and the petri dishes were transferred to the sterile cabinet until next use.

Germination Test

The germination test was conducted according to the Rules for Seed Analysis following methodologies adapted from Raphael et al., (2017) with some modification. 15 cottonseeds imbibed were evenly distributed on double layer of Whatman filter paper in each sterilized Petri dish. Prior to planting, filter papers were moistened with 5 ml of sterilized water. Sowing was carried out on moistened filter papers. After planting, petri dishes were covered and then placed in an incubator with a sensitivity of ± 1 °C and set at the corresponding temperatures. The number of germinated seeds were determined at 2 and 12 days from the beginning of the test. The germinated (plumule emergence) seedlings were recorded after 48 hours. The seeds were considered germinated when the radicle reached 2 mm using electronic digital caliper with 150 mm scale. During counting some petri dishes were kept moistened with distilled water. Diseased seeds or abnormal seedlings were removed once observed.

Germination Parameters

For each treatment, germination measurements were calculated and organized into the excel spreadsheets for statistical analysis.

- i. Germinability (%) = $N_T / N_s * 100$. Whereas; N_T is the total number of seeds germinated at the 12th day and N_s number of sowed seeds. Calculation was based on Ranal et al., (2009).
- ii. Mean germination time (days) [$t = \sum n_i t_i / \sum n_i$, Whereas; t_i is the time since the onset of the experiment to the n th observation (days) and n_i is the number of seed germinated in time i]. Calculation was based on Lusembo et al., (1995).
- iii. Mean germination rate is calculated as the reciprocal of the mean germination time. Calculation was based on Ranal et al., (2009).

Statistical analysis

All germination variables were statistically analyzed using a one-way ANOVA. The LSD value for mean comparison was calculated only if the general treatment F test was significant at a probability of ≤ 0.05 (Gomez and Gomez, 1984). All statistical analyses were performed with the aid of the SPSS (Version 17th) computer software.

RESULTS

Germination Parameters

Germinability was reduced for seeds from MAY 344 and CANDIA at low and higher temperature levels. Temperatures, genotypes and their interaction all had significant ($P \leq 0.01$) effects on cotton germination (Table 1). Germination at different temperature levels showed distinct patterns, with a higher germination percentage (66.33%) recorded at 20 °C and a minimum (1.67%) at 12 °C. As the temperature was lowered, final germination decreased and seeds failed to germinate at 8 °C. (Table 2). The cottonseed appeared to germinate within a range of temperatures. The results revealed that upper limit seed germination (45.17%) was found in cotton variety MAY 344 and the lower seed germination (16.17%) was recorded in variety CANDIA. The interaction indicated that both genotypes under the study had the maximum germination percentage at 20 °C the highest germination percentage (91.33%) was recorded in MAY 344 and the lowest (41.33%) in CANDIA (Table 2).

Mean germination time ranged from 0 to six days, with significant ($P \leq 0.01$) different between temperature regimes (Table 1). In the temperature gradient experiment of 36 °C, which rapidly initiated germination, the seeds took one day to germinate (Table 2). The seeds at 16 °C took longer; that is, it took them six days from the start of the treatment (Table 2). At 8 °C, the seeds needed the most extended period to initiate germination (Table 2). The results revealed with no significant ($P \leq 0.05$) different between genotypes and interaction on mean germination time (Table 1). Cottonseeds failed to germinate at 8 °C; they took few days (1.95 day) to germinated at 36 °C (Table 2). At 16 °C and 28 °C, the MAY 344 and CANDIA seeds germinated slowly, taking 8.48 and 5.59 6 days in MAY 344, and 5.33 and 6.24 days in CANDIA (Table 2).

Table 1: Analysis of Variance (F Values) for effects of genotype, temperature and genotype x temperature interaction on germination parameters of cottonseeds.

Source of Variation	d.f.	Germination Parameters		
		Germinability (%)	Germination Time (days)	Emergence Rate Index (% d ⁻¹)
Genotype	1	294,13**	0.068ns	124,12**
Temperature	7	57,66**	15,36**	40,37**
Genotype x Temperature	7	12,98**	1,76ns	13,88**

Table 2: Effects of temperature, genotype and genotype x temperature interaction on germination parameters of cottonseeds.

		Germination Percentage (%)	Germination Time (days)	Emergence Rate Index (% d ⁻¹)
Genotypes				
	May-344	45.17a	4.06	1.89a
	Candia	16.17b	3.94	0.58b
Temperatures (°C)				
	8	0.00f	0.00f	0.00d
	12	1.67f	3.00de	0.02d
	16	29.67d	6.91a	0.68cd
	20	66.33a	5.00bc	2.77a
	24	57.00b	5.43abc	2.02ab
	28	36.33cd	5.91ab	1.27bc
	32	42.67c	3.83cd	2.37a
	36	11.67e	1.93e	0.75cd
Genotype x Temperature Interactions				
8	MAY-344	0.00f	0.00	0.00e
	CANDIA	0.00f	0.00	0.00e
12	MAY-344	2.00f	3.60	0.02e
	CANDIA	1.34f	2.40	0.02e
16	MAY-344	47.33c	8.48	1.06cde
	CANDIA	12.01ef	5.33	0.31e
20	MAY-344	91.33a	4.12	4.12a
	CANDIA	41.33cd	5.89	1.42cd
24	MAY-344	85.34a	5.65	3.09b
	CANDIA	28.67de	5.20	0.96cde
28	MAY-344	53.33bc	5.59	1.90c
	CANDIA	19.34ef	6.24	0.63de
32	MAY-344	67.33b	3.17	3.98a
	CANDIA	17.99ef	4.49	0.76de
36	MAY-344	14.67ef	1.91	0.97cde
	CANDIA	8.67ef	1.95	0.53de

Values with different letters in the same column for each main effect are statistically different at $p \leq 0.05$. The emergence rate index was significantly ($P \leq 0.01$) different at each level of temperature (Table 1). The results showed that, maximum speed was observed at a temperature pattern of 20 °C, followed by 32 °C, 24 °C, 28 °C, 36 °C and minimum at 16 °C and 12 °C (Table 2). On overall analysis, MAY 344 showed the maximum speed of germination, while CANDIA germinated with the slowest speed (Table 2). The interaction between temperature and genotype was also significant ($P \leq 0.01$) for the emergence rate index (Table 1). The interaction indicated that MAY 344 had the fastest germination speed at 20 °C, 32 °C and 24 °C temperature levels, while the genotype CANDIA showed maximum speed at 20 °C, 24 °C and 32 °C. At 8 °C, all genotypes did not show speed of germination (Table 2).

DISCUSSION

Temperature is critical for regulating plant growth and development. The percentage of the cottonseed germination potential increases linearly as the temperature rises and then decreases linearly until reaching the optimal level, followed by a reduction beyond that level (Raphael et al., 2017). The germination percentage was highest at 20 °C in both of the cotton genotypes. The result was similar with

previous findings (Wanjura and Buxton, 1972; Smith and Varvil, 1984). At 24 °C, all the genotypes were statistically on par with the 20 °C temperature; however, numerically, a slight reduction was observed. As the temperature exceeded 24 °C, a significant reduction in germination percentage was recorded for the genotypes and reached a minimum level at 36 °C. In a similar observation to this research, Sharma et al., (2022) observed highest germination percentage at 20 °C in most of the wheat genotypes. In addition, working with rapeseed in Hungary, Haj Sghaier et al., (2022) noted an increase germination percentage at 20 °C. A temperature above or below the optimum caused the germination potential to drop (Ikram, et al., 2022; Burke and Wanjura, 2010). High temperatures of 36 °C greatly hindered seed germination and subsequent emergence owing to the inhibitory impact of high temperatures. The inhibition of seed germination has been well documented in response to high temperature which often occurs through the induction of Abscisic acid (ABA) (Toh et al., 2008). Moreover, high temperature during germination causes cell and embryo death and strictly prohibits the normal germination process or sometimes proved to be lethal in many plant species (Iloh et al., 2014; Kumar et al., 2011).

There were some notable genotypic differences in the germination percentage at different temperature levels. The genotypes MAY 344 was on par germination across the temperatures. This genotypic variability might be due to the genetic potentiality of different genotypes to withstand temperature fluctuations. However, the response of genotypes towards the early heat stress shows any clear relationship with their characteristic breeding nature to cope with terminal heat stress. The similar results were reported by the previous findings (Chu et al. 2016; Fernando and Anibal, 2018).

The speed of germination followed a different pattern as compared to the germination percentage. The germination speed increased with the rise in temperature, and it was significantly higher at 32 °C than 20 °C, but it reduced at higher temperature, i.e., 36 °C. On increases in temperature up to 36 °C led to the most rapid and complete germination of seeds after one day of incubation (Table 2). Germination was sluggish when the temperature was reduced to 12 °C. However, low temperatures of 12 °C or below caused delayed germination, so that the process required a longer time. Metabolic reactions and enzyme activity cause variation in the germination time during the germination process. Indeed, lower temperatures cause seeds to have a slower metabolism, resulting in slower growth, whereas higher temperatures attribute to have a higher rate of seed reserve mobilization, dissipating the seed energy required for growth (Cassaro-Silva et al., 2001; de Oliveira et al., 2013). Working with maize, Khaeim et al., (2022) revealed that germination at ≤ 15 °C required a longer time to reach the standard measurement point of germination. In another studies, resulted an increase of germination rate in cotton seeds at higher temperatures (Raphael et al., 2017, Francisco and James, 2011).

CONCLUSION

The findings of this study highlighted the critical factor affecting cottonseed germination and established the optimal range for successful germination. The optimal temperature for cottonseeds germination was within a more comprehensive range from 20 °C to 24 °C. Maximum germination speed was obtained at 36 °C. Genotypic variability was observed in the response towards heat stress given during the germination stage. These findings have the potential to optimize the sowing time in different agroclimatic regions and breeding programs for the development of modern cotton cultivars tolerant to early heat stress.

REFERENCES

1. Abdelraheem A., Esmaili N., O'Connell M., Zhang J 2019. Progress and perspective on drought and salt stress tolerance in cotton. *Ind. Crops Prod.* 130: 118–129.
2. Bradow JM., Bauer PJ. 2010. "Germination and seedling development," in *Physiology of Cotton*, Stewart JM., Oosterhuis DM., Heitholt JJ., Mauney JR, Eds., Dordrecht: Springer, 48–56 pp.
3. Burke JJ., Wanjura DF 2010. Plant responses to temperature extremes. In: *Physiology of cotton*. Springer, 123-128.
4. Cassaro-Silva M 2001. Efeito Da Temperatura Na Germinação de Sementes de Manduirana (*Senna macranthera* (Collad.) Irwin et Barn. —Caesalpinaceae). *Rev. Bras. Sementes*, 23: 92–99.
5. Chu T., Chen R., Landivar J., Maeda M., Yang CY., Starek M 2016. Cotton growth modeling and assessment using unmanned aircraft system visual-band imagery. *Journal of Applied Remote Sensing*, 10(3): 1-19.

6. de Oliveira AKM., Ribeiro JWF., Pereira KCL., Silva CAA 2013. Efeito Da Temperatura Sobre a Germinação de Sementes de *Diptychandra Aurantiaca (Fabaceae)*. Acta Sci. Agron., 35: 203–208.
7. Duesterhaus B., Hopper N., Gannaway J., Valco TD 2000. A screening test for the evaluation of cold tolerance in cottonseed germination and emergence. Proceedings of the Beltwide Cotton Conference., 1: 596–599.
8. Fernando VBA., Aníbal TP 2018. Germination of three cotton genotypes seeds (*Gossypium hirsutum* L.) with imbibition in water treatments. Revista Logos, Ciencia & Tecnología, 10(4): 149-161.
9. Fiaz A., Asia P., Noor M., Muhammad A. A., Muhammad NA., Khurram S., Subhan D., Niaz A 2020. “Heat Stress in Cotton: Responses and Adaptive Mechanisms,” in Cotton Production and Uses. Agronomy, Crop Protection, and Postharvest Technologies”, Shakeel A., Mirza H., Eds, Springer publisher, 393-425.
10. Gomez KA., Gomez AA 1984. Statistical procedure for agricultural research. 2nd edition, John Wiley and Sons Co, New York. pp680.
11. Haj Sghaier A., Tarnawa Á., Khaeim H., Kovács GP., Gyuricza C., Kende Z 2022. The Effects of Temperature and Water on the Seed Germination and Seedling Development of Rapeseed (*Brassica napus* L.). Plants 11, 2819.
12. Ikram M., Rehamn HU., Soysal S., Aamir M., Islam MS., Kumari A., Sabagh AE 2022. Impact of climate change on cotton growth and yield. In: Cotton production under abiotic stress. Emine Karademir, Cetin Karademir (eds), iksad publishing house, 5–21.
13. Iloh AC., Omatta G., Ogbadu GH., Onyenekwe PC 2014. Effects of elevated temperature on seed germination and seedling growth on three cereal crops in Nigeria. Sci. Res. Essays, 9: 806–813.
14. ISTA 1976. International Rules of Seed Testing. Seed Science & Technology 4: 23-28.
15. Jingxiang H., Jiarui Z., Xuezhi L., Yingying M., Zhenhua W., Heng W., Fulai L 2023. Effect of biochar addition and reduced irrigation regimes on growth, physiology and water use efficiency of cotton plants under salt stress. Industrial Crops & Products 198: 1-16.
16. Kerby TA., Keeley M., Johnson S 1989. Weather and seed quality variables to predict cotton seedling emergence. Agron. J., 81: 415–419.
17. Khaeim H., Kende Z., Jolánkai M., Kovács GP., Gyuricza C., Tarnawa Á 2022. Impact of Temperature and Water on Seed Germination and Seedling Growth of Maize (*Zea mays* L.). Agronomy, 12: 397.
18. Khetrans AS., Waseem B., Sanaullah B., Akram S., Adnan NS., Muhammad Y., Salih AIS., Bilal HM., Muzafar AL., Shabeer A., Sheer AM., Shahbaz KB 2015. Influence of Temperature Regimes on Germination of Cotton (*Gossypium hirsutum* l.) Varieties. Journal of Biology, Agriculture and Healthcare, 5(11): 1-7.
19. Kumar S., Kaur R., Kaur, N., Bhandhari K., Kaushal N., Gupta K., Bains TS., Nayyar H 2011. Heat-stress induced inhibition in growth and chlorosis in mungbean (*Phaseolus aureus* Roxb.) is partly mitigated by ascorbic acid application and is related to reduction in oxidative stress. Acta Physiol. Plant., 33: 2091–2101.
20. Lusembo P., Sabiiti EN., Mugerwa JS 1995. Influence of seed size on seed and seedling characteristics of *Centrosema Pubescens*. African Crop Science Journal, 3(4): 547-551.
21. Lyons JM 2005. Chilling injury in plants. Annual Review of Plant Physiology., 4: 445–466.
22. Maguire JD 1962. Speed of germination-aid in selection and evaluation for seedling emergence and vigor. Crop Sci, 2: 176–177.
23. Munir M., Jmil M., Baloch J., Khatak KR 2004. Growth and Flowering of *Antirrhinum majus*L. Under Varying Temperatures. Intern. J. of Agric. and Biol., 1: 173–178.
24. Nabi G., Mullins CE 2008. Soil temperature dependent growth of cotton seedlings before emergence. Pedosphere, 18: 54–59.
25. Oner C., Sema B 2010. Effects of climatic factors on cotton production in semi-arid regions. Res. on Crops., 11(3): 785-791.
26. Pearson RW., Ratliff LF., Taylor HM 1970. Effect of soil temperature strength and pH on cotton seedling root elongation. Agron. J., 62: 243–246.
27. Ranal MA., Denise GDA., Wanessa RF., Clesnan MR 2009. Calculating germination measurements and organizing spreadsheets. Revista Brasil. Bot., 32(4): 849-855.

28. Raphael JPA., Bruno G., Jesion GSN., Gabrielle CM., Ciro AR 2017. Cotton germination and emergence under high diurnal temperatures. *Crop Sci.*, 57: 2761–2769.
29. Reddy KR., Hodges HF., Reddy VR 1992. Temperature effects on cotton fruit retention. *Agron. J.*, 84: 26-30.
30. Sharma S., Singh V., Tanwar H., Mor VS., Kumar M., Punia RC., Dalal MS., Khan M., Sangwan S., Bhuker A 2022. Impact of High Temperature on Germination, Seedling Growth and Enzymatic Activity of Wheat. *Agriculture*, 12: 1500.
31. Smith CW., Varvil JJ 1984. Standard and cool germination tests compared with field emergence in upland cotton. *Agron. J.*, 76: 587–589.
32. Steiner JJ., Jacobsen TA 1992. Time of planting and diurnal soil temperature effects on cotton seedling field emergence and rate of development. *Crop Sci.*, 32: 238–244.
33. Toh S., Imamura A., Watanabe, A., Nakabayashi K., Okamoto M., Jikumaru Y., Hanada A., Aso Y., Ishiyama K., Tamura N., 2008. High Temperature-Induced Abscisic Acid Biosynthesis and Its Role in the Inhibition of Gibberellin Action in Arabidopsis Seeds. *Plant Physiol.*, 146: 1368–1385.
34. Tuck AG., Tan DK., Bange MP., Stiller WN 2010. Cold-tolerance screening for cotton cultivars using germination chill protocols. *J. of Sci.*, 45(3): 145-150.
35. Upendra MS., Brett LA., Andrew WL., Rajan PG 2017. Root biomass, root/shoot ratio, and soil water content under perennial grasses with different nitrogen rates. *Field Crops Research*, 210: 183–191.
36. Vassilevska-Ivanova R.; Tcekova Z 2002. Effect of Temperature on Seed Germination and Seedling Growth of Sunflower (*Helianthus Annuus* L.). *Compte Rendus l'Académie Bulg. Sci.*, 55: 10–67.
37. Wanjura DF., Buxton DR 1972. Hypocotyl and radicle elongation as affected by soil environment. *Agron. J.*, 64: 431–434.
38. Yasar S., Karademir E 2021. Determination of the factors limiting cotton fiber quality in Turkey. *Journal of Applied Life Sciences and Environment*, 1(185): 85-99.

MODERN ÇAĞDA ÇOCUKLARDA GELİŞİM SORUNLARI

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ÖZET

Modern çağda çocuklarda gelişim sorunları, çeşitli sosyo-kültürel, dijital ve psikolojik etkilerle karmaşık bir yapıya bürünmüştür. Bu sorunlar arasında şunlar öne çıkmaktadır:

1. Dijital bağımlılık ve ekran süresi: Teknolojinin yaygın kullanımı, çocuklarda artan ekran bağımlılığına yol açarak, sosyal becerilerin gelişimini olumsuz etkileyebilir. Özellikle küçük yaşlarda aşırı ekran süresi, dikkat eksikliği, uyku sorunları ve obezite gibi fiziksel ve zihinsel sağlık sorunlarına yol açabilir.

2. Sosyal izolasyon: Dijital dünyada sosyalleşme, yüz yüze iletişimin yerini alabiliyor. Bu durum, çocukların sosyal becerilerini, empati geliştirmelerini ve grup dinamiklerini anlamalarını engelleyebilir.

3. Akademik baskılar ve mükemmeliyetçilik: Modern çağda eğitim ve kariyer baskısı artmakta. Bu durum, çocuklarda stres, anksiyete ve depresyon gibi duygusal sorunların ortaya çıkmasına neden olabiliyor.

4. Duygusal ve psikolojik sorunlar: Sosyal medya ve çevrimiçi platformlar, çocuklar üzerinde ideal bir "mükemmel hayat" algısı yaratarak, özgüven sorunlarına ve beden algısı bozukluklarına neden olabiliyor. Zorbalık, sosyal baskılar ve sürekli kıyaslama, çocukların psikolojik sağlığını olumsuz etkileyebilir.

5. Aile dinamiklerinin değişimi: Aile yapısındaki değişiklikler (boşanma, tek ebeveynli aileler, çift kariyerli ebeveynler) ve ebeveynlerin yoğun iş temposu, çocukların duygusal gelişimini etkileyebilir. Yeterli ilgi ve destek alamayan çocuklar, duygusal gelişimlerinde gerilik yaşayabilirler.

6. Hiperaktivite ve dikkat eksikliği bozukluğu (DEHB): Modern çağda bu tür bozuklukların teşhisi daha yaygın hale geldi. Çocuklarda aşırı hareketlilik, odaklanma sorunları ve dürtüsel davranışlar, eğitim sürecini ve sosyal ilişkileri zorlaştırabilir.

Bu gelişim sorunlarının üstesinden gelmek için, aileler, eğitimciler ve toplumsal kuruluşlar çocuklara daha fazla destek sağlama sorumluluğunu üstlenmelidir.

Anahtar kelimeler: çocuk, aile, gelişim, gelişim sorunları

ABSTRACT

In the modern age, developmental problems in children have taken on a complex structure with various socio-cultural, digital and psychological effects. The following problems stand out among these:

1. Digital addiction and screen time: The widespread use of technology can lead to increased screen addiction in children, negatively affecting the development of social skills. Excessive screen time, especially at young ages, can lead to physical and mental health problems such as attention deficit, sleep problems and obesity.

2. Social isolation: Socializing in the digital world can replace face-to-face communication. This can prevent children from developing social skills, empathy and understanding group dynamics.

3. Academic pressures and perfectionism: In the modern age, pressure for education and careers is increasing. This can cause emotional problems such as stress, anxiety and depression in children.

4. Emotional and psychological problems: Social media and online platforms can create an ideal "perfect life" perception in children, causing self-confidence problems and body image disorders. Bullying, social pressures and constant comparisons can negatively affect children's psychological health.

5. Changes in family dynamics: Changes in family structure (divorce, single-parent families, dual-career parents) and parents' busy work schedules can affect children's emotional development. Children who do not receive enough attention and support may experience delays in their emotional development.

6. Hyperactivity and attention deficit disorder (ADHD): In the modern age, the diagnosis of such disorders has become more common. Hyperactivity, concentration problems and impulsive behaviors in children can make the educational process and social relationships difficult.

In order to overcome these developmental problems, families, educators and social organizations should take responsibility for providing more support to children.

Keywords: child, family, development, developmental problems

ARAŞTIRMA VE BULGULAR

Eğitim üzerine yazılmış hemen bütün kitaplar insanın sosyal bir varlık olduğunu vurgular. Mademki öyledir, o zaman öncelikle toplum ve toplumun içinde olduğu sosyal hayata bakmak, onun getirdiği koşullar üzerinde durmak, özellikle de “Son yıllarda ne geldi dünya çocuklarının başına? Neler yaşıyorlar?” diye sorkulamak lazım. Son yıllarda çocukların karşılaştıkları, tesiri altında kaldıkları başlıca üç değişim alanının var olduğunu görüyoruz... Bunlardan ilki “tüketim eğilimi”dir. Piyasa ekonomisindeki eğilimler bireyin diğer (sosyal - duygusal) arzularını önemsemeyip sadece tüketime yönelik arzularını sömürmekte ve rekabet duygusunu artırmaktadır. Hafta sonları ya da akşamları, işten, okuldan çıkınca insanlar yine kapalı mekânlara gitmektedirler. Herkesin, her şeyi tüketmeye şartlandırılması, bunun kitle iletişim araçlarıyla sürekli pompalanması, gerek olmamasına rağmen birden, ikiden fazla aynı şeye sahip olmak ve tüketmenin sonucunda, teknolojinin de gelişmesiyle beraber, teknolojik araç – gereçlerle kuşatılmak bu eğilimin sonucudur.

Çocukların küreselleşen ekonomi içinde yaşamlarını sürdürebilmeleri için okul da onları daha fazla çalışmaya zorlamaktadır. Geniş aile bağları bu yöndeki olumsuzlukları azaltabilmektedir ancak ülkelerin gelişmişlik düzeylerindeki artışa bağlı olarak bu bağlar da zayıflamaktadır. Bu olumsuz eğilimin yanısıra “kamusal olan” ın “özel olan” için feda edilmesi sorunu vardır ve bu durum dünya bankası politikası gibi bütün ülkelere yayılmaktadır. Diyelim ki biz hepimiz bir mahallede yaşıyoruz. Bir sürü evler, yapılar var... Bakkal var, kasap var, manav var... Ancak bu mahalle içinde yeşil alanların, parkların, bahçelerin de olması gerekiyor. Bütün bu olması gerekenler kimin hakkıdır? Genel olarak bir toplumda yaşayan vatandaşların hakkıdır.

Buna bağlı olarak da ikinci değişim alanı, yani, “çocukların sokak ilişkilerinin azalması” durumu ortaya çıkmıştır. Geçmişte çocuklar sokakta günlerini geçirip oyun oynayabilirlerdi ancak özellikle büyük kentlerde bu durum artık gerçekleşmemektedir. Serbest olarak oynayacakları boş arsalar yok, hayal kurup muzırlık yapacakları parklar yok, çamurla oynayacakları, rahatça ip atlayıp top oynayabilecekleri mahalleler maalesef yoktur. Bunu yerine betonlarla çepeçevre kuşatılmış mekânlar var. Özel sitelerde oturmasına ve insanların küreselleşen bir iletişim ağı içinde olmasına karşın komşuluk ilişkileri azalmaktadır. Artan hareketlilik nedeniyle yetişkinler de çocuklar da daha fazla kişiyle bir araya gelmektedirler ancak gerçek iletişim kurmada zorlanılmakta, yüz yüze olmaktan, göz kontağı kurmaktan kaçınılmaktadır. Bu durum sosyal duygusal yaşamımız açısından olumlu sonuçlar doğurmamaktadır.

Üçüncü değişim alanı ise “genel çevresel problemler” dir. Çocuklar bir yandan genel problemlerden haberdar olurken, bir yandan da kendi doğal alanlarından uzaklaşmaktadırlar. Yaşamdaki bütün bu değişimlerin sonucunda da doğadan ve doğallıktan yoksun, kapalı mekanlarda kendini daha iyi hisseden, içine kapanan ve hasta olduğunu bile anlayamayan bir gençlik ile karşı karşıya kalınmaktadır. Bütün dünyadaki bu olumsuz gidişin etkisini azaltabilmek için öncelikle yapılması gereken şey, insanların eğitim alma hakkını sağlamaktır.

Yaşamımızdaki bu değişim alanları çocukları ile baş etmek konusunda anne babaları çok zorlamaktadır. Özellikle büyük şehirlerde yaşayan aileler -ki bunların birçoğu tek çocuklu çalışan anne ve babalardır- çocuklarıyla baş edemeyip özgürlük ve sınır dengesini ayarlayamamaktadırlar. Oysaki “Evet”ler ve “hayır”lar istenirse öyle güzel ayarlanır ki çocuklar hem özgürlük hissederler hem de sınırları algırlarlar. Her yaştaki insanın ve özellikle de çocukların, enerjileri olumlu yönde harcanabilecek ilgi alanlarına yönlendirildikçe ve kendilerini ifade edebilecekleri ortam ve fırsatlar onlara sağlandıkça ruhen sağlıklı olma ihtimalleri artar. Bu gelişme ise onların sosyal hayatta başarılı olmalarını, kendilerine güven duymalarını, olumlu benlik duygusu geliştirmelerini sağlar. Bu zemin hazır olmadan bireyin çalışma ve akademik başarı göstermede çok önemli bir yeri olan içsel motivasyona sahip olması beklenemez. Bu gerçeği anne babaların öncelikle öğrenmesi ve kabul etmesi gerekmektedir. Bunun yanı sıra, akademik başarı sadece fen ve matematik alanlarındaki başarıdan ibaret değildir, akademik başarı bizim bilişsel yapımızın bir tek yönü ele alınarak değerlendirilemez. Farklı yetenek alanlarımız geliştirilerek o yönlerde başarı sağlanabilir; örneğin; sporda, sağlık konularında, sosyal konularda, yabancı dil

öğreniminde, iletişim becerilerinde... Ancak son saydıklarım -maalesef- başarıdan sayılmıyor... Biliyorsunuz, çocuklarımızın sosyal konulardaki dersleri ya da beden eğitimi, görsel sanatlar gibi dersleri zaman zaman ya boş geçen dersler arasında yer almakta ya da o ders saatlerinde önemli olarak algılanan matematik, fen ve teknoloji konularındaki dersler yapılmaktadır. Yani bu derslere olması gereken önem verilmemektedir.

Eğer bu anlayış doğru olsaydı bu kadar çalışmanın, dersanelere gitmenin sonucunda şöyle olurdu; Azeri çocukları bütün fen ve matematik ağırlıklı tarama araştırmalarında diğer ülkelerin çocuklarına göre daha yüksek puanlar alırdı... Oysa ki yapılan araştırma sonuçları bizim nerdeyse en son sıralarda olduğumuzu gösteriyor. Bizim esas sorunumuz, getirdiğimiz sistemlerde gereğince tutarlılık ve süreklilik gösterememe özelliğine sahip olmamız, özellikle de millî eğitim sistemlerinde.

Oyun, çocukların baş edebildikleri ve baş edemedikleri her şeyi yani hayatlarını yansıttıkları bir ortamdır. Oyun çocuğun işidir. Bizim yapmamız gereken de oyun için ona uygun zaman ve ortam hazırlamaktır. Zengin uyarıcı dolu bir çevre hazırlayarak rehberlik etmek, ortam hazırlamak ve sonra geride durmak... Gerisini o keşfediyor zaten... Erken çocukluk dediğimiz “0 – 8 yaş” dönemi zaten “keşfetme” ve “merak” üzerine kurulmuş bir dönemdir... Anne balar çocuklarının oyunlarını keserek, onun sosyal ilgilerini yok ederek, onu bilgisayarın ya da test kitaplarının başına gitmeye zorlayarak işlerin çözümleneceğini zannediyorlar. Oysaki çocuk hazır olmadan uygun eğitim ve öğretim yaşantısıyla karşılaşmadan öğrenme gerçekleşmiyor. Anne ve babalar çocuklarına nasıl bakıp destekleyeceklerini bilmezlerse çocuklarını da doğru yetiştiremezler. Ya da çalışan anne akşam eve geldikten sonra çocuğuna yeterli zaman ayıramadığı için kaygılanıp bütün ilgisini, parasını, her şeyini çocuğa yöneltir ve her istediğini yaparsa o çocuk tabii ki şımarık olur.

Oyunla ilgili yayımlanmış araştırmalar veya kitaplar bizlere der ki; erken dönemde çocuğun gününün büyük bir kısmını serbest oyun oynayarak geçirmesi gerekmektedir. Üstelik elleri için içinde olacak; çamurda, böcekte, bahçede, tamirde, inşa işinde. Çünkü çocuklar en iyi oynarken öğreniyorlar. Başka ülkelere gittiğinizde insan eli değmemiş doğal ortamlarda çocuklara sabah ve akşamüstü birer saat olmak üzere serbest yürüyüş yaptırıyorlar. Çocuklar ustelik de çevredekilerle konuşmuyor. Sadece bakıyor, doğayı inceliyor. Bu gözlem yapabilme becerisi ise bilişsel gelişim için öncelikle istenen bir şeydir. Orada gözlem yapsın, çevresine baksın, çiçeği, böceği görsün ve incelesin. Burada öğretmenin görevi, çocuk doğa gezisinden gelince başlıyor... Diyelim ki böyle bir gezi yaptırdınız, otursunuz birlikte bir yere, sorarsınız: “Sen ne gördün, ne duydun?” Çocuklardan biri der ki “Ben jet uçağı sesi duydum”, diğeri “Ben duymadım”, biri der “Kuş öttü, serçe sesi duydum” diğeri “Ben kaplumbağa gördüm, sen ne gördün? Araba sesi duydum” Ardından da her birinin algıladığı bilgiyi arkadaşlarına aktardığını düşünürsek hem kavram öğreniminin hem de ifade edici dil gelişimlerinin nasıl desteklenebileceğini görürüz. Üstelik çocuklara böyle etkinliklerle hem kendini ifade etme şansı, hem de diğerlerini dinleme becerisini kazanma fırsatı sunulur.

Bu süreçte çocuklar hepimizin farklı algılayabildiğini ve çevremizde çok çeşitli nesne ya da varlık olduğunu fark ederler. Farklılıkları fark etmek ise bilişsel gelişim sürecinde aşmamız gereken ilk aşamadır. İnsan, bir şeyleri fark etmezse onunla ilgili merak da duymaz, bilgilenme gereksinimi de duymaz. Mesela; diyelim ki siz huzursuz bir insansınız ancak kendiniz bunun farkında değilsiniz, insanları üzüyorsunuz. Hatalarınızı düzeltmeniz, eksikliklerinizi telafi etmeniz için öncelikle sizin kendinizin farkında olmanız gerekiyor ki kendinizi sağaltabileceğiniz, önlemler alabileceğiniz. Çocukların da matematikle ilgili ilk becerilerinin oluşması için çevrelerindeki farkında olmaları, gözlem yapabilmeleri ve gözlemlerini kayıt altına alabilmeleri gerekir. Biliyorsunuz ki, okuma yazma bilmeyen çocuklar bunu yapabilir. Bir kâğıt verirsiniz, söylersiniz: “Haydi başla çocuğum, gördüklerini çiz. Ne gördün? Kaç tane gördün? Başka ne gördün?” . Çocuk der: “Üç tane birbirine benzeyen yaprak gördüm”. Ardından söylersiniz: “O zaman haydi o üç yaprağı çiz”. Gördünüz mü işte, matematik çalışıyoruz fakat aynı zamanda sanat eğitimi yapıyoruz, bunun yanı sıra, algıladıklarını hatırlama alıştırmaları yapmış oluyoruz. Çocukları yürüterek, psikomotor olarak onları geliştirip, deşarj ederek önce algılamalarını sağlamak için ortam sağladık, sonra da dönüp bunları akademik beceriye çevirdik. Gözlem yapmak, çizmek, rengini ve sayısını söylemek, zaman ve mekanla ilgili yönergeleri yanıtlamak, rengini doğru boyamak ve s. ise küçük yaşta kazandırılacak akademik becerilerdendir. Çocuk, bu tür akademik becerileri erken yaşlarda kazanırsa ileride yani ilk öğretimdeki dersler yüklenince, daha çok konsantrasyon isteyen işler artınca o kazandığı becerileri sergilemeye başlar. Mesela, diyelim ki bir kitap aldık, kitapta kuş, çiçek ve s. resimleri var, resimlerin yanına da boşluklar koyulmuş. Öğretmenden çocuğa soru sorması bekleniyor: “Bu çiçeği ne zaman gördün? Tarihini yaz” ve ya “Nerede gördün,

bunun adı ne? ". Böyle bir çalışma aslında öğretmen ve ebeveynlere şu mesajı da veriyor: "Çocuğu gezdirin, değişik öğrenme ortamlarına sokun ancak gezdirirken de gelişigüzel gezdirmeyin, amaçlı gezdirin". Böyle bir etkinliğin devamında öğretmen "Bu gördüklerimizin benzeri acaba başka hangi ülkelerde olur, biliyor musunuz?" diyerek konuyu geliştirebilir, merak uyandırıp çocuğu araştırmaya, kütüphaneye gitmeye, internette tarama yapmaya yönlendirebilir.

Modern dünyanın en önemli ürünlerinden olan bilgisayar veya televizyon gibi teknoloji araçlarını çocuklara kullandırmada da belli bir yöntem belirlenmelidir. Teknolojik araçların eğitimde şüphesiz çok önemli yerleri vardır, ancak "doğru amaçlarla" kullanılması lazım. Televizyonda bazen güzel belgeseller, çocuk programları, çizgi filmler yayınlanmaktadır ancak anne babalar bu tür programları incelemeli ve çocuğun sürekli ekran karşısında kalmasına izin vermek yerine, onun için uygun birkaç programa onunla birlikte karar vermelidirler. Çocukla beraber oturup haftada bir iki program izlemeli ve sonra televizyonu kapatmalıdırlar. Anne babalar her seferinde olmasa bile bazen ona dikkatli izlemesi için telkinde bulunmalı ve daha sonra programdan, filmde birlikte sonuçlar çıkarmalı yani çocuğundan izlediği programın ana fikrini çıkarmasını istemelidir. Veya ona " Bu filmi sen yapsaydın adı ne olurdu gibi hayal gücünü geliştirici sorular da sorabiliriz. Bir de eve gelir gelmez televizyonun düğmesine basılmamalıdır. Peki, bastığımız zaman ne oluyor? Çocuğa, "Evladım, bu öyle önemli bir araç ki bunsuz olamıyoruz" mesajını vermiş oluyoruz. Bilgisayar kullanımını konusunda da söylenecekler benzerdir. Teknolojik araçlar gerektiğinde açılıp yararlanılmalı ve sonra kapatılmalıdır. Aksi takdirde yaşamda yapılacak birçok şey yapılmamış ve aile bireyleri evin içinde gereksiz yere atıl bir şekilde ve birbirlerinden kopuk zaman geçirmiş olurlar. Bu da "aile merkezli aile" kavramını sarsar ve aile bireyleri arasında iletişim kopukluğu başlar. Hâlbuki tavır ve davranışlarımızla çocuğumuza ne mesaj verdiğimizi sürekli sorgulamamız yani doğru model olmamız gerekiyor ebeveynler ve öğretmenler olarak.

"Aile" merkezli yaşamamız da çocuk gelişiminde şart olacak bir mevzudur. Evet, aile bireylerinin evi sıcak bir yer olarak algılayabilmesi, kendisini rahatlıkla ifade edebilmesi ve gereksinimlerini karşılayabilmesi için "aile" merkezli yaşamalıyız, "çocuk" merkezli veya "anne" merkezli veya "baba" merkezli değil. Evde yapılacak birçok şeyi ailece paylaşarak yapmak çok önemlidir. Yeterince paramız var diye maç ve dizi seyretmek için salona bir LCD televizyon, anneler mutfakta yemek hazırlarken seyretsin diye mutfaka bir televizyon; olmadı bir de çocuğun odasına televizyon koyarsak eğer, o zaman kimin neyi, niye seyrettiğini bilemeyiz. Aynı şey bilgisayar için de geçerlidir, yani çocuğunuz internette hangi sitelere girip dolaşiyor, kiminle "chat" yapıyor, nelerle meşgul oluyor; kontrol edemezsiniz. Çocuklar bunları isteyebilirler tabii ki. Çocuklar sürekli bir şeyler isteyebilirler çünkü onlar henüz "ben merkezci" dönemde dirler, kendileri için sürekli bir şeyler isteyebilirler fakat acaba siz almalı mısınız? O henüz meselelere kendi penceresinden bakmaktadır ancak siz ona karşıdan bakmayı yani "empati" kurma becerisini yavaş yavaş kazandırmalısınız. Heves ile gerçek bir gereksinin ve istek kavramlarını karıştırmamak da gereklidir. "Tabii ki yavrum, sen bunu da isteyebilirsin, onu da isteyebilirsin ikinci ayakkabıyı da isteyebilirsin yalnız buna gerek yok çünkü ailemizin farklı ihtiyaçları var, onlara da para ayırmalı, bütçemizin bir kısmını bunun için kullanmalıyız" demelisiniz. Hatta birlikte bütçe yapmalı ve tüketim kalemlerine birlikte karar vermelisiniz. Azerbaycanda çok az aile bunu yapabiliyor, yaptığı zaman da mutlu oluyor... Biz herkese bunu öneriyoruz: Ailecek birlikte karar veriniz, "Eve bir şey alınacak ya da mutfaka bir şey alınacak ise eğer, ne alakası var şimdi, çocuk mu karar verecek? Tepemize mi çıkartacağız onları?" demeyiniz çünkü böyle davranarak vereceğiniz başka bir mesaj daha var pedagojik olarak: "Sen önemlisin, ailemizin bir ferdisin; sana değer veriyor, saygı duyuyoruz; senin kararların belki de bize hiç aklımıza gelmeyecek bir fikir verecek" gibi. Odasına bir dolap mı istiyor, kalkın hep beraber ona dolap almaya gidin. Odasını beraber ölçün biçin, hangi duvara yaslamak istediğine ve diğer detaylara karar versin. Burada o dolap bahane, bunu önermekle vermek istediğimiz başka mesajlar var: Aile olmayı öğreneceğiz her şeyden önce, çıkmışken bir yemek yiyeceğiz belki, onu da heyecanla, hevesle yapacağız birlikte. Çünkü evlilikler zaman zaman motivasyona ihtiyaç duyuyor. Karı koca, çocuklar, nine, dede kim varsa evde kalkın gidin, birlikte gezin, birlikte o heyecanı duyun, sizle beraber çocuğunuz da duysun: "O kaç lira? Hangi malzemenin özelliği ne, hangisi daha uygun? Benim ailem hangisini alabilecek? Ailemiz nasıl bir aile? Ben de tutumlu olmak zorunda mıyım?" gibi konularda düşünsün. Dolabına sahip olduğunda da bakımının nasıl yapılacağını öğretip birlikte yerleştirmeniz gerekmektedir. Çocuk ancak böyle bir yaklaşımla -hazıra konmadan- yaşam becerileriyle donatılabilir ve kabul eden ve hoşgörü gösteren bir aile içinde hissedebilir kendisini. Bunun yanı sıra tutumluluğu öğretmeden "doğru vatandaş" olma becerisini nasıl öğreteceksiniz? Bilgisayar, televizyon ve s. ona öğrenmesi gereken toplumsal değerleri, ailenize ait kuralları öğretemez. Yani çocuğun bir

topluluk içinde yaşaması kendiliğinden her şeyi öğrenmesine yetemez. Çevresindeki yetişkinlerin içinde yaşanan kültürün özelliklerini yorumlayarak çocuğa aktarması gereklidir. Ebeveyn aracılığıyla çocuğun öğrenmesi çok önemlidir... Eve gidince o gün yaşadıklarınızı çocuğunuzla paylaşınız. Bu, aynı zamanda aranızda sıcak bir iletişim kurulmasına ve sağlıklı bir bağlanma yaşanmasına da yol açar. O da bize bugün yaşadıklarından bilgiler aktaracak ve biz de dinleyip onunla sohbet edeceğiz ki dinlenilmenin güzelliğini yaşasın, kendine güven duysun. Ayrıca o da dinleme becerisi kazansın ve çevresindeki kişilerle sağlıklı iletişim kurma yolunda ilerlesin. Hayatı öğrenmek zorundalar: Nerede ne var? Kim kimdir? Bu nedir? İnsanlar onlar için ne diyor? Çünkü, günlük yaşam koşturması derken çocuklar ev yaşamını paylaşmadan bir köşede oturtuluyorlar. Çocuklar sınava hazırlanıyor diye temizlik yaptırılmıyor, evin işleri onlarla paylaşılmıyor, ellerine cep telefonu veriliyor, para veriliyor, servis ayarlanıyor. Sonra çocuklar dersane, okul, ev ve kafeler arasında yaklaşık altı yıllarını geçiriyorlar. İnsan olarak hepimizin olabildiğince çok açık havada kalmaya ihtiyacımız var, ta bebeklikten yaşlılığa kadar çünkü öyle yaratılmışız. Bizler doğanın bir parçasıyız. Doğadan, doğallıktan uzaklaştıkça da başımıza maddi-manevi sorunlar açılıyor. Çok değerli bir söz var bu konuda fakat kimin söylediğini hatırlayamayacağım, şöyle diyor: “Hiçbir yeni teknoloji görmedim ki mutlaka bir tersliğe yol açmasın, olumsuz bir yan etkisi olmasın.” Karamsar bir cümle, ancak doğruluk payı da var sonuçta. Bir şeyler icat ediliyor, o icat ya kansere yol açıyor ya da atığı kolay kolay yok edilemiyor vs. Biliyorsunuz ki teknoloji zaten çok hızlı geliyor, ürünler gittikçe küçülüyor, teknolojik atıklar sorun oluyor. Teknoloji güzel ancak bunun yanında getirdiği olumsuzluklar da var. Çocuk merkezli bir problem çözme yaklaşımı; araştırma ve incelemeye, iş birliğiyle sorun çözmeye yönlendiren açık uçlu materyaller kullanan destekleyici ebeveyn ve öğretmen tutum ve davranışlarını gerektiriyor.” Çocuk merkezli eğitim ve öğretim yaklaşımının doğruluğunun bütün ülkelerde yapılan araştırmalarla ortaya konduğunu da hatırlatarak bu cümlelerin şimdiye kadar vurguladıklarımınla örtüştüğünü belirtmek isterim.

Bu kitapta Froebel’in güzel bir değerlendirmesi de var (Froebel, okul öncesi eğitim kurumlarının, anaokullarının kurucusu olarak bilinen alman bilim insanı), eğitimcilerle bahçıvanlar arasında bir analogi yapmış yani benzetme yapmış (Analogi yöntemi, bilinmeyenle bilinen arasında köprü kurarak öğrenmeyi kolaylaştıran bir yöntemdir). Diyor ki: “Eğitimci bahçıvan, anaokulu ise çocuk bahçesidir.” Froebel bu bahçede çocukların kendi doğal yapıları ile evrenin yapısının birbirine uyumunu sağlayacak şekilde eğitim verilmesi gerektiğini vurguluyor. Bahçıvanlar bu çocuk bahçesinde öyle bir eğitim yapınlar ki çocuk kendi doğasıyla evrenin yapısı arasında ilişki kurabilsin ve evrenle başa çıkabilecek şekilde eğitim alsın. Ne güzel bir benzetme bu. Çoğu kuramcı bizlerin doğal çevrenin bir parçası olduğumuzu, bu yüzden de teknolojinin doğanın yerini alamayacağını ve aksine doğayla aramızdaki bağların gelişimini körelteceğini ifade ediyor. Anne ve babalar çocuklarının öncelikle duyuşsal becerileriyle mi meşgul olmalıdırlar?

Bu konunun içinde ahlak gelişimi yani ahlaki davranışlar var. “Bir davranışın ahlaka uygun olabilmesi için üç aşamadan da sağlıklı bir şekilde geçmesi gerekli” diyor uzmanlar. Birincisi durumu yorumlamak, ikincisi karar vermek, üçüncüsü de ilerleyeceği yolda ilerlemek. Bu üç aşamalı bağımsız ilerleme şekli hem bilişsel gelişimle hem de duyuşsal gelişimle yakından ilgilidir. Diyelim ki bir kişi bir durumla karşılaştı ve bu durumu yorumluyor. Karar vermesi ve izleyeceği yolda ilerleyebilmesi için iki farklı yönde beceriye ihtiyacı var, biri bilişsel, diğeri duyuşsal. Buradan şu sonucu çıkarabilirsiniz: Öğretmenler ve evdeki ilk eğitimciler olarak anne babalar, öncelikle çocuklarının duyuşsal becerileriyle meşgul olsunlar lütfen, bilişsel beceriler arkadan gelir. Yalnız burada ahlaki gelişimden kastımız içinde yaşadığımız toplumun sosyal normlarını, değerlerimizi kazanabilmek için gereken beceriler konusunda kaydettiğimiz ilerlemedir. Erken çocukluk dönemindeki çocukların yetiştirilmesiyle meşgul olacak olan yetişkinler unutmamalıdırlar ki “Küçük çocuklar, önemli şeyleri kendilerine söylenmesi yoluyla değil diğer çocuklarla oynarken ve fiziki çevreyle etkileşim hâlindeyken bilgiyi kendi kendine yapılandırarak öğrenirler.” Hani birçok kere hatırlatırsınız ya “Hırkayı giy yavrum, üşürsün” diye, o yine dalga geçer, unuttur gider. Ancak oyun oynarken, diğer çocuklarla konuşurken bakar arkadaşlarına, onlarda da var, üşüdüğünü hisseder ve sonra der: “Üşüyorum anne, hırkayı ver.” Böylelikle kendisinin farkında olur. Ayrıca oyun öyle imkanlar tanır ki çocuğa, vücut ve zihin hemhal olur. Çevrenin çocukların bilişsel gelişimine etkisini vurgulayan bir kuramcı olan Vygotsky, bu etkileşimin sosyal yapının içine saplanmış olduğunu ve bundan önemli ölçüde etkilendiğini belirtiyor. Bu etkileşimi gerçekleştirmek için sosyal bir yapı kurmayı öneriyor, çocukları sosyal sistemlerin, toplum projelerinin içine, mesela gönüllü çalışmaların içine sokmayı ve sonra da onları izlemeyi ve değerlendirmeyi öneriyor. Şimdi hiç kimse çocukların el becerilerine önem vermiyor, yaşam becerileriyle donatmıyor; herkes çocuğunu koruyor,

kolluyor, besliyor, üstelik yanlış besliyor- fakat maalesef oyuna izin vermiyor. Sözün kısası, yanlış yetişmiş bir çocuk elde etmek için ne lazımsa yapıyoruz. Sağlıksız, gürbüz, apartman katlarında güvende, her şeyi var ancak yalnız başına bir çocuk. Görünürde hiçbir eksiği yok fakat aslında böyle çocukların o kadar çok eksiği vardır.

Özellikle öğretmen anne babaların şikâyet ettikleri bir konu da şu: Okulda gün boyu öğrencilerle ilgilenirken bütün enerjilerini tüketiyorlar, eve geldiklerinde ise kendi çocuklarına yeterince ilgi gösteremediklerini hatta bazen onları incittiklerini belirtiyorlar. Tabii bu durum benzer şekilde diğer çalışan anne babalar için de geçerli.

Bu durumun içinde psikolojideki ifadesi ile “öğrenilmiş çaresizlik” ve “kendini olumsuz yükleme” var. Aslında bu konuda kendi kendinizi eğitebilirsiniz, danışmanlık alabilirsiniz, yeter ki isteyin.. Tabii bu, farklı yollarla da desteklenebilir; evli yetişkinlerin sinema, tiyatro oyunları aracılığıyla bireylerin kişisel gelişimleri desteklenebilir, seminerler verilebilir, onlara “Çevrenizde ne olursa olsun siz önemlisiniz çünkü anne babasınız, kendinizle ilgilenin, kendinize bakın” denilebilir. İnsanlar maalesef evlenip de çocuk sahibi olunca önceki uğraşlarını – hobilerini- (aslında maalesef çoğunluğun önceden de böyle uğraşlara sahip olmadığı bilinmektedir!) bir tarafa bırakıyorlar, kendilerini geliştirmek için arayış içinde olmuyor, kitap okumuyor, dünyadaki ve ülkelerindeki gelişmeleri ve sosyal olayları takip etmiyorlar. Büyük bir çoğunluk evden işe, işten eve gidiş şeklindeki kısır bir döngü içindeler. Şikâyet ediyorlar ama “haydi” dediğimizde de sadece seyirci olarak kalıyor, katılımcı olmaya heves göstermiyorlar. Bunun başlıca sebeplerinden biri küçük yaşta beri TV ve internette sunulan yayınları izleyerek sadece izleyici olmayı kabul etmeleri ve giderek atillaşmalarıdır. Evde çok gergin olan insanlar gerginliğin esasen yaptıkları işlerden, birbirleriyle olan ilişkilerinden kaynaklandığını unutuyorlar. Sabah erkenden neşe ile kalkmak, güzelce hemen hazırlanmak, kahvaltıyı birlikte hazırlamak, çocuklar veya eşler evden çıkarken onları uğurlamak, arkalarından el sallamak. Bunların hepsinin içerisinde karşılıklı bir mesaj vardır: “Biz birbirimizi seviyoruz, hepimiz önemliyiz. Çevrenizdekileri mutlu edebilmek için öncelikle kendinizi mutlu etmenin yollarını bulmalısınız. İnsanların olumlu geri bildirimine ihtiyacı vardır. Paylaşabildiğiniz her şeyi çocuklarınızla ve eşinizle paylaşın, gününüzü anlatın, yalnız bunu yaparken cümleye olumsuz başlamayın. Günümüzde insanlar kendilerini ifade edememelerinin gerginliği içerisinde.”

Küçük çocukların duyguları ilgileri ve değerleri değişkendir; bir durumdan diğerine muhafaza edilemez, kararları çabuk değişebilir. Anne ve babalar bunları bilirlerse hem kendilerini hem de çocuklarını hırpalamazlar. Anne ve baba çocukların özgür yetiştirilmesi gerektiğini ancak sınırlarını algılayabilmesi için de onun her istediğinin gerçekleşmeyeceğinin söylenmesinde bir sakınca olmadığını belirtmek isterim. Bazen ailedeki yetişkinlerin işlerinin yoğunluğu ve çocukları uğruna kendilerini ihmal etmenin sonucunda gergin oldukları görülmektedir. Yetişkinlerin doğru olanı bilerek ve bu hüsudan yola çıkarak kendilerini geliştirmeleri gerekmektedir. Bunu yapabilmek için ise değişmeyi, gelişmeyi istemek ve kararlı olmak şarttır. Modern çağda çocuk dünyası değişiyor ve ebeveynler bu şartlar altında gelişmeyi ve sorumluluk almayı başarmalıdır.

KAYNAKÇA

1. Aral, N., Baran, G., Bulut, Ş. ve Çimen, S. (2000). Çocuk Gelişimi 2. İstanbul: Turan Ofset.
2. Bacanlı, H. (2000). Gelişim ve Öğrenme. Ankara: Nobel Yayınları.
3. Çakmaklı, K. (1991). Aileler İçin Sosyal Hizmet. İstanbul: T.C.Aile Araştırma Kurumu Başkanlığı Yayınları.
4. Ülgen, G. ve Fidan, E. (1992). Çocuk Gelişimi. İstanbul: Milli Eğitim Basımevi.
5. Yavuzer, H. (1993). Çocuk Psikolojisi. İstanbul: Remzi Kitabevi.
6. Yörükoğlu, A. (1986). Çocuk Ruh Sağlığı. Ankara: Doğu Matbaası.

PRODUCTION AND QUALITY EVALUATION OF BISCUITS PRODUCED FROM WHEAT, SORGHUM AND AFRICAN YAM BEAN COMPOSITE FLOURS

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Abstract

This study was carried out to determine the suitability of wheat, sorghum and African yam bean composite flour in the development of biscuits. Sorghum and African yam bean were processed into fine flours. Five blends of composite flours were prepared by mixing wheat, sorghum and African yam bean flours in the following proportions: 90:5:5 (AA1), 80:10:10 (BB2), 70:15:15 (CC3), 60:20:20 (DD4), 50:25:25 (EE5) and 100% whole wheat flour was used as the control (FF6). The composite flours were used to produce biscuits which were evaluated for their proximate composition and sensory acceptability. The proximate composition of the biscuit samples varied significantly ($p < 0.05$) from 10.00 - 24.00%, 2.00 - 10.09%, 9.81 - 11.92%, 4.18 - 7.50%, 5.15 - 7.70% and 45.96 - 65.54% for moisture, ash, protein, fat, crude fiber and carbohydrate content of the biscuits, respectively. It was observed that incorporation of both sorghum and African yam bean flours in the biscuits significantly increased the moisture, ash, protein and crude fibre contents while the fat and carbohydrate content of the composite samples were reduced. The mean scores for the sensory evaluation of the biscuits showed that the colour, taste, aroma, texture and overall acceptability of the whole sample were all liked by the panelists as they rated all the quality attributes above average. This shows the possibility of producing nutritious cookies with desirable organoleptic qualities from wheat, sorghum and African yam bean flour. The findings of this study when implemented will help to reduce over dependency in imported wheat flour, thereby reducing huge amount of money spent in foreign exchange.

Keywords: Biscuit, wheat, sorghum, African yam bean, proximate composition.

Introduction

Biscuits may be regarded as a form of confectionery dried to a very low moisture content which is made from unleavened dough (Obi and Nwakalor, 2015). They are ready-to-eat, convenient and inexpensive food products, containing digestive and dietary principles of vital importance (Ukpong *et al.*, 2021). The major ingredients for production of biscuits are flour, fat, sugar, salt and water, which are mixed together with other minor ingredients, such as baking powder, skimmed milk, emulsifier and sodium meta-bisulphite to form dough containing a gluten network (Oyedele *et al.*, 2017). According to Nwakalor (2014), the dough is rested for a period and passed between rollers to make a sheet. These sheets are however, transformed into appetizing product through the application of heat in the oven. Alebiosu *et al.* (2020) noted that biscuits constitute valuable amount of iron, calcium, protein, calorie, fibre and some of the B-vitamins and they are classified based on the ingredient composition and processing techniques.

The basic ingredient for production of biscuit is wheat flour (Obi and Nwakalor, 2015). Wheat (*Triticum aestivum*) is one of the most useful and valuable crops grown around the world and it is considered as almost first among cereal largely due to the fact that its grain contains protein with unique chemical and physical properties, and other vital nutrients (Adeyanju *et al.*, 2021). However, Nigeria has unfavorable climatic condition for wheat cultivation but suitable for tropical crops such as roots, tubers, legumes and other cereals. Therefore, consumption of cereal based foods like biscuits require development of an adequate substitute for wheat. This has led to the use of composite flour in bakery products because of the economic and nutritional advantages attached to it (Bolarinwa *et al.*, 2016).

Composite flour according to Peter-Ikechukwu *et al.* (2020) can be defined as a mixture of different ratios of non-wheat flours obtained from roots and tubers, cereals, legumes, etc., with or without the addition of wheat flour. Composite flour has often been used with the intent of reducing importation of wheat and improving its nutritional value, most especially in countries where, wheat crop is not grown. The use of composite flour also promotes the use of some locally cultivated crops as flour and

increases the nutritional content of food products. Wheat flour is lacking in some limiting amino acids, such as lysine and threonine, even though it is considered as good source of calories and other nutrients (Sanni *et al.*, 2020). Thus compositing wheat flour with locally available flours from other cereals and legumes such as sorghum and African yam bean is expected to increase its nutritional quality.

Sorghum (*Sorghum bicolor*) is an important food crop grown on a subsistence level by farmers in the semi-arid tropics of Africa and Asia. It is one of the principal crops grown in northern Nigeria (Alebiosu *et al.*, 2020). It is typically an annual crop but some cultivars are perennial, commonly called guinea corn in West Africa. Sorghum contains between 11.30-13.00% proteins, 1-3.30% fat, 3-6.00% dietary fibre, and 70-74.63% carbohydrate. Sorghum is high in antioxidants which acts as a nutraceutical and helps to lower the risk of cancer, diabetes, heart diseases, among others (Arukwe *et al.*, 2021). It is the principal source of energy, protein, vitamins, and minerals for millions of the poorest in these regions. Its products are deficient in essential amino acids such as lysine, threonine, tryptophan and the presence of anti-nutritional factors such as tannins and phytates limit their nutritional value (Folake *et al.*, 2018). Therefore, attempts have been made to fortify these cereals with legumes or other cereals to make it nutritionally superior and acceptable products (Adegbola *et al.*, 2013).

The African Yam Bean (*Sphenostylis stenocarpa Hochst ex. A. Rich.*) is one of the under-utilized tropical African tuberous legumes found in Nigeria, Central African Republic, Gabon, Zaire and Ethiopia. It is of special value considering that it has duo food products (grain and tuber). The high protein composition of African yam bean makes it an important source of protein in the diet of many tropical countries (Ukpong *et al.*, 2021). In Nigeria it is commonly called *okpo dudu* or *odudu* or *azam* (Igbo), *girigiri* (Hausa), *sese* (Yoruba) and *nsama* (Ibibio). The nutritional content show that African yam bean is rich in protein, carbohydrate, vitamins and minerals and its protein contains equal or better levels of lysine and methionine than those of soybeans (Arukwe *et al.*, 2021). Therefore, substituting it with cereal flours in the production of biscuits would supply the lysine absent in them. This legume has also been reported to be of importance in the management of chronic diseases like hypertension, diabetes, and cardiovascular diseases because of its high dietary fibre content (Adeyanju *et al.*, 2021). It is eaten roasted, as groundnut or boiled and blended with ingredients like oil, pepper and salt. It is consumed in different form such as snacks, delicacy, main meal etc. It can be used for the fortification of other foods (Obi and Nwakalor, 2015). In spite of all this, African yam bean is underutilized and hardly consumed in urban areas which are attributed to its complex preparation method. The use of African yam bean in composite flour for cookies production will make it readily available for consumption by all persons.

Nowadays, extensive studies on the preparation of biscuits by fortification with some natively available and better nutritional value flours have been conducted (Obi and Nwakalor, 2015; Folake *et al.*, 2018; Arukwe *et al.*, 2021). Producing less gluten biscuits from wheat-sorghum-African yam bean flour blend may enhance the nutritional and health status of consumers. The utilization of wheat, sorghum and African yam bean in the production of baked goods are not well known in Nigeria and there is scanty information on the utilization of sorghum and African yam bean in Nigerian foods since they are both underutilized cereals and legumes respectively. Hence, this study seeks to evaluate the quality attributes of biscuits produced from composite flour from wheat, unmalted sorghum and African yam bean flour.

Aim and Objectives

The aim of this study is to evaluate the quality attributes of cookies produced from blends wheat, sorghum and African yam bean flour. The specific objectives of the study include:

1. To produce sorghum and African yam bean flours.
2. To formulate composite flours by blending wheat, sorghum and African Yam bean.
3. To produce biscuits from the composite flours.
4. To determine the proximate composition of the biscuit produced.
5. To evaluate the sensory qualities of the biscuits.

MATERIALS AND METHODS

Source of Materials

Sorghum grains, commercial wheat flour and baking ingredients (egg, milk, baking powder, sugar, margarine and vanilla flavor) will be obtained from Eke Oko Market in Anambra State while African yam bean seeds will be purchased from Ogoete Main Market in Enugu State. All the materials will be packaged in a clean bag and taken to the Food Processing Laboratory of Department of Food Technology, Federal Polytechnic Oko, Anambra State; for further processing and analysis.

Sample Preparation

Preparation Sorghum Flour

Sorghum flour will be prepared by adopting the method described in the study of Alebiosu *et al.* (2020) with slight modification. Sorghum grains will be cleaned and sorted to remove stones and other extraneous materials. The grains will be washed with potable water and dried in cabinet dryer at 70°C for 8hrs. The dried grains will be milled and sieved to obtain fine flour. The flour produced will be packaged in an airtight container prior to further use.

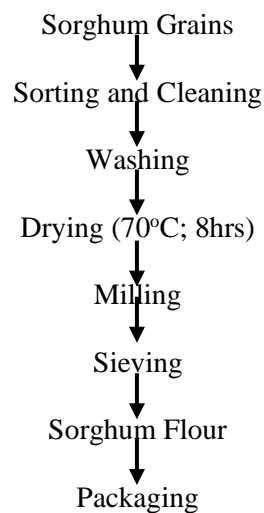
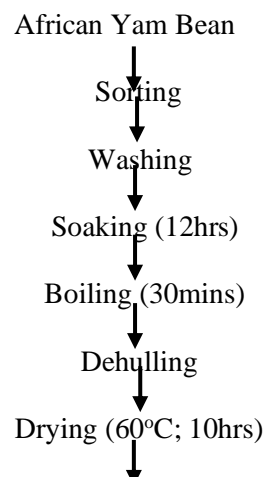


Fig. 1: Flow chart for the processing of sorghum flour.

Preparation of African Yam Bean Flour

The method described in the study of Adeyanju *et al.* (2021) will be adopted in the production of African yam bean flour with slight modification. Three kilograms (3kg) of white African yam beans will be sorted and washed thoroughly with clean tap water to remove unwholesome seeds, stones and adhering dusts. Thereafter, it will be soaked for 12 hours, boiled for 30 minutes and dehulled. The beans were dried in a cabinet dryer (60°C for 24hrs), and milled using an attrition mill. The flour obtained will be sieved, packaged in high density polyethylene bags and stored until needed for usage.



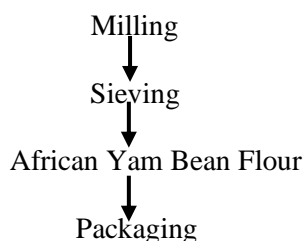


Fig. 2: Flow chart for the processing of African yam bean flour.

Formulation of Composite Flour

Sorghum flour, commercial wheat flour and African yam bean flour will be blended in the proportions shown in Table 3.1 to obtain the composite flours that will be used to produce biscuits. 100% wheat flour will serve as the control.

Table 1: Formulation of Composite Flours.

S/N	Wheat Flour	Sorghum Flour	African Yam Bean Flour
1.	100	0	0
2.	90	5	5
3.	80	10	10
4.	70	15	15
5.	60	20	20
6.	50	25	25

Production of Biscuits

Biscuits will be prepared using the method described by Adeyanju *et al.* (2021). Fat and sugar will be creamed together until fluffy. The flours, baking powder, whole egg and salt will be added and manually mixed in a bowl to form a dough. The dough will be rolled to a uniform thickness, cut and baked in an oven at 170°C for 20 min. The biscuits will be removed from the oven and allowed to cool on a rack, after which they will be packaged in low-density polyethylene bags and kept in a plastic container before

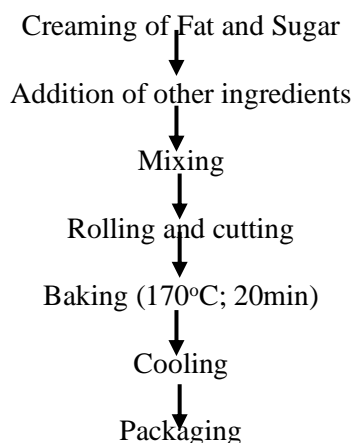


Fig. 3: Flow chart for the production of biscuits.

Proximate Analysis

The proximate analysis of the biscuit samples was carried out using the analytical methods of AOAC (2012).

Sensory Evaluation

A semi-trained panel of 20 judges made up of male and female staff and students of the Department of Food Technology, Federal Polytechnic, Oko will be used. The panelists will be educated on the respective descriptive terms of the sensory scales and requested to evaluate the various biscuit samples for taste, colour, texture, aroma and overall acceptability using a 9-point Hedonic scale, where 9 will be equivalent to like extremely and 1 meant dislike extremely. Presentation of coded samples will be done randomly and portable water will be provided for rinsing of mouth in between the respective evaluations (Iwe *et al.*, 2014).

Statistical Analysis

All measurements will be carried out in triplicate. The data generated will be analyzed using statistical program SPSS (version 25.0) and significant difference will be compared by Analysis of Variance test (ANOVA) following Duncan’s multiple range tests at the significance level of 5%.



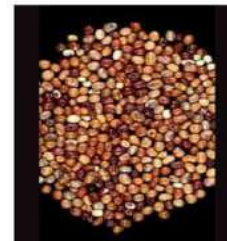
WASHING OF SORGHUM



DRYING OF SORGHUM



MILLING OF SORGHUM



AFRICAN YAM BEANS



SCALING OF THE FLOURS



MIXING OF THE FLOURS



MIXING OF THE WET INGREDIENTS



FORMING OF THE BISCUIT DOUGH



SAMPLE AA1



SAMPLE BB2



SAMPLE CC3



SAMPLE DD4



SAMPLE EE5



SAMPLE FF6

RESULTS AND DISCUSSION

Proximate composition (%) of biscuits produced from blends of wheat, sorghum and African yam bean flours.

The results of the proximate composition of biscuits produced from blends of wheat, sorghum and African yam bean flours are presented in Table 4.1. The moisture content of the samples ranged from 10.00% to 24.00% with sample FF6 (100:0:0 wheat-sorghum-African yam bean flour) having the least value while sample EE5 (50:25:25 wheat-sorghum-African yam bean flour) had the highest value. There was significant difference ($p < 0.05$) in the moisture content of the samples. It was observed that incorporation of sorghum and African yam bean flour significantly increased the moisture content of the biscuits. This observation is at par with the findings of Oyedele *et al.* (2017) who noted that incorporation of other flours in wheat flour increased the moisture content of the formulated product although their values (8.80 – 9.20%) were much lower than the one obtained in this study. The values obtained in this study for moisture content are also higher than 8.14 – 11.39% reported by Ukpong *et al.* (2021) for biscuits produced from composite flours of wheat and African yam bean. The variation in these results could be due to differences in the raw materials used. It could also be due to varied proportions of flours and other environmental factors. According to Akinsanmi (2015), moisture content is one of the most widely used instruments which determine the way foods are processed and its shelf life. It has also been used as a measure of stability and susceptibility to microbial contamination. Food products with lower moisture have greater shelf stability since spoilage is often caused by microbial activities and related chemical reactions that require higher moisture levels. Thus, the high moisture content observed in this study is a disadvantage as it may lead to early spoilage of the biscuit; making it unfit for consumption. The biscuits will therefore need proper packaging and storage in order to extend its shelf life.

Table 4.1: Proximate composition (%) of biscuits produced from blends of wheat, sorghum and African yam bean flours.

Sample	Moisture	Ash	Protein	Fat	Fibre	Carbohydrate
AA1	12.00 ^e ±0.4	8.12 ^b ±0.01	10.94 ^d ±0.0	5.80 ^b ±0.1	7.51 ^b ±0.0	55.63 ^b ±0.03
BB2	20.00 ^b ±0.1	8.00 ^b ±0.01	11.71 ^b ±0.0	4.60 ^e ±0.1	7.30 ^c ±0.0	48.39 ^e ±0.01
CC3	16.00 ^d ±0.5	10.00 ^a ±0.1	11.57 ^c ±0.0	5.00 ^c ±0.0	7.70 ^a ±0.0	49.73 ^d ±0.03
DD4	18.00 ^c ±0.0	7.00 ^c ±0.01	10.49 ^e ±0.0	5.30 ^d ±0.1	7.00 ^d ±0.0	52.22 ^c ±0.01
EE5	24.00 ^a ±0.3	8.00 ^b ±0.80	11.92 ^a ±0.0	4.18 ^f ±0.2	5.94 ^e ±0.0	45.96 ^f ±0.02
FF6	10.00 ^f ±0.0	2.00 ^d ±0.19	9.81 ^f ±0.02	7.50 ^a ±0.5	5.15 ^f ±0.0	65.54 ^a ±0.04

*

Values are means ± standard deviation. Means with the same superscript in the same column are not significantly different ($p < 0.05$). **Keys:** AA1 = 90:5:5 wheat-sorghum-African yam bean flour; BB2 = 80:10:10 wheat-sorghum-African yam bean flour; CC3 = 70:15:15 wheat-sorghum-African yam bean flour; DD4 = 60:20:20 wheat-sorghum-African yam bean flour; EE5 = 50:25:25 wheat-sorghum-African yam bean flour, FF6 = 100:0:0 wheat-sorghum-African yam bean flour.

There was drastic increase in the ash content of the formulated biscuits. The percentage ash content of the samples ranged from 2.00% in the control sample (FF6) to 10.00% in the sample produced from 70:15:15 wheat-sorghum-African yam bean flour (CC3). Some significant differences ($p < 0.05$) existed in their values, however, no significant difference ($p > 0.05$) was observed in the ash content of samples AA1 (90:5:5 wheat-sorghum-African yam bean flour), BB2 (80:10:10 wheat-sorghum-African yam bean flour) and EE5 (50:25:25 wheat-sorghum-African yam bean flour). The increase in the ash content of the biscuits is obviously due to addition of both sorghum and African yam bean flours in the formulation. Similar increase in ash content (from 0.48% to 4.21%) was observed by Obasi *et al.* (2012) as the level of substitution of wheat flour with African yam bean flour increased although their values are lower when compared with the one in the present study. In a similar study reported by Arukwe *et al.* (2021), the ash content of biscuits produced from sprouted wheat, sorghum and African yam bean flours were very low (1.83 – 3.95%) compared to the one in the present study. This could be attributed to difference in the processing methods used as well as varietal differences in the cereal and

legume grains used. Ash content in food substances indicates the presence of mineral matter in the food. Ash is a non-organic compound containing the mineral content of food which aids metabolism of other compound such as protein fat and carbohydrate (Alebiosu *et al.*, 2020). Therefore, the high ash content obtained in this study is an indication that the formulated biscuits may be rich in essential minerals.

As expected, the protein content of the formulated biscuits also increased significantly from 9.81% to 11.92% with the control sample (FF6) having the least value while the sample produced from 50:25:25 wheat-sorghum-African yam bean composite flour (EE5) had the highest values. The results revealed a significant difference ($p < 0.05$) in the protein content of the samples. These values tallied with the findings of Alebiosu *et al.* (2020) who reported values ranging from 9.18% to 11.78% for biscuits produced from composite flours of wheat, sorghum and defatted coconut kernel but lower than 12.62% to 19.52% reported by Ukpong *et al.* (2021) for biscuits produced from wheat and African yam bean tempeh. Also, Obasi *et al.* (2012) and Durojaiye *et al.* (2018) reported higher protein contents ranging from 12.57 – 22.00% and 13.11 – 18.61% respectively; for biscuits produced from different composite flours. The varied results could be due to differences in the raw materials and blending ratio used. Amadi (2019) stated that protein is needed in the body for the growth and repair of worn out tissues, formation of major enzymes and hormones as well as boosting of the immune system. Therefore the increased protein content of the formulated biscuits can aid in combating malnutrition in rural and developing countries of the world.

The fat content of the samples ranged from 4.18 – 7.50% with sample EE5 (50:25:25 wheat-sorghum-African yam bean flour) having the least value while the control sample (FF6) had the highest value. There was significant difference ($p < 0.05$) in the fat content of the products. The results revealed that incorporation of both sorghum and African yam bean flour in the product reduced the fat content significantly. This is not in line with the observation of Arukwe *et al.* (2021) who noted that inclusion of sprouted sorghum and African yam bean flour in biscuit formulation significantly increased the fat content. The varied results may be due to the differences in the processing methods used. Fat is an important ingredient used to raise energy density in formulation of fortified blended foods for vulnerable population (Bolarinwa *et al.*, 2016). It is also used to indicate the storage stability of food products as foods with high fat content are always prone to oxidative rancidity; resulting in off flavour and taste. The fat content obtained in this study is lower than the fat content (23.71-30.09%) of malted soybean-acha biscuit (ayo *et al.*, 2014) but similar to the fat content (5.20- 6.36%) of cookies produced from cocoyam, sorghum and pigeon pea flour blends (Okpala and Okolie, 2011).

The crude fibre content of the biscuit samples ranged from 5.15% to 7.70% with the control sample (FF6) having the least score while the sample CC3 had the highest values. The result showed that inclusion of both sorghum and African yam bean flour increased the fibre content of the biscuits although no definite trend was observed. These results are higher than 2.00 - 4.90% and 2.77 – 3.74% reported by Arukwe *et al.* (2021) and Alebiosu *et al.* (2020) respectively for biscuits produced from different composite flours. This could be due to the differences in the raw materials used as well as the varied processing methods employed. High fibre foods are reported to enhance gastrointestinal tract functions (Bolarinwa *et al.*, 2016). Thus, consumption of the formulated composite biscuits could help in normal bowel movements and aid digestion of food in human system.

The carbohydrate content of the flour ranged from 45.96% to 65.54% with sample FF6 (control) having the highest and 50:25:25 wheat, sorghum and African yam bean (EE5) having the lowest value. It was observed that addition of both sorghum and African yam bean flour drastically reduced the carbohydrate content of the biscuits. Other studies have also reported decrease in carbohydrate content of baked goods when cereals were blended with legumes (Obasi *et al.* 2012; Bolarinwa *et al.*, 2016; Alebiosu *et al.*, 2020; Ukpong *et al.*, 2021; Arukwe *et al.*, 2021). The carbohydrate content obtained in this study was however; lower than the carbohydrate content (57.97 - 73.89%) of sprouted wheat-sorghum composite biscuits enriched with African yam bean flour (Arukwe *et al.*, 2021). The variation in the carbohydrate content of the biscuits according to Oluwamukomi *et al.* (2011) could be due to differences in the composition of the composite flour. The carbohydrate contents of these samples are an indication that the products are good sources of energy. Carbohydrates are good sources of energy and that a high concentration of it is desirable in breakfast meals. In this regard, therefore, the high carbohydrates content of the biscuit would make it provide required energy needed for the body's metabolism and catabolism (Butt and Batool., 2010; Adeyanju *et al.*, 2021).

Mean scores for sensory evaluation of biscuits produced from blends of wheat, sorghum and African yam bean flours.

The results of the sensory evaluation of biscuit samples are as presented in Table 4.2. There was some significant ($p < 0.05$) difference in the taste the samples. Means scores of taste of the biscuit samples ranged from 7.50 to 8.55. Sample DD4 (60:20:20 wheat-sorghum-African yam bean flour) had the least score for taste while sample FF6 (100:0:0 wheat-sorghum-African yam bean flour) had the highest score. The results showed that incorporation of sorghum and African yam bean flour in the biscuits did not adversely affect their taste as their scores were above average. Alebiosu *et al.* (2020) reported similar results (6.90-8.15) for the taste of biscuits produced from wheat-sorghum-defatted coconut composite flours. Taste has been described to be the sensation of flavor perceived in the mouth and throat on contact with a substance and it is one of the most important attributes watched out for in a food product (Olurin *et al.*, 2021). Small and Prescott (2005) noted that the taste of any food product are solely dependent on the quality of ingredients used.

With respect to colour, the biscuit samples had mean scores ranging from 7.70 – 8.75 with sample DD4 having the least scores while the control sample (FF6) had the highest scores. All the samples scored above average in terms of colour indicating that incorporation of sorghum and African yam bean flour did not adversely affect this quality attributes. Olanipekun *et al.* (2018) recorded similar scores for biscuits produced from wheat-sorghum composite flours.

Visual color is an importance criterion of biscuits, as perceived in the consumer's eye. Moreover, color is a very important parameter in judging properly baked goods that not only reflect the suitable raw material used for preparation but also provides information about the formulation and quality of the product (Ferial and Azza, 2011). The panelists noted the that all the biscuit samples were brown in colour, however, the samples with higher proportion of sorghum and African yam bean flours had darker brown colour. This coloration could be due to the reaction between reducing the sugar and amino acids (Maillard reaction) and caramelization as reported by Fahim *et al.* (2016). Similar findings was observed by Fahim *et al.* (2016) who reported dark brown coloration in biscuits made from wheat-alfalfa nut flour blends. The results in this study are also in accordance with the findings of Ndife *et al.* (2011) as well as Ferial and Azza (2011) who reported a dark brown color in whole wheat flour-based biscuits supplemented with soybean flour and bambara groundnut flour respectively.

Table 2: Mean scores for sensory evaluation of biscuits produced from blends of wheat, sorghum and African yam bean flours.

Samples	Taste	Colour	Texture	Aroma	Overall Acceptability
AA1	7.95 ^{ab} ±1.36	7.75 ^b ±1.07	7.45 ^b ±0.89	7.95 ^{ab} ±1.39	7.75 ^b ±0.92
BB2	7.85 ^{ab} ±1.31	7.75 ^b ±1.33	7.40 ^b ±1.19	7.60 ^b ±1.57	7.65 ^b ±1.01
CC3	7.65 ^b ±1.46	7.80 ^b ±1.11	7.90 ^{ab} ±1.21	7.55 ^b ±1.47	7.73 ^b ±1.04
DD4	7.50 ^b ±1.10	7.70 ^b ±1.30	7.40 ^b ±1.31	7.85 ^{ab} ±1.42	7.60 ^b ±0.97
EE5	8.55 ^a ±0.94	8.15 ^{ab} ±1.0	8.40 ^a ±1.14	8.40 ^{ab} ±0.68	8.45 ^a ±0.84
FF6	8.55 ^a ±0.83	8.75 ^a ±0.55	8.55 ^a ±0.69	8.65 ^a ±0.75	8.63 ^a ±0.62

*Values are means ± standard deviation. Means with the same superscript in the same column are not significantly different ($p < 0.05$). **Keys:** AA1 = 90:5:5 wheat-sorghum-African yam bean flour; BB2 = 80:10:10 wheat-sorghum-African yam bean flour; CC3 = 70:15:15 wheat-sorghum-African yam bean flour; DD4 = 60:20:20 wheat-sorghum-African yam bean flour; EE5 = 50:25:25 wheat-sorghum-African yam bean flour, FF6 = 100:0:0 wheat-sorghum-African yam bean flour.

Texture is the key attributes of dry snacks products; denoting freshness and high quality (Dueik *et al.* 2010). According to Oyedele *et al.* (2017), texture is another important criterion perceived when snack is chewed between the molars and is usually expressed in terms of hardness and factorability. Texture mean scores ranged between 7.40 and 8.55. The scores for Sample EE5 and FF6 were significantly ($p < 0.05$) higher when compared to the rest of the composite biscuits. With reference to the 9-point hedonic scale used for the sensory analysis, the textures of the formulated biscuits were 'liked' by the

panelists although their degree of likeness varied slightly with the varying level of the composite flours in the biscuit samples. The scores obtained in this study is higher compare to 4.80 – 8.20 reported by Durojaiye *et al.* (2018) for biscuits made from composite flours of wheat, bambara groundnut and cowpea.

The mean scores for the aroma of the biscuit samples ranged from 7.55 in samples CC3 and to 8.65 in the control sample (FF6). Some significant difference ($p < 0.05$) existed in the aroma of the composite samples although they compared well with the control sample. The panelists noted that the samples containing higher percentage of African yam bean flour had beany flavor. This was expected because of the presence of the legume in the product. This observation did not agree with the report of Adeyanju *et al.* (2021) who reported lower scores (6.30 – 6.80) for aroma cookies produced from wheat-acha-African yam bean flour. Aroma is a fundamental sensory attribute which refers to the sensations in the nostrils as a result of rising of food or drink volatile compounds (Okache *et al.*, 2020).

The mean scores for the overall acceptability of the biscuits ranged from 7.60 – 8.63. The control sample was the most accepted sample with a score of 8.63 closely followed by sample EE5 (8.45) while DD4 had the least score (7.60). The results showed that substitution of wheat flour with up to 25% sorghum and African yam bean flour did not adversely affect the overall acceptability of the formulated biscuits as the panelists rated the whole samples above average. Nwatum *et al.* (2020) noted that the factors that contributes to the acceptability of a baked product includes baking conditions (temperature and time variables); the state of the biscuit constituents, such as fibre, starch, protein (gluten) whether damaged or undamaged and the amounts of absorbed water during dough mixing. Thus, the high acceptability of the formulated biscuits indicates that the aforementioned factors were not negatively influenced by incorporation of sorghum and African yam bean flours.

CONCLUSION AND RECOMMENDATION

Conclusion

This study determined the proximate composition and sensory acceptability of biscuits produced from the composite flours of wheat-sorghum and African yam bean. The findings of the study showed that the biscuits produced have increased nutrient contents which are all desirable for good health and wellbeing. However, the high moisture content recorded for the biscuit samples is undesirable as it may influence the shelf life of the products negatively. The study shows that supplementation of wheat with up to 25% sorghum flour and 25% African yam beans flour produced biscuits whose quality attributes including colour, taste, texture and aroma were well accepted. Therefore, the use of sorghum and African yam beans in biscuits formulation will go a long way in enhancing nutrition, health and wellbeing of the consumers and reduce the dependence on wheat flour, thereby saving the huge foreign exchange used in importing wheat, for other projects. It will also reduce food insecurity and diversify the use of sorghum and African yam bean.

Recommendation

This study recommends the use of both sorghum flour and African yam bean flour at up to 25% level of substitution to wheat flour in biscuit formulation since it yielded acceptable products with improved nutrients.

Further study is recommended on the formulated biscuits in order to ascertain the effect of addition of these flours on the minerals, anti-nutrients and vitamin compositions as well as the shelf life of the biscuits.

REFERENCES

- Abboye, A. D. (2021). Review Study on Current Bread Wheat (*Triticum aestivum* L.) Production Status and Key Challenges for Potential Efficiency of Wheat Markets in Ethiopia. *Journal of Ecology and Natural Resources*, 5(2):1-22.
- Abioye, V. F., Olanipekun, B. F. and Omotosho, O. T. (2015). Effect of varieties on the proximate, nutritional and anti-nutritional composition of nine variants of African yam bean seeds (*Sphenostylis Stenocarpa*). *Donnish Journal of Food Science and Technology*, 1(2):017-021.
- Achi, O. K. (2005). The potential for upgrading traditional fermented foods through biotechnology. *Afr. J. Biotech.* 4 :375-380.

- Adebo, O. A. (2020) African Sorghum-Based Fermented Foods: Past, Current and Future Prospects. *Nutrients*, 12(1); 1-25.
- Adegbanke, O. R., Osundahunsi, O. F. and Enujiugha, V. N. (2020). Chemical and Mineral Composition of Biscuit Produced from Wheat and Bambara Groundnut Flour". *Acta Scientifica Nutritional Health*, 4(10): 03-09.
- Adegbola, A. J., Awagu, E. F., Kamaldeen, O. S. and Kashetu, R. Q. (2013). "Sorghum: Most under-utilized grain of the semi-arid Africa, *J. Agric. Sci.*, 3: 147-153.
- Adegunwa, M. O., Adebawale, A. A. and Solano, E. O. (2012). Effect of thermal processing on the biochemical composition, antinutritional factors and functional properties of beniseed (*Sesamum indicum*) flour. *American Journal of Biochemistry and Molecular Biology*, 2(3):175-182
- Adewale, B., Daniel, A., and Aremu, C. O. (2013). The nutritional potentials and possibilities in African yam bean for Africans. *International Journal of Agriculture*, 3(1): 8-19.
- Adeyanju, J. A., Babarinde, G. O., Olanipekun, B. F., Bolarinwa, I. F. and Oladokun, S. O. (2021). Quality assessment of flour and cookies from wheat, African yam bean and acha flours. *Food Research*, 5(1): 371 – 379.
- Adeyanju, J. A., Babarinde, G. O., Olanipekun, B. F., Bolarinwa, I. F. and Oladokun, S. O. (2021). Quality assessment of flour and cookies from wheat, African yam bean and acha flours. *Food Research*, 5(1): 371 – 379.
- Adeyeye, A. and Ajewole, K. (2006). Chemical composition and fatty acid profiles of cereals in Nigeria. *Food Chem.* 44: 41-44.
- Afework Andualem, Abegaz, K. and Mezgebe, A. G. (2016). Development of pro-vitamin A and energy rich biscuits: Blending of orange-fleshed sweet potato (*Ipomea batatas* L.) with wheat (*Triticum vulgare*) flour and altering baking temperature and time. *African Journal of Food Science*, Vol. 10(6): 79–86.
- Aggarwal NK, Nigam P, Singh D and Yadav BS (2001). Process optimization for the production of sugar for the bioethanol industry from sorghum, a non-conventional source of starch. *World J. Microbiol. Biotechnol.* 17: 411-415.
- Ajayi, A. O. (2011). Sustainable dietary supplements: An analytical study of African yam bean *Sphenostylis sternocarpa* and Corn-Zea Maize. *European Journal of Experimental Biology*, 1(4):189-201.
- Ajayi, F. T., Akande, S. R., Odejide, J. O., Idowu, B., Udoji, I. A., Abdulrahman, F., Hassan, L. G., Maigandi, S., Itodo, H. U. and Udoji, I. A. (2010). Nutritive evaluation of some tropical under-utilized grain legume seeds for ruminant's nutrition. *Journal of American Science*, 6(7):1-7.
- Akintayo I and Sedgo J (2001). Towards sustainable sorghum production and utilization in West and Central Africa; Akintayo I.; Sedgo J. Eds.; WASRN/ICRISAT, 19-22 April 1999, Lomé, Togo. ISBN 92-9066- 4330-9. p. 162.
- Akoja, S.S. and Coker, O. J (2019). Functional Properties, Nutritional and Sensory Qualities of Wheat Biscuit Fortified with Defatted *Dioclea reflexa* Seed Flours. *Journal of Environmental Science, Toxicology and Food Technology*, 13(11): 46-55.
- Al-Dmoor H. M., (2013). Cake flour: Functionaly and quality (Review), *European Scientific Journal*, 9(3): 1-15.
- Alebiosu, M. O., Akinbode, B. A., Oni, I. S. and Oladele, J. O. (2020). Quality Evaluation of Cookies Produced from Wheat, Sorghum and Defatted Coconut Flour Blends. *Asian Food Science Journal*, 17(3): 11-21.
- Almaz, A. (2014). Response of sulphur fertilizer application to growth, yield and quality of bread wheat (*Triticum Aestivum*) in Kulumsa, Arsi, Ethiopia. *Journal of Experimental Botany*, 60(6): 1537-1553.
- Alozie, Y. E., Udofia, U. S., Lawal, O., & Ani, I. F. (2009). Nutrient composition and sensory properties of cakes made from wheat and African yam bean flour blends. *Journal of Food Technology*, 7 (4), 115-118.
- Anbessie, D. A. (2020). Pilot Review on Management Strategies of Constraints in Bread Wheat (*Triticum Aestivum* L.) production. *Journal of Ecology and National Resource*, 4(5): 200-210.
- Anglani C (2006). Sorghum for human food: a review. *Plant Foods Hum. Nutr.* 52: 85-89.

- Anne, C. S. (2016). Quality characteristics of composite cassava- ackee fruit- groundnut cookies. MSc. Thesis Submitted to the Department of Food Science and Technology; Kwame Nkrumah University of Science and Technology, Kumasi, Ghana. Pp. 1-40.
- AOAC, (2012). Official methods of Analysis. 19th edition. Association of official Analytical chemists. Washington, D.C., U.S.A; 2012.
- AOAC, (2012). Official methods of Analysis. 19th edition. Association of official Analytical chemists. Washington, D.C., U.S.A; 2012.
- Aronson, J.K. (2014). Plant poisons and traditional medicines. In Manson's Tropical Infectious Diseases, 23rd ed.; Cereal grains Farrar, J., Hotez, P.J., Junghanss, T., Kang, G., Lalloo, D., White, N.J., Eds.; Elsevier: Amsterdam, The Netherlands; pp. 1128–1150.
- Arukwe, D. C., Ezeocha, V. C. and Ubbor, S. C. (2021). Production and evaluation of cookies from composites of sprouted wheat, sorghum and african yam bean seed flours. *Nigerian Agricultural Journal*, 52(2): 277-283.
- Atangwho, I. J., Egbung, G. E., Ahmad, M., Yam, M. F., and Asmawi, M. Z. (2013). Antioxidant versus anti-diabetic properties of leaves from *Vernonia amygdalina* Del. growing in Malaysia. *Food Chemistry*, 141(1):3428- 3434.
- Awika JM and Rooney LW (2004). Sorghum phytochemicals and their potential aspects on human health. *Phytochemistry*. 65:1199-1221.
- Awika, J. M. (2011). Major Cereal Grains Production and Use around the World. In: Advances in Cereal Science: Implications to Food Processing and Health Promotion (Editors: J.M. Awika, V. Piironen, S. Bean. 1089:1-13.
- Awika, J.M. (2017). Sorghum: Its unique nutritional and health-promoting attributes. In Gluten-Free Ancient Grains; Taylor, J.R.N., Awika, J.M., Eds.; Woodhead Publishing: Cambridge, UK, 2017; pp. 21–54. *J. Cereal. Sci.* 2006, 44, 236–251.
- Ayo, J. A., Ojo, M. O., Omelagu, C. A. and Kaaer, R. U. (2018). Quality characterization of acha-mushroom blend flour and biscuit. *Nutrition and Food Science International Journal*, 7(3):1-10.
- Belitz H. -D., Grosch W. and Schieberle P., (2009). Food chemistry (4th Ed), Springer-verlag, Heidelberg Berlin Germany. Pp. 153.
- Bello, F. A., Ntukidem, O. J. and Oladeji, B. S. (2018). Assessment of Chemical Compositions, Physical and Sensory Properties of Biscuits Produced from Yellow Yam, Unripe Plantain and Pumpkin Seed Flour Blends. *International Journal of Food Science and Nutrition Engineering*, 8(5): 119-126.
- Berger, A., Rein, D., Schafer, A., Monnard, I., and Gremaud, G. (2005). Similar cholesterol-lowering properties of rice bran oil, with varied? oryzanol, in mildly hypercholesterolemic men. *European Journal of Nutrition*, 44: 163-173.
- Bolarinwa, I. F., Abioye, A. O., Adeyanju, J. A. And Kareem, Z. O. (2016). Production and quality evaluation of biscuits produced from malted sorghum-soy flour blends. *Journal of Advances in Food Science & Technology*, 3(3): 107-113.
- Bond, J. K. and Liefert, O. (2016). "Wheat: background." Washington DC: USDA Economic Research Service. Pp. 108.
- Brennan, M. A., Derbyshire, E., Tiwari, B. K., and Brennan, C. S. (2013). Ready-to-eat snack products: the role of extrusion technology in developing consumer acceptable and nutritious snacks. *International Journal of Food Science & Technology*, 48(5), 893-902.
- Brouns, F., Hemery, Y., Price, R. and Anson, N. M. (2012). Wheat aleurone: separation, composition, health aspects, and potential food use. *Critical Reviews Food Science and Nutrition*, 52: 553-568.
- Bunde-Tsegba, C. M., Okeke, V. and Sengev, I. A. (2021). Effect of Soybean Addition on the Quality of Plantain-Based Biscuits. *Food Science and Nutrition Research*, 4(1): 1-6.
- Chikwendu, J. N., Obiakor, O., Philomena, N., and Maduforo, A. N. (2014). Effect of fermentation on the nutrient and antinutrient composition of African yam beans (*Sphenostylis stenocarpa*) seeds and pearl millet (*Pennisetum glaucum*) grains. *The International Journal of Science and Technology*, 2(12):169.
- Cruaños L. L., (2013). Reformuación de galletas de masa corta: cambios en reología, textua y propiedades sensoriales, Doctoral Thesis, Universitat Politècnica de València. Pp. 1-40

- Czernohorsky J. H. and Hooker R., (2005). The Chemistry of baking , *New Zealand Institute of Chemistry, food and beverages, chemistry of baking*, Retrieved from: <http://nzic.org.nz/ChemProcesses/food>. Accessed on 28/01/2016.
- Dicko, M. H., Gruppen, H., Traoré, A. S., Voragen, A. G. and Berkel, W. J. (2006) Sorghum grain as human food in Africa: relevance of content of starch and amylase activities. *African Journal of Biotechnology*, 5(5): 384-395.
- Doughari, J. H. (2012). Phytochemicals and extraction methods, Basic structures and mode of action as potential chemotherapeutic agents, phytochemicals: A global perspective of their role in Nutrition and Health, Dr Venketeshwer Rao (Ed.); pp. 213, ISBN 978-953-51-0296-0.
- Enujiugha, V. N., Talabi, J. Y., Malomo, S. A., and Olagunju, A. I. (2012). DPPH radical scavenging capacity of phenolic extracts from African yam beans (*Sphenostylis stenocarpa*). *Food and Nutrition Sciences*, 3:7-13.
- Esan, Y. O. and Fasasi, O. S. (2013). Amino acid composition and antioxidant properties of African yam bean (*Sphenostylis stenocarpa*) protein hydrolysates. *African. Journal of Food Science and Technology*, 4(5):100-105.
- Etuk, E.B.; Okuedo, N.J.; Esonu, B.O.; and Udedibie, A.B.I. (2012). Antinutritional factors in sorghum: Chemistry, mode of action and effects on livestock and poultry. *Online J. Anim. Feed Res.*, 2: 113–119.
- FAO (2005). Food and Agricultural Organization of the United Nations, Rome. <http://www.faostat.fao.org>. (Accessed February 21, 2015).
- Fenster C (2003). White food sorghum in the American diet. In US Grains Council 43rd Board of Delegates' Meeting July 2003 Minneapolis MN. http://www.grains.org/news/latest_news/43_delegates_meeting_updates.html
- Feuillet, C., Langridge, P. and Waugh, R (2008). Cereal breeding takes a walk on the wild side. *Trends in Genetics* 24: 24-32.
- Folake, O. B., Abiodun, A. J. and Oluwatomiwo, I R. (2018). Evaluation of Proximate Composition of Biscuits Produced from Wheat (*Triticum aestivum* L.) and Sorghum (*Sorghum Bicolor* [L.]Moench) Composite Flour. *Elixir Food Science* 122: 51652-51656.
- Frances, W. G. (2017). Development of two improved *agbozume* biscuits using orange-fleshed sweetpotato puree and cowpea flour. Msc. Thesis submitted to the Department of Food Science and Technology, College of Science; Kwame Nkrumah University of Science and Technology, Kumasi. Pp. 1-53.
- Frank, U. E., Rita, N. O., and Chukwuemeka, S. A. (2016). Effect of African yam bean (*Sphenostylis stenocarpa*) on serum calcium, inorganic phosphate, uric acid, and alkaline phosphatase concentration of male albino rats. *Journal of Agricultural Science*, 8(1): 213-219.
- Gbenga-Fabuswa F. J. (2021). African yam beans (*Sphenostylis stenocarpa*): A review of a novel tropical food plant for human nutrition, health and food security. *African Journal of Food Science*, 15(2): 33-47.
- Gill, N. K. (2014). Process evaluation and quality optimization of apple snack. (Master of Science), *McGill University, Montreal*. Pp. 1-33
- Godwin ID and Gray SJ (2000). Overcoming productivity and quality constraints in sorghum: the role for genetic engineering. In Transgenic cereals. In Transgenic cereals; O'Brien L Henry R. J Eds AACC St Paul Minnesota USA; pp.153-177.
- Graham GG, MacLean WC Jr, Morales E, Hamaker BR, Kirleis AW, Mertz ET and Axtell JD (2006). Digestibility and utilization of protein and energy from Nasha, a traditional sudanese fermented sorghum weaning food. *J. Nutr.* 116: 978-984.
- Hadjivassiliou, M., Grunewald, R. A., Sharrack, B., Sanders, D., Lobo, A., Williamson, C., Woodroffe, N., Wood, N. and Davies-Jones, A. (2003). Gluten ataxia in perspective: epidemiology, genetic susceptibility and clinical characteristics. *Brain*, 126: 685–691.
- Hooda, S. and Jood, S. (2005). Organoleptic and nutritional evaluation of wheat biscuits supplemented with untreated and treated fenugreek flour. *Food Chemistry*, 90: 427-435.
- Hooda, S. and Jood, S. (2005). Organoleptic and nutritional evaluation of wheat biscuits supplemented with untreated and treated fenugreek flour. *Journal of Food Chemistry*, 90:, 427–435.

- Hopkins BG, Whitney DA, Lamond RE and Jolley VD (2008). Phytosiderophore release by sorghum, wheat, and corn under zinc deficiency. *J. Plant Nutr.* 21: 2623-2637.
- Hugo LF, Rooney LW, and Taylor JRN (2003). Fermented sorghum as a functional ingredient in composite breads. *Cereal Chem.* 80: 495-499.
- Hui Y. H., Corke H., De Leyn I., Nip W. -K. and Swanson R. B., (Eds), (2006). Bakery products science and technology (1st Ed), *Blackwell Publishing*, Iowa USA.
- Hunter G., Tinton T. and Carey P., (2008). Professional chef: Level 3 S/NVQ, *Cengage learning Emea*. Pp. 1-10
- ICRISAT (2005). Sorghum report. Patancheru India. <http://www.icrisat.org/text/research/grep/homepage/sorghum/sorghumhomepage.htm>
- Iwe MO, Okereke GO, and Agiriga AN (2014). Production and Evaluation of Bread Made from Modified Cassava Starch and Wheat Flour Blends. *Agrotechnology*, 4: 133.
- Iwe, M. O., Okereke, G. O., and Agiriga, A. N. (2014). Production and Evaluation of Bread Made from Modified Cassava Starch and Wheat Flour Blends. *Agrotechnol* 4: 133.
- Iwegbue, C. M. A. (2012). Metal contents in some brands of biscuits consumed in Southern Nigeria. *American Journal of Food Technology*, 7: 160-167.
- Kangama CO, and Rumei X (2005). Introduction of sorghum (*Sorghum bicolor* (L.) Moench) into China. *Afr. J. Biotech.* 4 :575-579.
- Klu, G., Amoatey, H. M., Bansa, D. and Kumaga, F. K. (2011). Cultivation and use of AYW (*Sphenostylis stenocarpa*) in the Volta Region of Ghana. *Journal of Food Technology in Africa*, 6(3), 393-403.
- Kumar, P.; Yadava, R. K., Gollen, B., Kumar, S., Verma, R. K. and Yadav, S. (2011). Nutritional Contents and Medicinal Properties of Wheat: A Review. *Journal of Life Sciences and Medicine Research*, 1(22): 1-10
- Lesego, B. P. (2014). Physico-functional properties of wheat-moroma bean composite flour and its performance in food systems. A Thesis Submitted to the School of Graduate Studies, University Of Ghana; in Partial Fulfillment of the Requirements for the Award of the Master of Philosophy Degree in Food Science. Pp. 19.
- Licata, R.; Chu, J.; Wang, S.; Coorey, R.; James, A.; Zhao, Y. and Johnson, S. (2014). Determination of formulation and processing factors affecting slowly digestible starch, protein digestibility and antioxidant capacity of extruded sorghum-maize composite flour. *Int. J. Food Sci. Technol.*, 49: 1408–1419.
- Michael, O. N., Etim, E. E., and Innocent, O. O. (2018). Investigation on the antidiabetic activity of *Sphenostylis stenocarpa* seed milk extract in alloxan-induced diabetes rats. *International Journal of Scientific and Research Publications*, 8(8):824-829.
- Mohapatra, D.; Patel, A.S.; Kar, A.; Deshpande, S.S.; and Tripathi, M.K. (2019). Effect of different processing conditions on proximate composition, antioxidants, anti-nutrients and amino acid profile of grain sorghum. *Food Chem.*, 271: 129–135.
- Ngwu, E. K., Aburime, L. C., and Ani, P. N. (2014). Effect of processing methods on the proximate composition of African yam bean (*Sphenostylisstenocarpa*) flours and sensory characteristics of their gruels. *International Journal of Basic and Applied Sciences*, 3(3):285-290.
- Nwakalor, C. N. (2014). Sensory Evaluation of Cookies Produced from Different Blends of Wheat and *moringa Oleifera* Leaf Flour. *International Journal of Nutrition and Food Sciences*, 3(40): 307-310.
- Nwankwo, M. O., and Ekeanyanwu, C. R. (2011). Nutritional Pharmacology and Phytochemicals Lambert Publication Germany. pp. 01-12.
- Obi, C. and Nwakalor, C. (2015). Production and Sensory Evaluation of Biscuits Using the Composite Flours of African Yam Bean and Wheat Flour. *Journal of Environmental Science, Toxicology and Food Technology*, 9(11): 83-84.
- Ogo, A.O., Ajekwe, D.J., Enenche, D.E. and Obochi, G.O. (2021). Quality Evaluation of Novel Biscuits Made from Wheat Supplemented with Watermelon Rinds and Orange Pomace Flour Blends. *Food and Nutrition Sciences*, 12: 332-341.
- Ogunjobi M. A. K. and Ogunwolu S. O., (2010). Physicochemical and sensory properties of cassava flour biscuits supplemented with cashew apple powder, *Journal of Food and Technology*, 8(1): 24-29.

- Ohanmu, E. O., Ikhajagbe, B., and Edegbai, B. O. (2018). Nitrogen distribution pattern of african yam bean (*Sphenostylis stenocarpa*) exposed to cadmium stress. *Journal of Applied Sciences and Environmental Management*, 22(7):1053-1057.
- Ojuederie, O. B., Balogun, M. O. (2019). African yam bean (*Sphenostylis Stenocarpa*) tubers for nutritional security. *Journal of Underutilized Legumes*, 1(1):56-68.
- Okoye, P. C., Anoliefo, G. O., Ikhajagbe, B., Ohanmu, E. O., Igiebor, F. A., and Aliu, E. (2019). Cadmium toxicity in African yam bean (*Sphenostylis stenocarpa*) (Hochst. ex A.Rich.) Harms genotypes. *Acta agriculturae Slovenica*, 114(2):205-220.
- Olasoji, J., Akande, S., and Owolade, O. (2011). Genetic variability in seed quality of African yam bean (*Sphenostylis stenocarpa* Hoscht. Ex A. Rich Harms). *African Journal of Agricultural Resources*, 6(27): 5848-5853.
- Oyedele, D. S., Oluwafemi, G. I., Adepeju, A. B., Otutu, O. L. and Oluwasola, P. O. (2017). Development and quality evaluation of cookies produced from flour blends of wheat, almond nuts and some natural plant materials. *FUTA Journal of Research in Sciences*, 13(3): 502-516.
- Oyedele, T. A., Kehinde, I. A., Afolabi, C. G. and Oyedeji, E. O. (2019). Effects of storage methods and mycoflora on proximate composition of African Yam Bean (*Sphenostylis Stenocarpa* Hochst Ex Rich) seeds. *Journal of Agricultural Science and Environment*, 18(1). 34-40.
- Pena-Bautista, R. J., Hernandez-Espinosa, N., Jones, J. Mm, Guzman, C. and Braun, H. J. (2017). CIMMYT Series on Carbohydrates, Wheat, Grains, and Health: Wheat-Based Foods: Their Global and Regional Importance in the Food Supply, Nutrition, and Health. Pp. 1-20.
- Penfield M. P. and Campbell A. M., (2012). Experimental food science (3rd Ed), *Academic Press*. Pp. 1-50.
- Peter-Ikechukwu, A. I., Ogazi, C. G., Uzoukwu, A. E., Kabuo, N. O. and Chukwu M. N. (2020). Proximate and Functional Properties of Composite Flour Produced With Date Fruit Pulp, Toasted Watermelon Seed and Wheat. *J Food Chem Nanotechnol* 6(3): 159-166.
- Piernas, C., and Popkin, B. M. (2010). Trends in snacking among US children. *Health Affairs*, 29(3), 398-404.
- Piironen, V., Lampi, A. M., Ekholm, P., Marttila, M. S. and Liukkonen, K. H. (2013). Micronutrients and phytochemical in wheat grain: In *Wheat Chemistry and Technology* (4th edn.). In: Khan K and Shewry PR (eds.), AACCI, pp: 223-278.
- Poudel, R. and Bhatta, M (2017). Review of Nutraceuticals and Functional Properties of Whole Wheat. *Journal of Nutrition and Food Science*, 7: 571-576.
- Prabhjot, S. (2017). Functional extruded products from rice flour, pulse flour and tomato powder blends. A thesis submitted to McGill University in a partial fulfillment of the requirements of the degree of Master of Science in Food Science and Agricultural Chemistry. Pp. 1-33.
- Proietti, I., Frazzoli, C.; and Mantovani, A. (2015). Exploiting nutritional value of staple foods in the world's semi-arid areas: Risks, benefits, challenges and opportunities of sorghum. *Healthcare*, 3: 172–193.
- Pylar E. J. and Gorton L. A., (2008). *Baking science and technology: Fundamental and ingredients*, Sosland Publishing Company, vol 1, Kansas city, USA. Pp. 1-50.
- Rao, B.D.; Bharti, N.; and Srinivas, K. (2017). Reinventing the commercialization of sorghum as health and convenient foods: Issues and challenges. *Indian J. Econ. Dev.*, 13: 1–10.
- Ratnavathi, C. V. and Patil, J. V. (2013). Sorghum Utilization as Food. *J Nutr Food Sci* 4: 247-256.
- Rios R. V., Pessanha M. D. F., De Almeida P. F., Viana C. L. and Lannes. C. S. D. S., (2014). Application of fats in some food products, *Food Science Technology (Campinas)*, 34(1): Campinas Brazil.
- Rooney LW and Waniska RD (2004). *Crop Utilization and Marketing: Food and Nutritional Quality of Sorghum and Millet*. Report Project TAM- 226. Department Texas A&M University College Station Texas, USA. pp. 77843-2474.
- Sam, S. M. (2019). Nutrient and antinutrient constituents in seeds of *Sphenostylis stenocarpa* (Hochst. Ex A. Rich.) Harms. *African Journal of Plant Science* 13(4):107-112.
- Sanni, T. A., Gbolagade, O. H., Ogunbusola, E. M. and Araoye, K. T. (2020). Quality assessment of cookies made from composite flour of wheat, sorrel seed protein isolate and yellow cassava flours. *J Microbiol Biotech Food Sci.*, 9(6): 1073-1079

- Sarwar, N., Gao, P., Seshasai, S. R., Gobin, R., Kaptoge, S., Di Angelantonio, E., Ingelsson, E., Lawlor, D. A., Selvin, E., Stampfer, M., Stehouwer, C. D. A., Lewington, S., Pennells, L., Thompson, A., Sattar, N., White, I. R., Ray, K. K., and Danesh, J. (2010). Diabetes mellitus, fasting blood glucose concentration, and risk of vascular disease: a collaborative metaanalysis of 102 prospective studies. *Emerging Risk Factors Collaboration Lancet*, 26(375):2215-2222.
- Senya, E. K., Kwaatema, F. and Sitsofe, K. R. (2021). Production and Acceptability of Tit-Bits Made From Wheat and Tiger Nut Flour Blends. *International Journal of Academic and Applied Research*, 5(1): 142-147.
- Sharma A., Jana A. H. and Chavan R. S., (2012) Functionality of milk powders and milk-based powders for end use applications-a review, *Comprehensive Reviews in Food Science and Food Safety*, 11: 518-528.
- Sharma, S., Bajwa, U. H. and Nagi, H. P. S. (2009). Rheological and baking properties of cowpea and wheat flour blends. *Journal Science Food Agriculture*, 79: 657–662.
- Shewry, P. R., Hawkesford, M. J., Piironen, V., Lampi, A. M. and Gebruers, K. (2013). Natural variation in grain composition of wheat and related cereals. *Journal of Agriculture and Food Chemistry*, 61: 8295-8303.
- Shin SI, Choi HJ, Chung KM, Hamaker BR, Park KH and Moon TW (2004). Slowly digestible starch from debranched waxy sorghum starch: Preparation and properties. *Cereal Chem.* 81: 404-408.
- Slukova, M., Levkova, J., Michalcova, A., Horackova, S. and Skrivan, P. (2017). Effect of the Dough Mixing Process on the Quality of Wheat Buckwheat Proteins. *Czech Journal of Food Science*, 6: 522-531.
- Soetan, K., Olugboye, O., Charles, O., and Karigidi, K. O. (2018). Comparative *in vitro* antioxidant activities of six accessions of African yam beans (*Sphenostylis Stenocarpa* L.). *Annals Food Science and Technology*, 19(3):455-461.
- Sramková, Z., Gegová, E. and Sturdík, E. (2009). Chemical composition and nutritional quality of wheat grain. *Acta Chimica Slovaca*, 2: 115-138.
- Stear C. A., (2012). Handbook of breadmaking technology, *Springer Science and Business Media*. Pp. 1-10
- Sumnu S. G. and Sahin S., (2008). Food engineering aspects of baking sweet goods, *Current Anthropology* 43(4):611-630.
- Taylor JRN and Dewar J (2001). .Developments in sorghum food technologies. In ‘Advances in Food and Nutrition Research. In Advances in Food and Nutrition Research Vol. 43; S.L. Taylor ed Academic Press San Diego USA.
- Taylor, J.R.N.; and Duodu, K.G. (2015). Effects of processing sorghum and millets on their phenolic phytochemicals and the implications of this to the health-enhancing properties of sorghum and millet food and beverage products. *J. Sci. Food Agric.* 2015, 95, 225–237.

**FARKLI KAOLEN KAYNAKLARININ SERAMİK SAĞLIK GEREÇLERİNDE SİR
ÖZELLİKLERİNE ETKİLERİ
EFFECTS OF DIFFERENT KAOLIN SOURCES ON THE GLAZE PROPERTIES OF
CERAMIC SANITARY WARE**

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Abstract

Ceramic sanitary ware (CSW) encompasses main product groups such as toilets, washbasins, urinals, and bidets. The production of Sanitary ware involves coating the Sanitary ware body with a CSW glaze and then firing it. The CSW glazes are characterised by high strength and hardness, and low surface roughness, and the glazes play a crucial role in hygiene. These glazes are obtained using various raw materials such as quartz, feldspar, kaolin, zircon, and zinc. Kaolin, a type of clay mineral, forms from the alteration of granite or volcanic rocks containing feldspar into the kaolinite mineral. Kaolin is rich in kaolinite, with a chemical composition of $Al_2O_3 \cdot 2SiO_2 \cdot 2H_2O$. The use of kaolin in Sanitary ware glazes is due to its role as a dispersing agent within the glaze, helping to evenly distribute other micronised raw materials in the glaze suspension, aiding in the adherence of the glaze to the body during application, and contributing to the thermal expansion properties of the glaze, thereby enhancing the compatibility between the body and the glaze and reducing the risk of crack formation. Additionally, kaolin contributes to the whiteness and opacity of the glaze, improving its aesthetic appearance. Moreover, due to the alumina content of kaolin, it also assists in enhancing the mechanical properties of the glaze, such as wear and impact resistance.

In this study, the chemical and mineralogical analyses of the kaolins used were conducted. Glaze compositions with similar particle size distributions were prepared using different kaolins. Particle size distributions were analysed using laser diffraction techniques, and rheological properties were examined with a rheometer. Thermal expansion properties were studied using a dilatometer, and melting behaviours were investigated with a heat microscope. The determination of glaze flow lengths, as well as the evaluation of colour, gloss, surface roughness, surface wear, and impact resistance, were conducted by firing on a vitrified body in plate sizes. Thus, the effects of different kaolins used in sanitary ware product glaze recipes on the mechanical and physical properties of the glazes have been elucidated.

Keywords: Ceramic Sanitary Ware, Glaze, Kaolin

Özet

Seramik Sağlık Gereçleri (SSG) klozet, lavabo, pisuvar ve bide gibi ana ürün gruplarını kapsamaktadır. SSG üretimi, iki ana bileşenden biri olan SSG bünyenin SSG sıırı ile kaplanıp pişirilmesiyle meydana gelmektedir. SSG sıırı yüksek mukavemet ve sertliğe, düşük yüzey pürüzlülüğüne sahip hijyenin büyük bir önem taşıdığı yapıdır. Kuvars, feldspat, kaolin zirkon, çinko vb. çeşitli hammaddelerin kullanılmasıyla elde edilmektedir. Bir çeşit kil minerali olan kaolin, feldspat içeren granitik veya volkanik kayaların altere olarak kaolinit mineraline dönüşmesi sonucu oluşmaktadır. Kaolin, kaolinit açısından zengin olup, kimyasal yapısı $Al_2O_3 \cdot 2SiO_2 \cdot 2H_2O$ 'dir. SSG sıırlarında kaolin kullanımının nedeni, kaolinin sıır içerisinde yüzdürücü bir ajan olarak görev yaparak sıır bileşimindeki diğer mikronize hammaddelerin homojen bir şekilde süspansiyon içerisinde dağılabilmelerini sağlamak, sıırın bünyeye uygulanması esnasında sıırın bünye üzerinde tutunabilmesinde rol oynamak, sıırın termal genleşme özelliklerine katkıda bulunarak bünye ve sıır uyumunun sağlanmasına yardımcı olarak çatlak oluşum riskini azaltmak, sıırın beyazlığına ve opaklığına katkı sağlayarak estetik görüntü oluşumuna katkı sağlamaktır. Ayrıca kaolinlerin alümina içeriği sebebiyle, sıırın aşınma ve çarpma dayanımı gibi mekanik özelliklerinin iyileştirilmesine de yardımcı olmaktadır.

Bu çalışmada kullanılan kaolinlerin kimyasal ve mineralojik analizleri gerçekleştirilmiştir. Kullanılan farklı kaolinlerin SSG sıırı içerisinde kullanılmasıyla benzer tane dağılımlarına sahip sıır kompozisyonları hazırlanmış; lazer difraksiyon tekniği ile tane dağılımları ve reometre ile reolojik özellikleri analiz edilmiştir. Isıl genleşme özellikleri, dilatometre cihazıyla ve erime davranışları ise ısı mikroskobu kullanılarak incelenmiştir. Sıır kompozisyonlarının sıır akma boylarının tespiti, plaka ebatında vitrifiye bünye üzerinde pişirim yapılarak ise renk, parlaklık (gloss), yüzey pürüzlülüğü, yüzey aşınma ve çarpma dayanımı özellikleri incelenmiştir. Böylece Seramik Sağlık Gereçleri sıır reçetelerinde kullanılan farklı kaolinlerin, sıırların mekanik ve fiziksel özelliklerine olan etkileri açığa kavuşturulmuştur.

Anahtar kelimeler: Seramik Sağlık Gereçleri, Sıır, Kaolen

1. GİRİŞ

Vitrifiye diğer adı ile “seramik sağlık gereçleri” banyo, tuvalet, mutfak gibi alanlarda kullanılan lavabo, eviye, klozet, rezervuar, bide, helataşı, pisuar, duş teknesi, vb. sıırlı sıırsız, beyaz renkli ürünlerin genel adıdır [1]. Sağlık gereçleri, son senelerde oldukça fazla bir şekilde ivmelenip büyüyen inşaat sanayisinin en mühim alt yapılarından. Islak olan yerlerde kullanılan bu malzemeler, gün geçtikçe daha da işlevselleşmektedir [2].

Endüstriyel sanayi olarak incelersek, seramik malzemelerin imalatına ülkemiz 1950’li senelerde başlamıştır. Günümüzde ise ülkeler arasında ön sıraları çeken seramik sağlık gereçleri üreticilerindedir. Yakaladıkları estetik görünüş, ücret politikası, kalite standartlarını yakalama seviyesi ile ülkemiz başarı kazanmıştır. Özellikle Avrupa Topluluğu Ülkeleri başta olmak üzere, diğer ülkeler arasında da gittikçe yükselen bir talep havuzu sağlayabilmiştir. Türkiye’de seramik malzemelerden sağlık gereçleri imalatı yapan şirketler kurulurken, mevcut hatlarında gelişmiş son teknolojileri kullanmaya ve uygulamaya oldukça önem vermiştir. Mevcut kapasite oranlarının sürekli olarak artması ve bununla beraber yeni imalat alanlarının açılması, gelişen teknolojileri sürekli olarak takip edebilme ve devreye alma şansı sağlamaktadır [2-3].

Seramik sağlık gereçleri grubu, organik olmayan hammaddelerinin belirlenen oranlarda harmanlanması, akışkan yapıdaki çamur haline dönüştürülerek alçı ya da sentetik olan bir reçine kalıplarda biçimlendirilmesi; ardından 1200 ile 1250°C aralıklarında pişirilmesi sonucu oluşan ve suyu emme oranı %0,75 rakamlarında olan seramik yapı malzemelerdir [2]. Teknik olarak adları, vitrifiye seramik adıyla bilinen sıırlanmış ya da camlaşmış seramiklerin gereçleri diye belirlenmesi, müşteriye verebildiği özelliklerle alakalıdır [4]. Kolay şekilde temizlenebilmesi, görüntü açısından her talebe uygun özelliklerde eldesi, yüksek ömürlü yapıda olması, suya dayanıklı oluşu, kimyasal yönde gelen etkilere ve sıcaklıklara dayanıklı olması, kiri çok tutmaması gibi sebeplerle sağlık araç gereçleri sektöründe öncü malzemelerdir [3-4].

Seramik ürünlerde yüzeyleri kaplayan, ürüne estetik, teknik, sııhhi özellikler kazandıran parlak ya da mat, cama benzer bir tabakadır. Kimyasal olarak, alkaliler ve toprak alkalilerin oluşturduğu silikat karışımlarının uygun sıcaklıklar altında eritilmesi ve soğutulması ile elde edilen camsı tabakadır. Sıırlardan beklenen özelliklere baktığımızda, karışımın talep edilen ısıda gelişip, cam fazı oluşturması, sıır ve bünye arasındaki uyumun tam olması, genleşme katsayılarının uygunluğu, kimyasal, optik ve

mekanik özelliklerinin beklenen kadar iyi olmasıdır. Seramik sırlarında aradığımız en büyük özelliklerden biri, üstüne çekilen çamur ile, normal koşullar altında fiziksel ve de kimyasal bağ kurmasıdır. Bu bağların farklı sebepler ile iyi ya da zayıf olmaları sonucunda, sırnın başarı durumu da belirlenmiş olmaktadır. Hatasız sır tabakasının, seramik çamurunun üstünde çoğunlukla çatlamadan ve kavlamadan kalması gerekmektedir. Fakat artistik amaçlar ile hata türü veya farklı sır hataları, dekoratif amaçlı kullanılırlar [5].

Son zamanlarda, seramik sağlık gereçlerinde kullanılan hammaddelerin alternatifleriyle değiştirilme çalışmaları sürdürülmektedir [6]. Reçetede yapılacak her türlü değişikliğin, fiziksel, mekaniksel, dekarasyon vs özelliklere etki etmektedir. Sağlık gereçlerinde kullanılan hammadde özelliklerinin porselen bünyelerin pirolastik davranışına etkisi, sinterleme sırasındaki yumuşama davranışı, farklı tane boyutlarının fiziksel özelliklere etkisi vs çalışmalar yapılmaktadır [6-9]. Bu sebepten bu çalışmada temel hammaddelerden biri olan kaolen mineralinin farklı kaynaklardan kullanımı ve sıhhi seramik bünyelerin nihai özelliklerine etkileri incelenmiştir.

2. GEREÇ VE YÖNTEMLER

Bu çalışmada, farklı kaolenler tedarik edilerek, tane boyut dağılımları Malver Mastersizer 2000 cihazıyla lazer difraksiyon yöntemi kullanılarak belirlenmiştir. Öğütme işlemi, Ceramic Instruments marka SD/2 1000 model jet değirmenlerde gerçekleştirilmiştir. Öğütme işleminin ardından 100 x 150 mm ebatlarındaki kurutulmuş vitrikiye bünye üzerine pistole ile sırlama yapılmıştır. Sırlama yapılan plakalar ve sır akmaları işletme şartların tünel fırında pişirim yapılmıştır. Pişirilen plakaların renk ve gloss (parlaklık) ölçümleri Konica Minolta marka CM-26dG model cihaz ile 10o/D65’de SCI ölçüm yöntemi kullanılarak, yüzey pürüzlülüğü ölçümü ise MarSurf marka PS 10 model yüzey pürüzlülüğü cihazı kullanılarak yapılmıştır.

Değirmenden alınan sırların reolojik özelliklerinin tespit edilebilmesi amacıyla Anton Paar Marka MRC 92 model reometre ile ölçüm yapılmıştır. Isıl genişleme değerlerinin tespit edilebilmesi için, plakalar ile birlikte dilatometre çubuğu için pişirim yapılmıştır. Ardından Isıl genişleme değerleri NETZSCH marka DIL 402 Expedis CL model dilatometre ile tespit edilmiştir. Yine değirmenden alınan sırlardan kurularak, sırnın ergime sıcaklıklarının tespit edilebilmesi amacıyla ELS marka MV model Isı Mikroskobu/Optik Dilatometre cihazı kullanılarak tespit edilmiştir. Sırların kimyasal ve mineralojik analizleri incelenmiştir.

3. SONUÇLAR

Öncelikle bu çalışmada kullanılacak olan üç adet kaolen numunesinin kimyasal karakterizasyonu yapılmıştır (Tablo 1)

Tablo 1. Kaolen Numunelerinin Kimyasal Analiz Sonuçları.

Kaolen	SiO ₂	Al ₂ O ₃	Fe ₂ O ₃	TiO ₂	CaO	MgO	Na ₂ O	K ₂ O	SO ₃	K.K.
K-1	47,35	36,68	1,125	0,3	0,12	0,11	0,001	0,62	-	13,69
K-2	48,74	35,69	0,898	1,515	0,1	0,02	0,05	0,12	-	12,86
K-3	63,96	23,86	0,986	0,360	0,09	0,07	-	0,28	0,76	9,63

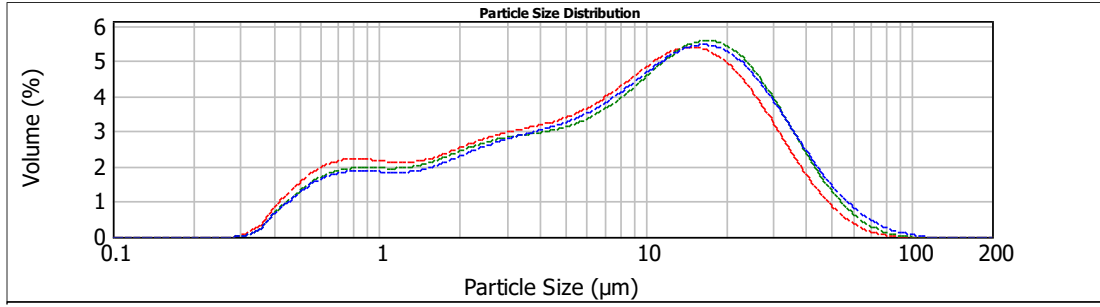
Kimyasal olarak karakterize edilen kaolenlerin 1200°C’deki pişme renkleri de tespit edilmiştir (Tablo 2).

Tablo 2. Kaolen Numunelerin Renk Ölçüm Sonuçları.

Kaolen	L	a	b
K-1	95,66	0,25	3,12
K-2	93,46	0,91	6,16
K-3	94,12	0,23	3,66

Kaolen numuneleri ortak bir sır formülasyonu içerisinde %16,5 oranında kullanılarak üç farklı sır reçetesi oluşturulmuştur. Bu reçetelerde K-1 kaoleni R-1 reçetesinde, K-2 Kaoleni R-2 reçetesinde ve K-3 kaoleni ise R-3 reçetesinde kullanılmıştır. Tüm reçetelere değirmen fazında aynı sarj süreleri verilerek öğütülmüştür ve lazer difraksiyon tekniği ile tane dağılımları ölçülmüştür (Tablo 3, Şekil 1). Şekil 1’deki tane boyut analizi sonuçları incelendiğinde 0.7, 3, 10-11 mikron arasında olmak üzere 3 noktada odaklanan bir toz boyut dağılımı görülmektedir. Özellikle 10-11 mikron arasında toz boyutunun

domine olduğu ortaya çıkmıştır. Tablo 3'te ise $d(0,1)$, $d(0,5)$ ve $d(0,9)$ değerleri verilmiştir. En yüksek değerlerin R-1 reçetesine ait olduğu görülmüştür.



Şekil 1. Hazırlanan Sır Reçetelerinin Tane Boyut Dağılım Grafikleri (Mavi: R-1; Yeşil: R-2 ve Kırmızı: R-3).

Tablo 3. Hazırlanan Sır Reçetelerinin Lazer Difraksiyon Tekniği İle Tane Dağılımları.

Sır Reçetesi	Sarj Süresi (dk.)	Sır Tane Boyut Dağılımları		
		$d(0,1)$	$d(0,5)$	$d(0,9)$
R-1	20	1,035	9,189	31,704
R-2	20	0,895	7,731	27,109
R-3	20	1,006	9,045	30,528

Bu reçetelere ait değirmen fazındaki sırların reometre ile reolojik verileri incelenmiştir (Tablo 4).

Tablo 4. Hazırlanan Sır Reçetelerinin reolojik ölçüm sonuçları.

Sır Reçetesi	Viskozite (Pa.s)			Toparlanma (%)	
	0,1 (1/s)	106 (1/s)	300 (1/s)	5 sn.	10 sn.
R-1	6,01	0,07	0,07	39,8	66,9
R-2	8,79	0,06	0,05	58,9	82,6
R-3	5,53	0,04	0,04	54,5	88,8

Öğütme işleminin ardından 100 x 150 mm ebatlarındaki kurutulmuş vitrifiye bünye üzerine pistole ile sırlama yapılmıştır. Sırlama yapılan plakalar ve sır akmaları işletme şartların tünel fırında 1210 °C'de pişirim yapılmıştır. Akma boyları birbirlerine benzer şekilde gözlenmiştir. Plakaların renk, gloss ve yüzey pürüzlülüğü ölçümleri yapılmıştır.

Tablo 5. Hazırlanan Sır Reçetelerinin Renk ve Parlaklık (gloss) Verileri.

Sır Reçetesi	L	a	b	Gloss
R-1	91,02	-0,67	-0,31	92,7
R-2	91,14	-0,86	-0,10	91,7
R-3	91,68	-0,71	-0,50	93,4

Tablo 6. Hazırlanan Sır Reçetelerinin Yüzey Pürüzlülüğü Verileri.

Sır Reçetesi	R_a (µm)	R_z (µm)	R_{max} (µm)
R-1	0,251	1,512	1,770
R-2	0,260	1,401	1,543
R-3	0,178	0,999	1,292

Sırların erime sıcaklıkları ısı mikroskobu cihazıyla tespit edilmiştir (Tablo 7).

Tablo 7. Hazırlanan Sır Reçetelerinin Isı Mikroskobu Sonuçları.

Sır Reçetesi	Sinterleşme (°C)	Yumuşama (°C)	Küre (°C)	Yarım Küre (°C)	Erime (°C)
R-1	1167	1214	1248	1280	1312
R-2	1174	1232	1272	1300	1331
R-3	1166	1216	1247	1284	1337

Sırların ısı genleşme değerleri incelenmiştir. Bu değer Seramik Sağlık Gereçlerinde bünye ile sırların uyumunu temsil eden en önemli veri olarak değerlendirilmektedir (Tablo 8).

Tablo 8. Pişirim Yapılan Sırların Isıl Genleşme Değerleri.

Sırların Reçetesi / T. Alpha (30 °C) 1/K x10 ⁻⁷	α 100	α 200	α 300	α 400	α 500	α 600	α 700	α 800
R-1	58,18	60,45	61,86	62,72	63,40	64,39	65,11	74,94
R-2	56,02	60,47	62,28	63,51	64,32	65,57	66,03	74,87
R-3	54,38	58,34	60,66	62,00	62,93	64,20	65,13	75,21

K-1, K-2 ve K-3 kaolen numunelerinden hazırlanan sırlara ait reçetelerin de kimyasal analizleri incelenmiştir (Tablo 9).

Tablo 9. Hazırlanan Sırların Reçetelerinin Kimyasal Analiz Sonuçları.

Komponent	Sırların Reçetesi		
	R-1	R-2	R-3
SiO ₂	56,06	56,83	58,3
Al ₂ O ₃	9,73	9,7	8,57
Fe ₂ O ₃	0,24	0,23	0,20
TiO ₂	0,10	0,24	0,13
CaO	10,88	10,82	10,72
MgO	0,90	0,8	0,78
Na ₂ O	2,10	1,87	1,87
K ₂ O	1,69	1,68	1,66
ZnO	0,99	1,00	1,01
SO ₃	0,03	0,01	0,16
ZrO ₂	6,33	6,03	6,17
K.K.	10,75	10,59	10,11

Hazırlanan tüm sırların reçetelerine ait sırların yüzey aşınma ve çarpma dayanım testlerinin sonuçları genel olarak ele alındığında standart ve müşteri istekleri kriterlerine göre kabul sınırlarında olduğu belirlenmiştir.

4. TARTIŞMA

Bu çalışmada farklı kaolenlerin seramik sağlık gereçleri (SSG) sırları üzerindeki etkileri incelenmiştir. Elde edilen bulgular, kaolenlerin kimyasal kompozisyonlarının ve partikül boyut dağılımlarının, SSG sırlarının reolojik, optik ve mekanik özellikleri üzerinde belirgin etkiler oluşturduğunu göstermektedir. R-1, R-2 ve R-3 sırlarının incelenmesiyle, özellikle K-3 kaoleni içeren reçetenin, diğer iki reçeteye kıyasla daha düşük yüzey pürüzlülüğü (Ra: 0.178 µm) ve daha yüksek parlaklık (Gloss: 93.4) değerlerine sahip olduğu tespit edilmiştir. Bu durum, R-3 kaoleni ile hazırlanan sırların daha düzgün ve estetik bir yüzey oluşturduğunu ortaya koymaktadır.

Isıl genleşme testleri dikkate alındığında, farklı kaolenlerin sırların bünye uyumuna katkı sağladığı belirlenmiştir. R-3 reçetesi, düşük ısı genleşme katsayısı (α_{400} : 62×10^{-7} 1/K) ile dikkat çekmiş ve bu özellik, termal stres altında sırların çatlama riskini azaltma potansiyeli ön görülmüştür. Bu bulgular, R-3 kaoleninin hem estetik hem de dayanıklılık açısından avantaj sunabileceğini göstermektedir.

5. SONUÇLAR

Bu çalışmada, üç farklı kaolen kaynağının seramik sağlık gereçleri sırları üzerindeki etkileri incelenmiştir. Elde edilen sonuçlar, kaolenlerin kimyasal kompozisyonlarının ve partikül boyut dağılımlarının sırların reolojik, optik ve mekanik performanslarını önemli ölçüde etkilediğini

göstermektedir. R-3 reçetesi, diğer kaolenlere kıyasla daha parlaklık, düşük yüzey pürüzlülüğü ve iyi ısıl genleşme özellikleri göstermiştir. Bu bulgular, K-3 kaoleninin seramik sağlık gereçleri üretiminde estetik ve mekanik performans açısından tercih edilebileceğini göstermektedir.

KAYNAKLAR

1. Kafalı, Mehmet Ali. Seramik Sağlık Gereçleri. Sektörel Araştırmalar, Ankara: Türkiye Kalkınma Bakanlığı, 2005
2. Daday M T 2012. Seramik Sağlık Gereçlerinde Damar Hatalarının Giderilmesi, Doktora Tezi, Anadolu Üniversitesi, Fen Bilimleri Enstitüsü, Seramik Mühendisliği Anabilim Dalı, Eskişehir, 252 s.
3. Sarı H 2012. Seramik Sağlık Gereçlerinde Pişirim Sıcaklık ve Sürelerinin Azaltılması, Doktora Tezi, Anadolu Üniversitesi, Fen Bilimleri Enstitüsü, Seramik Mühendisliği Anabilim Dalı, Eskişehir, 177 s.
4. Baklacı S 2019. Seramik Sağlık Gereçlerinde Sır Yüzeyinin İyileştirilmesi, Yüksek Lisans Tezi, Eskişehir Teknik Üniversitesi, Fen Bilimleri Enstitüsü, Malzeme Bilimi ve Mühendisliği Anabilim Dalı, Eskişehir, 123 s.
5. Fraser H T 2010. Seramik Sır Hataları ve Çözümleri Kitabı, 1, Karakalem Kitabevi Yayınları, İzmir, 192 s.
6. Tunçel, D.Y., Seramik sağlık gereçleri bünyelerinin piroplastik deformasyonunun azaltılması, Doktora Tezi, Anadolu Üniversitesi, Fen Bilimleri Enstitüsü, Seramik Mühendisliği Anabilim Dalı, 2012.
7. Miura, M., Shimadzu, T., Shin, H., Ishida, E.H., "Evaluation of softening deformation behaviour in porcelain bodies during firing", Ceram. Eng. Sci. Proc., 20, 2, 1999.
8. Özel, E., Tunçel, D.Y., Kara, M. K., "Sert hammadde tane boyutunun sağlık gereçleri porseleninin fiziksel özelliklerine etkisi", Journal of the Faculty of Engineering and Architecture of Gazi University, Cilt 26, No 2, 299-306, 2011.
9. Tunçel, D. Y., Özel E., "Evaluation of pyroplastic deformation in sanitaryware porcelain bodies", Ceramics International, 38, 1399-1407, 2012.

CAMİ MİMARİSİ GELİŞİMİNİN KADIN KULLANICI ÜZERİNDEN ANALİZİ

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ÖZET

Mekan, topluma ait kodlarla işlenmiş hafızaya sahiptir ve değişen ve dönüşen aktif bir süreç içerisinde varlığını sürdürür. Toplumdaki değişimin/dönüşümün yansıması mekan üzerinden okunabilmektedir. Bu çalışma, toplumun yaşantısındaki değişimle birlikte kamusal mekanda var olma oranında artış gözlemlenen ‘ Kadın’ kullanıcının mekandaki dönüşüme etkisini analiz etmeyi amaçlamaktadır. Çalışma kapsamını, erkek ya da kadın her iki cinsiyetin de ibadet mekanı olan cami mimarisi oluşturmaktadır. Çalışmada veri analizi yöntemi kullanılmıştır. Çalışmanın örnekleme, 2018 yılında yapılan Cami Fikir Yarışmasında birincilik derecesi alan tasarımlardır. 200 kişi kapasiteli birinci kategori ve 1000 kişi kapasiteli ikinci kategori birincilerinin tasarımları kadın kullanıcı özelinde, ibadet mekanına giriş/çıkış, harimle bağlantı, mekan algısı, abdesthane ve tuvalet kullanımı başlıklarında deşifre edilmiştir.

Anahtar Kelimeler: Cami Mimarisi, Kadın, Mekan

ABSTRACT

The space has a memory processed with the codes of the society and continues its existence in an active process that changes and transforms. The reflection of change/transformation in society can be read through space. This study aims to analyze the effect of the 'Female' user, whose presence in public spaces has increased with the change in the life of the society, on the transformation in the space. The scope of the study consists of mosque architecture, which is a place of worship for both men and women. Data analysis method was used in the study. The sample of the study is the designs that won first place in the Mosque Idea Competition held in 2018. In the study, data analysis method was used. The designs of the winners of the first category, with a capacity of 200 people, and the winners of the second category, with a capacity of 1000 people, were deciphered specifically for the female user, under the headings of entrance/exit to the place of worship, connection with the sanctuary and perception of space, ablution and toilet use.

Keywords: Mosque Architecture, Woman, Space

GİRİŞ

Mabet kelimesi Arapça ibadet mastarından türemiştir ve bir dini inanışa sahip kişilerin çeşitli zaman dilimlerinde, toplu ya da tek başlarına bulunarak çeşitli dini ritüelleri gerçekleştirdiği özel mekan olarak tanımlanır.(Url 1) Hicret sonrası Hz. Peygamber’in evi ve inanların toplu olarak ibadet ettiği ilk İslam mabedi olan Mescid-i Nebevi’den günümüze Müslümanlığın yayıldığı coğrafyalarda farklı biçimlenişlerle cami mimarisi var olmuştur. İnanların yaş, cinsiyet, statü, fiziksel özellik gibi farklılıklarıyla camilerde eşitlik temelinde var olabilmeleri, dini, sosyal, siyasi, idari ve eğitim ihtiyaçlarını karşılamaları için gereklidir. Bu nedenle toplumun tüm katmanları cami mekanında etkileşim içinde olmalıdır.

Camiler, sadece mimari bir tasarımın biçimsel özelliğini değil, var olduğu toplumun yaşam şekli, insan ilişkileri ve hayata bakış açısını yansıtarak sosyolojik yapıya da ışık tutar. Toplumun dinamiklerindeki değişim, inanca bakış açısını değiştirmekte ve ibadet mekanlarında dönüşüme neden olmaktadır.(Ören, 2022)

İslamiyet öncesi cahiliye döneminde hak ve özgürlükler açısından kadının toplumdaki erkek cinsiyetiyle eşit olduğundan söz etmek mümkün değildir. İslamiyet’le birlikte dinin görüş ve gereklilikleri kutsal kitap ve Hz. Peygamber’in yaşantısı üzerinden inanlara aktarılmıştır. İslamiyet’in kutsal kitabı Kur’an-ı Kerim’de, kadın ve erkek cinsiyetini, insan olmaları yönüyle eşit, hayattaki rolleri itibarıyla ise birbirini tanımlayan varlıklar olduğunu ve akli melekesi yerinde olanların cinsiyetten bağımsız olarak, Allah’ın emir ve yasaklarına uymada ve kulluk etmede aynı sorumlulukta olduğunu

gösteren ayetler bulunmaktadır.(Yılmaz, 2007) Semavi dinlere inanların Hz. Âdem'den beri farklı şekil ve vakitlerde namaz kılmadan sorumlu olması, namaz ibadetinin dindeki önemini göstermektedir. Namaz kılma ibadeti ile ilgili Kuran-ı Kerim 'deki ayetler ve hadislere göre bu ibadetin gerçekleştirilmesi İslam'ı gerektiği gibi yaşamak ve cennete ulaşmak için gerekliliktir.(Öz,2022) Bu derece önemi vurgulanan namaz kılma ibadeti yeryüzündeki herhangi bir yerde gerçekleştirilebilir. Fakat Hz. Peygamber'in Medine'ye hicret ettikten sonra kendi eviyle birlikte toplu ibadetin birlikte yapılmasına imkan sunan ilk ibadet mekanı olan Mescit-i Nebevi 'yi inşaa ettirmesi, camilerdeki toplu ibadet etmenin önemli olduğunu Hz. Peygamber dönemindeki uygulama üzerinden göstermektedir. Vakit namazlarının gerçekleştirilmesinde camide olma zorunluluğu olmamasına rağmen Cuma ve Bayram namazlarının toplu olarak kılınması gerekliliği inanları günün beş vakti olmasa dahi toplu olarak camide birlikte olmaya yönlendirmektedir. Namaz kılma ibadeti kadın ya da erkek herkese farz kılınmıştır. Kur'an-ı Kerim'de kadınların camiye gidip ibadet etmeleri ve oradaki eğitim etkinliklerinden yararlanmaları ile ilgili herhangi bir kısıtlama bulunmamaktadır. Hatta Hz. Peygamber, kadınların camiye gitmelerini teşvik etmiştir. O'nun zamanında Mescid-i Nebevi'de kadınlar vakit, cuma ve bayram namazlarına katılmışlar, camide yapılan vaaz ve sohbetlerle din ve sosyal hayatla ilgili konularda bilgi edinmişlerdir.(Yılmaz, 2007) Hz Peygamber, kadınların rahatlıkla ibadet mekanını kullanabilmesi için harimin arkasında özelleşmiş alan oluşturmuş ve kadınların erkeklerin arkasında saf tutarak namaz kılmasını sağlamıştır.(Aycan, 2013)

Kadın-cami ilişkisi sınırlılığında ibadet yapıları incelendiğinde cinsiyete bakış açısındaki kültürel farklılıkların mimariye yansıdığı söylenebilir. Çok az kadın kullanıcının olduğu Nepal örneklerinden, Çin ve Amerika'daki kadınlara özel cami yelpazesine farklı kullanım oranlarıyla camiler yapılmıştır.(Özkurt, 2015),(Tayılga, Demiraslan, 2020)

ARAŞTIRMA VE BULGULAR

Bu çalışma, topluma ait kodlarla işlenmiş hafızaya sahip cami mimarisinin süreç içerisindeki değişimini /dönüşümünü toplumsal cinsiyet üzerinden ele almakta kadın kullanıcı özelindeki analiz etmeyi amaçlamaktadır. Çalışmanın örnekleme, 2018 yılında yapılan Cami Fikir Yarışmasında birincilik derecesi alan tasarımlardır. Çalışmada, veri analizi yöntemi kullanılmıştır. 200 kişi kapasiteli birinci kategori ve 1000 kişi kapasiteli ikinci kategori birincilerinin tasarımları, kadın kullanıcı özelinde özelinde, ibadet mekanına giriş/çıkış, harimle bağlantı ve mekan algısı, abdesthane ve tuvalet kullanımını başlıklarında deşifre edilmiştir.

'Cami Tasarımı Fikir Yarışması' Konusu ve Amacı

'Cami Tasarımı Fikir Yarışması' 2018 yılında, Diyanet İşleri Başkanlığı adına Çevre Şehircilik Bakanlığı tarafından düzenlenen fikir yarışmasıdır. Yarışmanın amacı, İslam dinin ibadet mekanı olan camilerin, dini işlevinin yan işlevlerle desteklendiği ve odak haline geldiği tasarımların paylaşılmasını sağlamaktır. Yarışma 200 kişi kapasiteli mahalle cami ve 1000 kişi kapasiteli şehir merkez cami olmak üzere iki farklı kategoride düzenlenmiştir (Url 2) Yarışmaya 325 katılım olmuş, her iki kategori için 8 proje ödüle layık görülmüştür.(Url 3)

Yarışma Şartnamesinin Kadın Kullanıcı Özelinde Analizi

Yarışma şartnamesinde yer alan '*Camilerin; ...kadın, engelli, yaşlı, genç ve çocuklar tarafından ulaşılabilir, güvenli ve konforlu bir şekilde kullanılabilen, estetik, sağlamlık ve ekonomiyi de gözetilen bir yaklaşım sergilemesi gerekmektedir.*' (Url 2) ifadesi kapsayıcılık açısından tasarımcıları yönlendirmektedir. İfade ile kadın kullanıcı ve mekânsal gerekliliklerinin tasarım girdisi olarak alınması gerekliliği vurgulanmaktadır.

Yarışmanın her iki kategorisi için oluşturulan ihtiyaç programlarında, ibadet mekanı için toplam kullanıcı sayısı verilmiştir fakat kadın ve erkek kullanıcıların sayısı ile kullanıcı sayısına bağlı olarak cinsiyete göre özelleşmiş ibadet mekanların büyüklüğünün belirlenmesi tasarımcılara bırakılmıştır.

200 kişilik cami için ihtiyaç programına ilişkin notlardaki '*İbadet mekânında birden fazla giriş düşünülebilir ve ayrı girişli mahfil tasarlanabilir.*' (Url 2) maddesinden tasarımlarda kadın kullanıcı için bağımsız girişlerin oluşturulabileceği fakat bunun zorunluk olmadığı anlaşılmaktadır. Fakat ikinci kategori için oluşturulan 1000 kişilik cami için ihtiyaç programına ilişkin notlardaki '*İbadet mekânında birden fazla giriş düşünülmesi ve ayrı girişli mahfil tasarlanması.*' (Url 2) maddesine göre ikinci kategorideki tasarımlarda cinsiyete göre özelleşmiş girişlerin bulunması zorunluluktur.

İkinci kategori için oluşturulan 1000 kişilik cami için ihtiyaç programına ilişkin notlarda; '*Kadınlar mahfiline de tuvalet, abdesthane ve kapalı otoparktan direkt ulaşım sağlanması. Kadınlar mahfilinde çocuk oyun mahalli de düşünülmesi. Akustik özellikli, müezzinin okuduğu sesi duyabileceği alan*

düşünülmesi. (Url, 2) ifadesi kadın kullanıcı için oluşturulması istenilen mekanları ve mekan özelliklerini tariflemektedir.

1.Kategori Cami İhtiyaç Programı	2.Kategori Cami İhtiyaç Programı																																																																																								
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Şekil 1: 200 ve 1000 kişilik cami ihtiyaç programı (Url 2)

Cami Fikir Yarışmalarında Derece Alan Tasarımların Kadın Kullanıcı Özelinde Analizi

1. Kategoride Birincilik Ödülü Alan Projenin Kadın Kullanıcı Özelinde Analizi

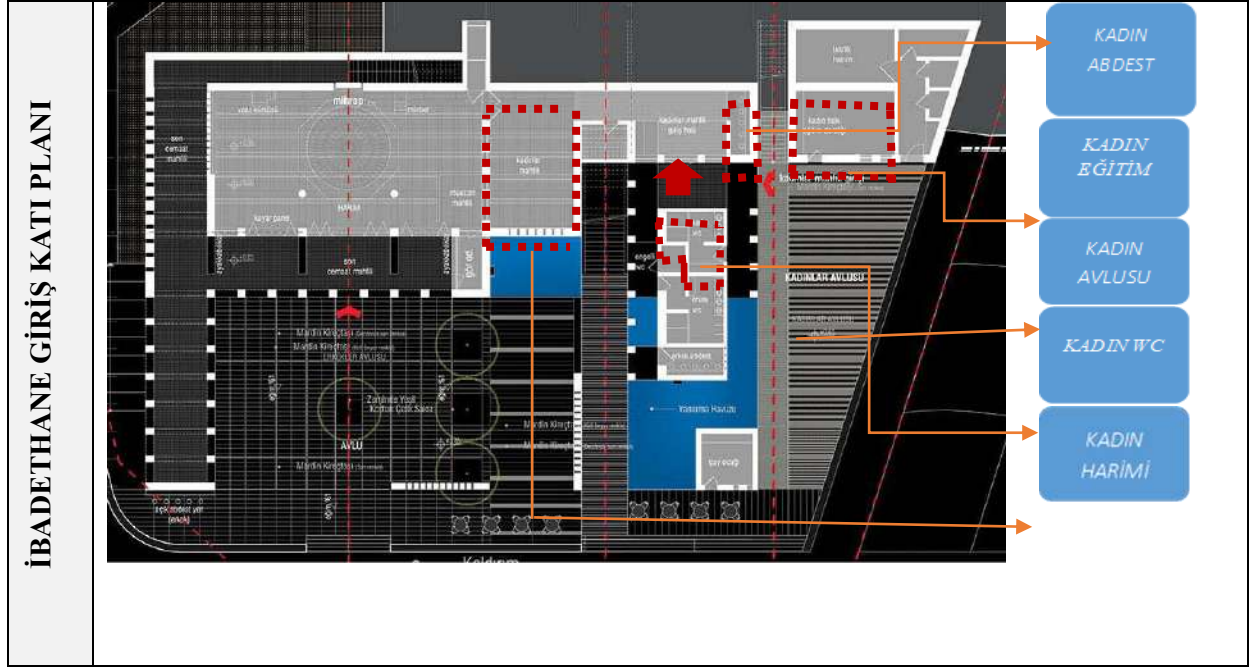
200 kişi kapasiteli Birinci kategori birincisi olan 13061 rumuzlu projede çalışma alanı, Artuklu mimarisine ait yapıların yoğun olarak bulunuşu, koruma durumu, retorasyon çalışmalarındaki nitelik ve turizm potansiyeli nedeniyle Mardin'in Artuklu ilçesi seçilmiştir. Proje ekibine göre, tasarımın '*...geçmiş ile şimdinin ya da mantık ile duyguların ürettiği çelişkilerle yüzleşip eksik kalanın tamamlanması*' temel felsefedir.(Url 4) Proje raporundaki ifadelerde evrensellik, birlik ve beraberlik kavramlarına değinildiği ve ibadet yapısının iç ve dış mekanında özelleşmiş çözümlerin oluşturulmasının girdi olarak tasarımcıları yönlendirdiği tespit edilmiştir. (Url 4)



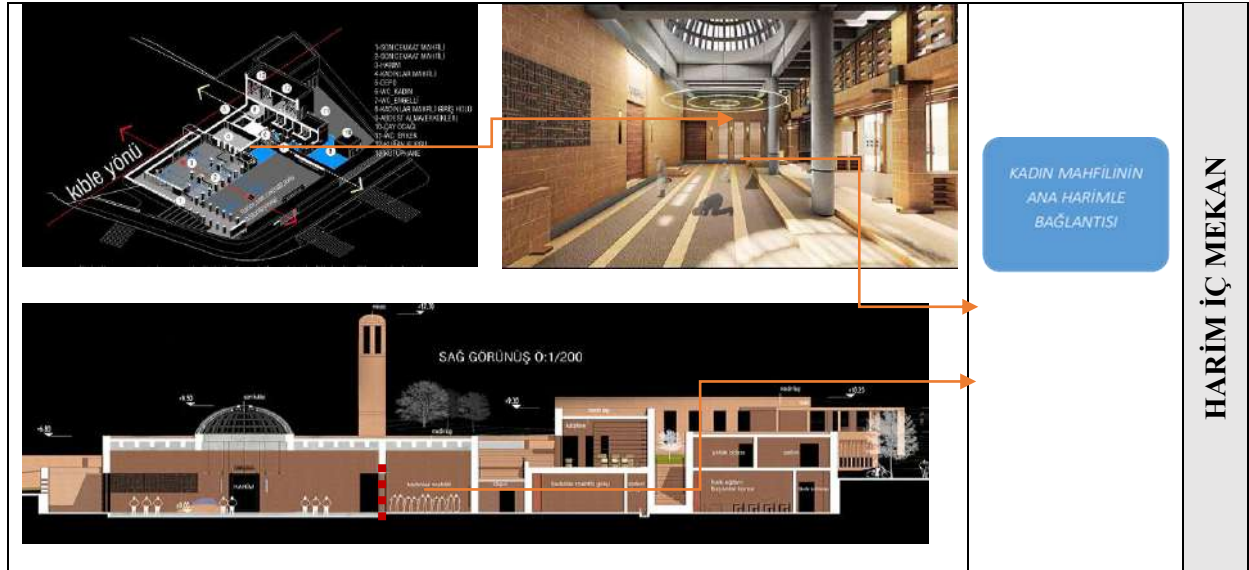
Şekil 2: Birinci Kategoride Birincilik Alan Proje (Url 4)

Projede, kadın kullanıcı için özel avlu oluşturulmuştur. İbadet ve eğitim mekanları ile abdesthane ve tuvaletlere erişim bu avlu ile sağlanmıştır. Kadın ibadet mekanı ile erkek ibadet mekânın büyüklükleri karşılaştırıldığında, tasarımcıların, toplam kullanıcı sayısının dörtte birinin kadın kullanıcı olacağı öngörüsüyle planlama yaptıkları anlaşılmaktadır. Şartnamede cinsiyete bağlı kullanıcı sayısı kısıtlaması olmamasına rağmen tasarımcıların geleneksel cami örneklerindeki kadın kullanıcı sayısının erkek kullanıcı sayısından az olması durumundan etkilendikleri düşünülmektedir. Kadının kentsel mekanda var olma oranındaki artışa rağmen kullanıcı sayısına bağlı kısıtlılığının olması hedeflenen eşitlik temelinde kapsayıcılık felsefesiyle çelişmektedir.

Erkek kullanımına ait ana harim ile kadın mahfili arasında kapı ile oluşturulan bağlantı namaz ibadeti sonrasında cami bağlantısını kurması açısından olumlu bulunmakla beraber kadın kullanıcı ibadet esnasında caminin ana unsurlarından olan kubbe, minber ve mihrapla görsel iletişim kuramamaktadır.



Şekil 3: Birinci Kategoride Birincilik Alan Projenin Fonksiyonel Çözümlemesi (Url 4 üzerinden işlenmiştir)

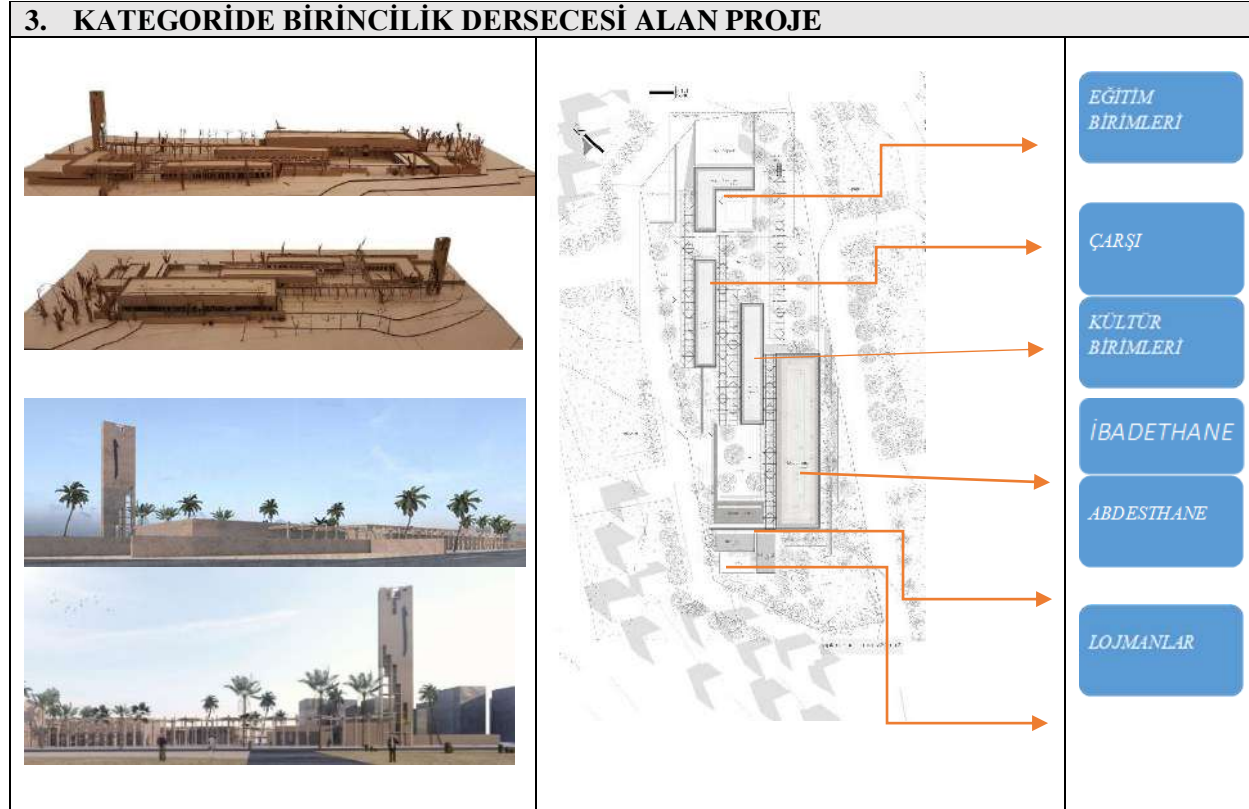


Şekil 4: Kadın Mahfilinin Ana Harim Bağlantısı (Url 4 üzerinden işlenmiştir)

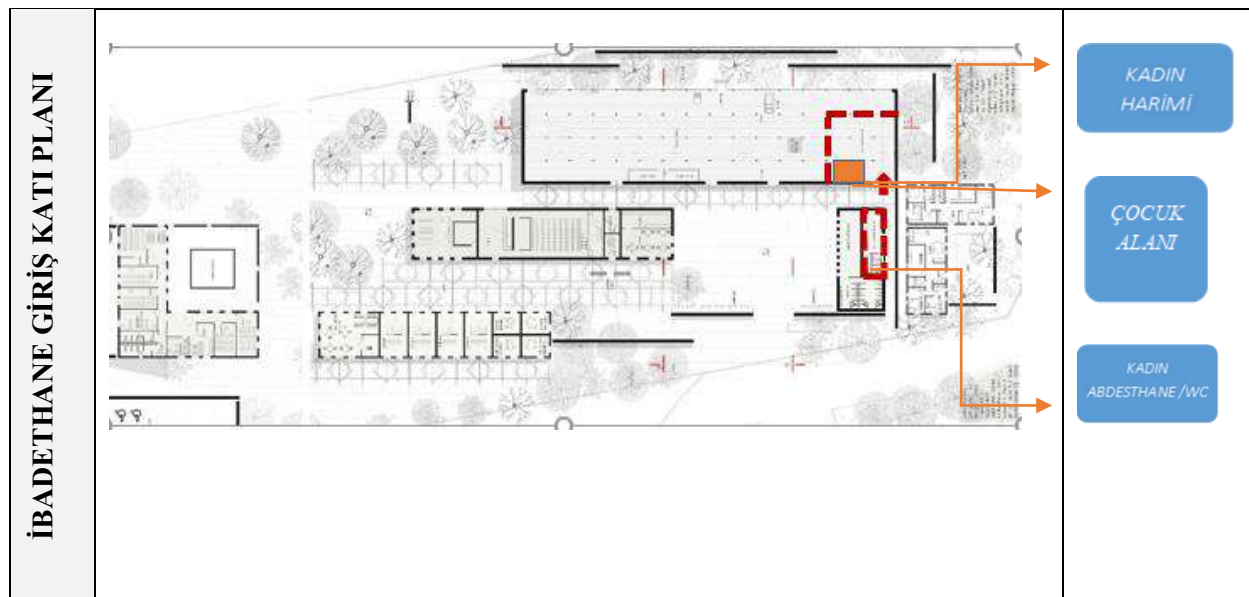
2. Kategoride Birincilik Ödülü Alan Projenin Kadın Kullanıcı Özelinde Analizi

1000 kişi kapasiteli ikinci kategori birincisi olan 47251 rumuzlu projede çalışma alanı, Mardin olarak belirlenmiştir. Proje ekibi tasarım felsefesini 'Allah ile kul arasındaki ilişkiyi, doğanın ve ışığın gücünü kullanarak temsil etmeye çalıştık' şeklinde açıklamaktadır.(Url 5) Proje raporunda geçen 'Namaz vakitlerinde kamusal alanlardan beslenen avlularla ibadet mekanına dört kapıdan giriş yapabilmektedir. Bu kapılardan birisi de kadınlar için ayrılmıştır.' (Url 5) ifadesi tasarım kararlarının alınmasında kadın kullanıcı grubunun gözetildiğinin göstergesi olmakla beraber iç mekan organizasyonunda kadın kullanıcıya özelleşmiş bir ifadeye rastlanmamıştır.Tasarım, ibadet ve diğer yan fonksiyonların bulunduğu parçalı kütlelerin sokak ve avlular ile bütünleştiği kompozisyonu yansıtır. Kütlelerin dış mekanı kadın kullanıcı için erişilebilirdir. Eğitim, kültür birimleri ile çarşı için cinsiyete özel giriş olmamasına rağmen, ibadethane ve abdesthaneler için ayrı giriş bulunmaktadır. Kadın ibadet mekanı ile erkek ibadet mekanının büyüklükleri karşılaştırıldığında, kadın ibadet mekanının, erkek ibadet mekanına oranla küçük olduğu tespit edilmiştir. Şartnamede cinsiyete bağlı

kullanıcı sayısı kısıtlaması olmamasına rağmen tasarımcıların geleneksel cami örneklerindeki kadın kullanıcı sayısının erkek kullanıcı sayısından az olması durumundan etkilendikleri düşünülmektedir. Ayrıca tasarımda kadın ibadet mekanının içerisinde çocuk alanının tasarlanmış olması çocuklarıyla camide bulunan kullanıcının konforu açısından olumludur.



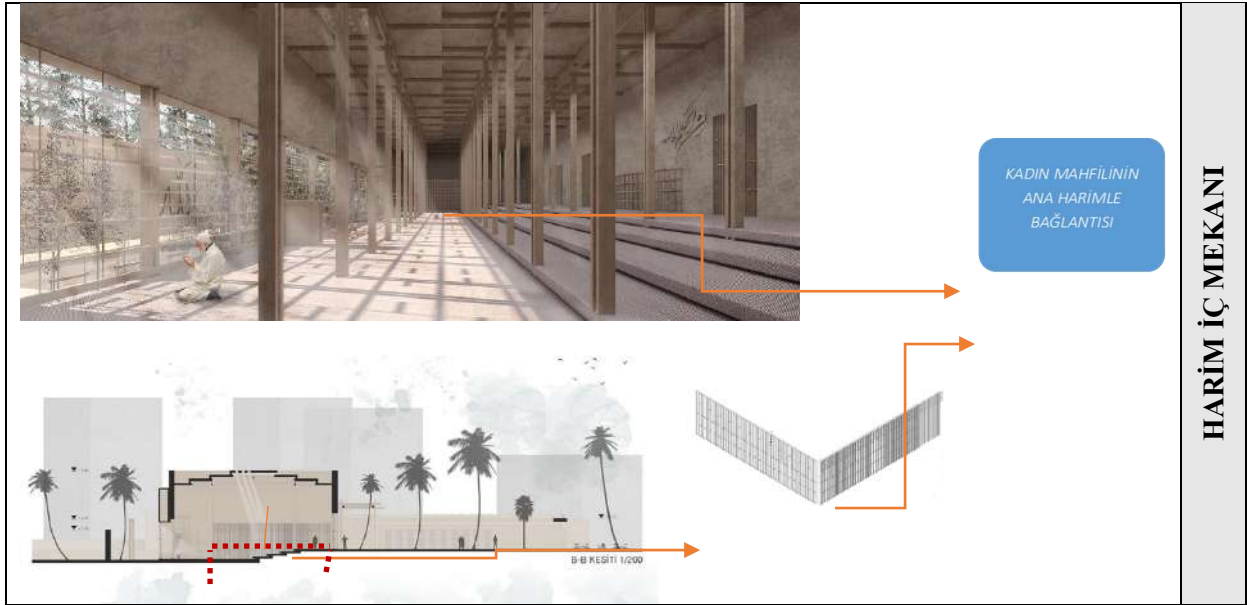
Şekil 6: İkinci Kategoride Birincilik Alan Projenin Fonksiyon Çözümlemesi (Url 5 üzerinden işlenmiştir)



Şekil 7: İkinci Kategorisinde Birinci Olan Projenin Zemin Kat Planı Fonksiyon Çözümlemesi (Url 5 üzerinden işlenmiştir)

Erkek kullanımına ait ana harim ile kadın mahfili arasında bağlantı yoktur. Kadın mahfilinin ahşap kafesle sınırlandırılmış olması minber, mihrap ve mihrap cephesinde oluşturulan yeşil dokuyla görsel

bağlantıyı kesintiye uğratmaktadır. Kafesle sınırlandırılmadan dolayı kullanıcı mekanı bütün olarak algılamamaktadır.



Şekil 8: İkinci Kategoride Birincilik Alan Projenin Kadın Mahfili ve Ana Harim Bağlantısı (Url 5 üzerinden işlenmiştir)

SONUÇ

Süreç içerisinde toplum içerisinde kadın rolü değişmiş ve dönüşüme uğramıştır. Konut ve yakın çevresindeki kullanım alanı genişleyen kadın günümüzde kentsel mekanda var olmakta ve aktif olarak yaşama katılım sağlamak için mücadele etmektedir. Bu bakış açısıyla, kentsel mekanı oluşturan bileşenlerden olan camilerin kadının mekan beklentisini karşılayabilecek şekilde tasarlanmış olması gereklidir. İbadet etme konusunda eşit sorumlulukta olduğu erkek cinsiyeti ile ibadetin gerçekleştiği mekanda da eşitlik temelinde var olmalıdır. Bu çalışma , cami-kadın-ibadet başlıklarında Türkiye'deki tasarım yaklaşımını fikir yarışmaları üzerinden okuması nedeniyle önemlidir.Örnekleme çalışma sonucunda mimari biçimlenişi açısından geleneksel cami örneklerinden ayrıışan tasarımların dereceye layık görüldüğü tespit edilmekle beraber kadının cami kullanımının oranının düşük olacağı öngörüsünün devam ettiği sonucuna varılmıştır. Çalışmanın cami- cinsiyet üzerinde yapılacak çalışmaları yönlendiricisi olacağı düşünülmektedir.

KAYNAKÇA

- Aycan, İ. , 2013, İslam Geleneğinde Cami ve Kadın, Cami Kadın ve Aile, Ankara: Diyanet İşleri Başkanlığı
- Ören, M.F.,2022, Toplumsal Cinsiyet ve Cami: Kadınlar Camilerde Platformu Örneği, Akdeniz Kadın Çalışmaları ve Toplumsal Cinsiyet Dergisi, Sayı VI (1) 210-231
- Öz, Ö. F.,2022, Namazların Vaktinde Kılınması Hakkında bir Hadis ve Değerlendirmesi, Premium-journal of social sciences, 6(23),361-378
- Özkurt, K., 2015, Cami Mimarisinde Kadınlara İlişkin Mekânlar, İslam ve Sanat, Tartışmalı İlmi Toplantı, Antalya.
- Tayılga , G., Demirarslan S., Camilerde Kadınlar Mahfili ve Diğer Özelleştirilmiş Mekan İhtiyaçları: Marmara Üniversitesi İlahiyat Fakültesi Camii Örneği, Türk &İslam Dünyası Sosyal Araştırmalar Dergisi, 7(26), 42-64
- Yılmaz, H., 2007, Hz. Peygamber Döneminden Günümüze Kadınlar ve Cami Eğitimi, Değerler Eğitimi Dergisi , 5(14)107-130
- Url 1: <https://islamansiklopedisi.org.tr/mabed>
- Url2:<https://www.yarismo.org/img/cami%20fikir%20yar%20C4%B1%C5%9Fmas%C4%B1%20C5%9Fartname.pdf>

Url 3: <https://www.diyenet.gov.tr/tr-TR/Kurumsal/Detay/25808/cami-tasarimi-fikir-yarismasi-odul-toreni-ankarada-yapildi>

Url 4: <https://www.arkitera.com/proje/1-odul-1-kategori-cami-tasarimi-fikir-yarismasi/>

Url 5: <https://www.arkitera.com/proje/1-odul-2-kategori-cami-tasarimi-fikir-yarismasi/>

**YAŞLI BİREYLERDE YAŞAM ALANI HAREKETLİLİĞİNİN ÖNEMİ
IMPORTANCE OF LIFE SPACE MOBILITY IN ELDERLY INDIVIDUALS**

Öğr. Gör. Dr. Ayşe TORAMAN KARAGÜLMEZ

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ÖZET

Yaşlı bireylerde yaşam alanı hareketliliği (YAH) ile ilişkili faktörleri anlamak, hareketlilik azalmasının önlenmesi veya tedavi edilebilmesi açısından son derece önemlidir. Yaşam alanı hareketliliği, bireyin uyuduğu odadan topluma doğru uzanan seyahat alanı olarak tanımlanmaktadır. Yaşam alanı hareketliliği değerlendirmeleri sayesinde fonksiyonel yetenek ile çevrenin sosyal, ekonomik ve kültürel yönleri arasındaki etkileşim ortaya konabilmektedir. Bu çalışmanın amacı, yaşlı bireylerde YAH ile ilgili faktörleri ortaya koymak ve yaşam alanı hareketliliğinin önemi konusunda sağlık profesyonellerine farkındalık kazandırmaktır. Günümüze kadar yapılan çalışmalarda YAH'ın; yaş, cinsiyet, vücut kütle indeksi, sosyoekonomik durum, eğitim düzeyi, sosyal katılım, bilişsel yetenek, fiziksel aktivite, fiziksel performans, düşme, düşme korkusu, alt ekstremité kas kuvveti, kavrama kuvveti, yürüme özellikleri ve yaşam kalitesi ile ilişkili olduğu bildirilmiştir. Bunun yanı sıra yaşlı bireylerde YAH'ın morbidite, mortalite durumunu ve sağlık hizmeti kullanımını doğru bir şekilde tahmin edebildiği belirtilmiştir. Ayrıca yaşlı bireyin bağımsızlık seviyesini biyopsikososyal açıdan ele alması bakımından geriatrik değerlendirmenin mutlaka bir parçası olması gerektiği vurgulanmıştır. Yaşam alanı değerlendirmesinde kullanılan birçok ölçek bulunmaktadır. Ancak YAH değerlendirmesinde daha objektif ölçüm yöntemleri kullanılarak yapılacak ileriye dönük çalışmalara ihtiyaç olduğu görülmektedir. Sonuç olarak, yaşlı bireylerde yaşam alanı hareketliliğindeki düşüşü etkileyebilecek tüm faktörler, planlanacak müdahale stratejileri için kilit bir rol oynayabilir. Bu nedenle sağlık profesyonellerinin YAH'ın öneminin farkında olmaları ve geriatrik değerlendirmenin bir parçası olarak değerlendirmelerinde buna yer vermeleri son derece önemlidir.

Anahtar Kelimeler: Düşme, Yaşlı, Yaşam Alanı Hareketliliği

ABSTRACT

Understanding the factors associated with Life Space Mobility (LSM) in elderly individuals is extremely important in terms of preventing or treating decreased mobility. Life space mobility is defined as the travel area extending from the room where the individual sleeps to the society. The interaction between functional ability and the social, economic and cultural aspects of the environment can be revealed through LSM assessment. The aim of this study is to reveal the factors related to LSM in elderly individuals and to raise awareness among health professionals about the importance of LSM. In studies conducted to date, it has been reported that LSM is associated with age, gender, body mass index, socioeconomic status, education level, social participation, cognitive ability, physical activity, physical performance, falls, fear of falling, lower extremity muscle strength, grip strength, walking characteristics and quality of life. In addition, it has been stated that living space mobility can accurately predict morbidity, mortality and health service use in elderly individuals. It has also been emphasized that it should definitely be a part of the geriatric assessment in terms of addressing the independence level of the elderly individual from a biopsychosocial perspective. There are many scales used in LSM assessment. However, it seems that there is a need for future studies using more objective measurement methods in the assessment of LSM. As a result, all factors that may affect the decline in mobility in the life space in elderly individuals may play a key role in the intervention strategies to be planned. Therefore, it is extremely important for health professionals to be aware of the importance of mobility in the life space and to include it in their evaluations as part of the geriatric assessment.

Keywords: Falls, Elderly, Life Space Mobility

GİRİŞ

Yaşlanma sürecinde hareketlilik seviyesinin azalması birçok sağlık sorununun önemli bir göstergesidir (Chung, Boyle ve Wheeler, 2022). Yaşam alanı hareketliliği, vücudun fizyolojik kapasitesi ile günlük yaşamda karşılaşılan dış zorluklar arasındaki dengeye dayanır (Baker, Bodner ve Allman, 2003; Peel, Baker, Roth, Brown, Brodner ve Allman, 2005). Yaşlı bireyin evinden dışarı çıkma sıklığının azalması ve daha uzak bölgelere seyahat etmemesi, YAH sınırlamaları olarak ifade edilmektedir (Chung, Boyle ve Wheeler, 2022). Yaşlı bireylerde yaşam alanı hareketliliğindeki sınırlamalar ve düşüşler, sakatlık, daha düşük yaşam kalitesi, düşme riski ve ölüm oranında artış ile yakından ilişkilidir (Kennedy, Sawyer, Williams, Lo, Ritchie, Roth, Allman ve Brown, 2017; Lo, Brown, Sawyer, Kennedy ve Allman, 2014; Portegijs, Rantakokko, Viljanen, Sipilä ve Rantanen, 2016; Rantakokko, Portegijs, Viljanen, Iwarsson, Kauppinen ve Rantanen, 2016; Sheppard, Sawyer, Ritchie, Allman ve Brown, 2013).

Hareketlilik, bireyin gitmek istediği yere nasıl ve ne zaman gittiği farketmeksizin gitme yeteneği olarak tanımlanmakta olup (Satariano, Guralnik, Jackson, Marottoli, Phelan, 2012), yürümeyi ve araba, toplu taşıma veya diğer ulaşım araçlarını kullanmayı da içeren bir kavramdır (Eronen, von Bonsdorff, Rantakokko, Portegijs, Viljanen ve Rantanen, 2016). Hareketlilik, yaşam alanının önemli bir bileşenidir ve yaşlı bireylerin bağımsızlığını sürdürmeleri için gereklidir (Dunlap, Rosso, Zhu, Klatt ve Brach, 2022). Hareket kabiliyetindeki azalmalar, sakatlık, düşük yaşam kalitesi, hastaneye yatma ve ölümlerle yakından ilişkilidir (Bentley, Brown, McGwin, Sawyer, Allman ve Roth, 2013; Kennedy, Sawyer, Williams, Lo, Ritchie, Roth, Allman ve Brown, 2017; Rantakokko, Portegijs, Viljanen, Iwarsson, Kauppinen ve Rantanen 2016; Rosso, Metti, Faulkner, Brach, Studenski, Redfern ve Rosano, 2019; Sheppard, Sawyer, Ritchie, Allman ve Brown, 2013). Hareketliliği, biyolojik özelliklerden toplumsal etkilere kadar birbiriyle karmaşık ilişkiler barındıran birçok faktör etkilemektedir (Webber, Porter ve Menec, 2010). Özellikle ileri yaş, aktivite kısıtlılığı ve sosyal etkinliklere katılım kısıtlamaları hareket kabiliyetinin azalmasına yol açmaktadır (Wilkie, Peat, Thomas ve Croft, 2006).

May ve diğerleri (1985) tarafından yaşam alanı hareketliliğinin ilk spesifik uzamsal ölçütü ortaya konulmuş ve bir kişinin belirli bir zaman diliminde seyahat ettiği alan olarak tanımlanmıştır (May, Nayak ve Isaacs, 1985). İlk olarak Baker ve diğerleri (2003) tarafından geliştirilen Yaşam Alanı Değerlendirmesinin (Baker, Bodner ve Allman, 2003; Parker, Baker ve Allman, 2002), yaşlı bireyler (Sheppard, Sawyer, Ritchie, Allman ve Brown, 2013), göz hastalığı olan kişiler (Kammerlind, Fristedt, Ernsth Bravell ve Fransson, 2014), tekerlekli sandalye (Mortenson, Miller, Backman ve Oliffe, 2012) ve akülü araba kullanıcıları (Auger, Demers, Gélinas, Routhier, Jutai, Guérette ve Deruyter, 2009) ve palyatif bakım hastaları (Scott, Coombes, Braybrook, Roach, Harðardóttir, Bristowe, Ellis-Smith, Higginson, Gao, Bluebond-Langner, Farsides, Murtagh, Fraser ve Harding, 2022) gibi birçok farklı popülasyonda hareketliliği ölçmek için kullanıldığı görülmektedir. Son yıllarda, yaşlı bireylerin yaşadığı çevre ile ilişkili olduğu için YAH'ı inceleme konusuna artan bir eğilim olduğundan bahsedilmektedir (Ahmed, Curcio, Auais, Vafaei, Pirkle, Guerra ve Gomez, 2021).

Yaşam alanı hareketliliği, bir kişinin günlük yaşamda hareket ettiği uzamsal alandır (Baker, Bodner ve Allman, 2003) ve fonksiyonel yetenek ile çevrenin sosyoekonomik ve kültürel yönleri (Taylor, Buchan ve van der Veer, 2019) arasındaki etkileşimi yansıtmaktadır. Dolayısıyla YAH, bir kişinin günlük yaşamındaki somut faaliyetini temsil etmekte ve kişinin evinde yürümesi, otobüse binip alışverişe gitmesi veya bir arkadaşını ziyaret etmesi için başka bir şehre gitmesinden oluşan tüm hareketlilik biçimlerini kapsamaktadır (Eronen, von Bonsdorff, Rantakokko, Portegijs, Viljanen ve Rantanen, 2016). Bir insanın yaşam alanı en kısıtlı haliyle yatağından ya da yatak odasından oluşabilmekte ve tamamen kısıtlanmadığında yaşadığı şehrin dışına, hatta yurt dışına kadar uzanabilmektedir (Eronen, von Bonsdorff, Rantakokko, Portegijs, Viljanen ve Rantanen, 2016). Bu nedenle YAH, hem günlük yaşam aktivitelerinin hem de kişinin aktivitelerinin maksimum coğrafi sınırlarını (uzay) birleştirerek, mevcut fiziksel hareketliliğin ötesinde bir topluluk katılımı ölçüsü sağlamaktadır (Taylor, Buchan ve van der Veer, 2019). Buna ilaveten özellikle yaşlı bireylerin mevcut hareketlilik seviyelerinin bilinmesi ve bu seviyenin sürdürülmesinde hangi faktörlerin rol oynadığının tespit edilmesi de toplum sağlığı açısından önemlidir.

Yaşam alanı hareketliliğindeki kısıtlanmanın, depresyon (Polku, Mikkola, Portegijs, Rantakokko, Kokko, Kauppinen, Rantanen ve Viljanen, 2015), fonksiyonel performansta azalma (Portegijs, Iwarsson, Rantakokko, Viljanen ve Rantanen, 2014), bilişsel gerileme (James, Boyle, Buchman, Barnes ve Bennett, 2011), kırılgnlık (Xue, Fried, Glass, Laffan ve Chaves, 2008), sakatlık (Curcio, Alvarado,

Gomez, Guerra, Guralnik ve Zunzunegui, 2013), sağlık hizmetlerinden yararlanma (Lo, Rundle, Buys, Kennedy, Sawyer, Allman ve Brown, 2015), huzurevine yatış (Sheppard, Sawyer, Ritchie, Allman ve Brown, 2013) ve mortalite (Boyle, Buchman, Barnes, James ve Bennett, 2010) için belirleyici olduğu bildirilmektedir. Ayrıca tek başına YAH ölçümünün düşmelerle yaygın olarak ilişkilendirilen olumsuz sağlık sonuçlarının çoğunu tespit edebildiği vurgulanmaktadır (Ahmed, Curcio, Auais, Vafaei, Pirkle, Guerra ve Gomez, 2021). Yaşam alanı hareketliliği ile ilişkili faktörlerin anlaşılması, klinisyenlerin hareketlilik engeli olan yaşlı bireyleri tespit etmesine, bu bireylerde YAH'ı korumak ve arttırmak için hedefler belirlemesine ve bu hedeflere yönelik tedavi stratejileri geliştirmesine rehberlik edebilir. Bu çalışmayı yapmaktaki amacımız yaşlı bireylerde yaşam alanı hareketliliğini etkileyen faktörleri ortaya koymak ve yaşam alanı hareketliliğinin önemi konusunda sağlık profesyonellerine farkındalık kazandırmaktır.

ARAŞTIRMA VE BULGULAR

Yaşam alanı hareketliliği, yaşlı bireylerin bulunduğu ortamlardaki hareketlerin kapsamını, sıklığını ve bağımsızlığını değerlendiren yenilikçi bir hareketlilik ölçme yoludur (Baker, Bodner ve Allman, 2003). Günümüze kadar literatürde yaşlı bireylerde YAH ile ilgili yapılmış çalışmalar incelendiğinde, YAH'ın; yaş, cinsiyet, vücut kütle indeksi, komorbidite, sosyoekonomik durum, eğitim düzeyi, sosyal katılım, bilişsel yetenek, fiziksel aktivite, fiziksel performans, düşme korkusu, düşme, alt ekstremitte kas gücü, yürüme özellikleri, kavrama kuvveti ve yaşam kalitesi ile ilişkili olduğu bildirilmiştir. Buna ilaveten YAH'ın morbidite, mortalite durumunu ve sağlık hizmeti kullanımını doğru bir şekilde tahmin edebildiği de belirtilmiştir. Bu çalışmada yaşlı bireylerde yaşam alanı hareketliliğini etkileyen faktörler; sosyodemografik özellikler, fiziksel aktivite, düşme korkusu ve düşme, alt ekstremitte kas gücü ve yürüme özellikleri, sosyal katılım ve diğer faktörler olmak üzere beş başlık altında incelenecek olup YAH değerlendirmesi ile ilgili bilgiler verilecektir.

Sosyodemografik Özellikler

İleri yaş, kadın cinsiyet ve yüksek vücut kütle indeksi ile YAH arasında anlamlı ilişki olduğu bulunmuştur (Dunlap, Rosso, Zhu, Klatt ve Brach, 2022; Eronen, von Bonsdorff, Rantakokko, Portegijs, Viljanen ve Rantanen, 2016; Fristedt, Kammerlind, Fransson ve Ernst Bravell, 2022). Daha genç yaştaki bireylerin ileri yaşta kılere kıyasla daha fazla yaşam alanı hareketliliğine sahip oldukları bildirilmiştir (Dunlap, Rosso, Zhu, Klatt ve Brach, 2022). Buna ilaveten komorbidite indeksi ne kadar yüksekse YAH'ın o kadar düşük olduğu tespit edilmiştir (Dunlap, Rosso, Zhu, Klatt ve Brach, 2022). Yaşam alanının kısıtlanmasına neden olan faktörlerin çoğu, sosyoekonomik durum ile sağlık ve işlevsellik arasındaki ilişkide rol oynayan faktörlere benzetilmiştir. Buna sebep olarak düşük sosyoekonomik durumun, yürümede güçlük (Groffen, Koster, Bosma, van den Akker, Aspelund, Siggeirsdóttir, Kempen, van Eijk, Eiriksdóttir, Jónsson, Launer, Gudnason ve Harris, 2013), fiziksel işlevsellikte azalma (Enroth, Raitanen, Hervonen ve Jylhä, 2013) ve bilişsel durumda bozulma (Atti, Forlani, De Ronchi, Palmer, Casadio, Dalmonte ve Fratiglioni, 2010) ile yakın ilişkide olması gösterilmiştir. Eronen ve diğerleri (2016) tarafından toplumda yaşayan, yaşları 75 ila 90 arasında değişen 878 kişi üzerinde yapılan bir çalışmada; düşük sosyoekonomik durum ile YAH'daki azalma arasında ilişki olduğu bildirilmiştir (Eronen, von Bonsdorff, Rantakokko, Portegijs, Viljanen ve Rantanen, 2016). Bu ilişkiyi en fazla etkileyen faktörlerin ise yüksek vücut kütle indeksi, kötü bilişsel durum ve zayıf fiziksel performans olduğu ifade edilmiştir (Eronen, von Bonsdorff, Rantakokko, Portegijs, Viljanen ve Rantanen, 2016).

Yaşam alanı hareketliliği ile eğitim düzeyi arasında ilişki olduğu tespit edilmiştir (Dunlap, Rosso, Zhu, Klatt ve Brach, 2022; Eronen, von Bonsdorff, Rantakokko, Portegijs, Viljanen ve Rantanen, 2016). Yapılan çalışmalarda; eğitim düzeyi yüksek olan bireylerin yaşam alanı hareketlilik puanları, eğitim düzeyi düşük olan bireylere kıyasla daha yüksek bulunmuştur (Dunlap, Rosso, Zhu, Klatt ve Brach, 2022; Eronen, von Bonsdorff, Rantakokko, Portegijs, Viljanen ve Rantanen, 2016). Bu nedenle hareket kısıtlılığı bulunan yaşlı bireylerde YAH'ı arttırmaya yönelik tedaviler planlanırken bireyin kişisel özelliklerinin de (yaş, cinsiyet, eğitim düzeyi, eşlik eden hastalıklar ve sosyoekonomik durumun) dikkate alınması gerektiği vurgulanmaktadır.

Fiziksel aktivite

Yaşlı bireylerde fiziksel aktivite, işlevin sürdürülmesinde ve bağımsız hareket etmede önemli bir yere sahiptir (Tsai, Portegijs, Rantakokko, Viljanen, Saajanaho, Eronen ve Rantanen, 2015). Yaşlı bireylerin fiziksel aktiviteye katılma fırsatları çoğunlukla kendi yaşam alanlarının yakın çevresinde gerçekleşmektedir (Glass ve Balfour, 2003). Yaşam alanı hareketliliği ile fiziksel aktivite birbirleriyle

yakından ilişkilidir. Yapılan çalışmalarda sınırsız yaşam alanı daha yüksek fiziksel aktiviteyle (Tsai, Portegijs, Rantakokko, Viljanen, Saajanaho, Eronen ve Rantanen, 2015) ilişkilendirilirken, kısıtlı yaşam alanı düşük fiziksel aktiviteyle ilişkilendirilmiştir (Portegijs, Tsai, Rantanen ve Rantakokko, 2015).

Düşme Korkusu ve Düşme

Düşme korkusu, bir kişinin yapabileceği günlük aktivitelerden kaçınmasına neden olan düşmeyle ilgili kalıcı endişe olarak tanımlanır (Tinetti ve Powell, 1993). Düşme korkusunun, kondisyon kaybı, sosyal izolasyon, daha fazla düşme, daha fazla kırılabilirlik, hareketlilikte azalma ve artan mortalite ile ilişkili olduğu rapor edilmiştir (Scheffer, Schuurmans, van Dijk, van der Hooft ve de Rooij, 2008; Vellas, Wayne, Romero, Baumgartner ve Garry, 1997; Viljanen, Kulmala, Rantakokko, Koskenvuo, Kaprio ve Rantanen, 2012). Buna ek olarak yürüyüş özelliklerini değiştirerek, hareketliliği daha fazla etkileyecek şekilde yürümenin daha temkinli adaptasyonlarına (örneğin, yürüme hızının azalması ve adım genişliğinin artması) yol açtığı da bildirilmiştir (Donoghue, Cronin, Savva, O'Regan ve Kenny, 2013). Yapılan çalışmalarda yaşam alanı hareketliliği ile düşme korkusu arasında anlamlı ilişki olduğu tespit edilmiştir (Auais, Alvarado, Guerra, Curcio, Freeman, Ylli, Guralnik ve Deshpande, 2017; Dunlap, Rosso, Zhu, Klatt ve Brach, 2022). Yaşlı bireylerde düşme korkusunun fiziksel aktivite seviyesini düşürerek, denge ve kas-iskelet sisteminde zayıflamaya yol açtığı belirtilmiştir. Bu durumun sonucunda da mobilite yeteneğinin, sosyal katılımın ve yaşam alanı hareketliliğinin azaldığı ifade edilmiştir (Auais, Alvarado, Guerra, Curcio, Freeman, Ylli, Guralnik ve Deshpande, 2017).

Düşmelerin fonksiyonel gerileme, sakatlık, sosyal izolasyon, bağımsızlık ve kondisyon kaybı, düşme korkusu ve artmış mortalite ile ilişkili olduğu (Gill, Murphy, Gahbauer ve Allore, 2013; Hajek ve König, 2017; Sekaran, Choi, Hayward ve Langa, 2013; Spaniolas, Cheng, Gestring, Sangosanya, Stassen ve Bankey, 2010; Stel, Smit, Pluijm ve Lips, 2004), yaşlı bireylerin yaşadığı çevrede hareket etme biçimlerini kısıtlamalarına yol açtığı bildirilmiştir. Nihayetinde bu durumda YAH'ı etkilediği ifade edilmiştir (Ahmed, Curcio, Auais, Vafaei, Pirkle, Guerra ve Gomez, 2021). Yapılan çalışmalarda toplumda yaşayan yaşlı bireylerde tekrarlayan ve yaralanmaya neden olan düşmelerin, zaman içinde YAH ile ilişkili olduğu ve bu ilişki gücünün düşme sayısına ve yaralanmaya neden olan düşmelerin ciddiyetine bağlı olarak farklılık gösterdiği belirtilmiştir (Ahmed, Curcio, Auais, Vafaei, Pirkle, Guerra ve Gomez, 2021; Lo, Brown, Sawyer, Kennedy ve Allman, 2014). Tekrarlayan düşmeler ve özellikle ciddi yaralanmalara neden olan düşmelerin ise, dış mekân hareketliliği dâhil olmak üzere fonksiyonel aktivitelerde önemli seviyede azalma ve bakımevine uzun süreli yatış riskinin artmasıyla ilişkili olduğu tespit edilmiştir (Gill, Murphy, Gahbauer ve Allore, 2013). Aslında bir yaralanma ile ilişkili olsun veya olmasın tüm düşmelerin, altı ay içerisinde yaşam alanı hareketliliğinde meydana gelen azalmayla ilişkisi olduğu ve yaşam alanında geri dönüşü olmayan bir kayba yol açtığı rapor edilmiştir (Lo, Brown, Sawyer, Kennedy ve Allman, 2014). Özellikle kısıtlı hareket kabiliyetine sahip yaşlı bireylerde tekrarlı ve yaralayıcı düşmelere maruz kalma riskinin daha yüksek olduğu ve bunun sonucunda da YAH'da daha fazla azalma olduğu bildirilmiştir (Ahmed, Curcio, Auais, Vafaei, Pirkle, Guerra ve Gomez, 2021).

Yapılan çalışmalarda herhangi bir yaralanma olmaksızın kaza sonucu düşen toplumda yaşayan yaşlı bireylerde, YAH azalmasının nedenlerini belirlemek için ileride yapılacak çalışmalara ihtiyaç duyulduğundan bahsedilmiştir (Lo, Brown, Sawyer, Kennedy ve Allman, 2014; Lo, Rundle, Buys, Kennedy, Sawyer, Allman ve Brown, 2016). Ayrıca düşmelerin toplumsal hareket kabiliyetinde azalmaya neden olabileceği mekanizmaları açıklığa kavuşturmak ve hareket kabiliyetindeki azalmanın basit bir fiziksel bozukluktan mı yoksa kişiyi daha fazla fonksiyonel gerileme riskine maruz bırakan karmaşık bir fizyolojik bozulmadan mı kaynaklandığını belirlemek için daha fazla araştırma yapılması gerektiği belirtilmiştir (Lo, Brown, Sawyer, Kennedy ve Allman, 2014).

Alt Ekstremitte Kas Gücü ve Yürüme Özellikleri

Son zamanlarda yapılan bir çalışmada daha genç yaş, daha fazla alt ekstremitte kas gücü, yürümeye daha fazla güven ve yürümenin daha düşük enerji maliyeti, daha fazla yaşam alanı hareketliliği ile ilişkili bulunmuştur (Dunlap, Rosso, Zhu, Klatt ve Brach, 2022). Yaşam alanı hareketliliğindeki varyansın yaklaşık %24'ünün yaş, alt ekstremitte kas gücü, yürüyüş etkinliği ve yürüyüş verimliliği ile açıklanabileceği ifade edilmiştir (Dunlap, Rosso, Zhu, Klatt ve Brach, 2022). Bu sonuç, bağımsızlığı korumak için yürümenin enerji maliyetinin önemini ve bunun yürüyüş hızındaki düşüşlere ve hareketlilik kısıtlamalarına potansiyel etkilerini kabul eden literatürdeki sonuçlarla da desteklenmiştir (Schrack, Simonsick ve Ferrucci, 2010; VanSwearingen, Perera, Brach, Wert ve Studenski, 2014; Wert, Brach, Perera ve VanSwearingen, 2013). Ek olarak yürümenin enerji maliyetinin mobilitedeki düşüşün erken bir belirteci olduğu vurgulanmıştır (Schrack, Simonsick ve Ferrucci, 2010). Yürüyüşün

zamanlaması ve koordinasyonuna odaklanan fizik tedavi müdahalelerinin, yürümenin enerji maliyetini azaltabileceği ve yaşam alanı hareketliliğini iyileştirebileceği rapor edilmiştir (Collins, Schrack, VanSwearingen, Glynn, Pospisil, Gant ve Mackey, 2018; VanSwearingen, Perera, Brach, Wert ve Studenski, 2011).

Sosyal Katılım ve Diğer Faktörler

Yaşam alanı hareketliliği, yaşlı bireyin sosyal faaliyetlere katılmak için çevre içinde hareket etme yeteneğinin bir göstergesi olup (Taylor, Buchan ve van der Veer, 2019), toplumsal hareketliliğinin boyutunu tanımlamaktadır (Eronen, von Bonsdorff, Rantakokko, Portegijs, Viljanen ve Rantanen, 2016). Günümüzde bir kişinin günlük yaşamdaki sosyal ve pratik ihtiyaçlarını karşılamaya yönelik birçok sanal hareketlilik seçeneği mevcut olsa da, YAH önemini korumaya devam etmiştir. Sosyal becerilerin ve yürütücü işlevin güçlü bir şekilde YAH ile ilişkili olduğu bildirilmiştir (Seinsche, Zijlstra ve Giannouli, 2020). Toplumda yaşayan yaşlı bireylerde sınırlı yaşam alanı hareketliliği; aşırı kilo, azalmış bilişsel yetenek ve daha zayıf fiziksel performansla ilişkili iken (Eronen, von Bonsdorff, Rantakokko, Portegijs, Viljanen ve Rantanen, 2016), sınırsız yaşam alanı hareketliliği daha yüksek yaşam kalitesiyle (Rantakokko, Portegijs, Viljanen, Iwarsson ve Rantanen, 2013) ve sosyal faaliyetlere daha fazla katılımı ilişkili bulunmuştur (Barnes, Wilson, Bienias, de Leon, Kim, Buchman ve Bennett, 2007). Bunun yanı sıra düşük kavrama kuvveti (Fristedt, Kammerlind, Fransson ve Ernst Bravell, 2022) ve düşük yaşam kalitesi ile YAH'daki azalma arasında da (Rantakokko, Portegijs, Viljanen, Iwarsson ve Rantanen, 2013) ilişki olduğu tespit edilmiştir. Yaşlı bireylerde daha geniş yaşam alanı ile daha iyi yaşam kalitesinin, yaşlı bireylerin sağlık durumlarından bağımsız olarak birbirini destekleyen unsurlar olduğu ifade edilmiştir. Dolayısıyla yaşlı bireylerin istediği yere istediği zamanda gidebilme olanağının garanti altına alınması ile yaşam kalitesinin artırılmasının mümkün olabileceği belirtilmiştir (Rantakokko, Portegijs, Viljanen, Iwarsson ve Rantanen, 2013).

Yaşam Alanı Hareketliliğinin Değerlendirilmesi

Yaşam alanı hareketliliğinin, yaygın olarak Birmingham'daki Alabama Üniversitesi'nin yaşlanma çalışmasında kullanılan Yaşam Alanı Değerlendirme aracı kullanılarak (Baker, Bodner ve Allman, 2003) değerlendirildiği görülmektedir. Testte her yaşam alanı seviyesi için (yatak odası, diğer odalar, ev dışı, mahalle, kasaba, şehir dışı), katılımcılara son dört hafta boyunca haftada kaç gün bu seviyeye ulaştıkları ve bir kişiye veya bir yardımcı cihaza ihtiyaç duyup duymadıkları sorulmaktadır. Elde edilen hareketlilik puanları 0-120 puan arasında değişmektedir. Testten alınacak yüksek puanlar bireyin daha iyi yaşam alanı hareketliliğine sahip olduğu şeklinde yorumlanmaktadır. Bireyin testten 0-59 arası puan alması kısıtlı yaşam alanına sahip olduğuna işaret ederken, 0-120 arası puan alması ise sınırsız yaşam alanına sahip olduğu anlamına gelmektedir (Sawyer ve Allman, 2010). Testte kesme değeri olarak 60 puan kullanılmaktadır. Bireyin 60 ve üzeri puan alması, bireyin yaşadığı mahallenin ötesinde bulunan alanlara bağımsız olarak erişme becerisine sahip olduğu anlamına gelmektedir (Sawyer ve Allman, 2010). Yaşam alanı hareketlilik puanlarında 10 puanlık bir farkın klinik olarak anlamlı olduğu kabul edilmektedir (Baker, Bodner ve Allman, 2003). Ancak nispeten küçük farklılıklar da yaşlı bireylerin günlük yaşamlarında anlamlı olabilmektedir (Eronen, von Bonsdorff, Rantakokko, Portegijs, Viljanen ve Rantanen, 2016). Nitekim bir yılda 1,5-2,5 puanlık bir düşüşün, bireyin beyan ettiği sağlık ve hareketlilikteki düşüşle ilişkili olduğu bildirilmektedir (Portegijs, Iwarsson, Rantakokko, Viljanen ve Rantanen, 2014).

Son zamanlarda yapılan bir çalışmada, Küresel Konumlama Sistemi saatlerinin yaşlı bireylerin gerçek yaşam hareketliliği hakkında oldukça ayrıntılı bilgi verebildiği bildirilmiştir (Chung, Boyle ve Wheeler, 2022). Bunun yanı sıra yaşlı bireylerin YAH performansındaki değişikliklerin daha objektif olarak ortaya konabilmesi için coğrafi menzilin niceliğini daha doğru tahminlerle sağlayan Küresel Konumlama Sistemi teknolojisi kullanımından faydalanılması gerektiği ifade edilmiştir (Chung, Boyle ve Wheeler, 2022). Bu nedenle yaşlı bireylerde hem YAH değerlendirmesinin hem de Küresel Konumlama Sistemi teknolojisinin birlikte kullanımının hareketliliği ölçmede daha doğru sonuçlar verebileceğini düşünmekteyiz.

SONUÇ

Aktif yaşlanmanın en temel unsuru yaşlı bireyin gitmek istediği yere istediği zamanda güvenli bir şekilde gidebilmesidir. Ayrıca bu durum yaşlanma alanındaki araştırma, uygulama ve politikalar açısından da son derece önemlidir (Satariano, Guralnik, Jackson, Marottoli, Phelan ve Prohaska, 2012). Bu çalışmada sunulan yaşam alanı hareketliliğindeki düşüşü etkileyebilecek tüm faktörler, yapılacak müdahale stratejileri için kilit bir rol oynayabilir. Ayrıca çalışmamız hareketlilik engeli riski taşıyan

yaşlı bireyleri tedavi ederken, yaşam alanı hareketliliğinin fiziksel belirleyicilerine ek olarak sosyodemografik ve psikososyal faktörlerin de dikkate alınmasının önemini vurgulamaktadır. Yaşlı bireyin bağımsızlık seviyesini biyopsikososyal açıdan ele alması bakımından YAH ölçümü geriatrik değerlendirmenin mutlaka bir parçası olmalıdır.

Yaşam alanı hareketliliğini arttırmaya yönelik zaman içinde yaşam alanındaki değişiklerle ilişkili hareketlilik belirleyicilerinin tespit edilebilmesi için gelecekte yapılacak çalışmalara ihtiyaç vardır. Ayrıca, nesnel ölçümlerin yapılmasını sağlayan Küresel Konumlama Sistemi gibi hareketlilik göstergeleri kullanan araştırmalar daha da arttırılmalıdır. Bu sayede, yaşam alanı hareketliliğini nicelleştirmek ve fiilen ulaşılan toplum hareketliliği seviyesini belirlemek mümkün olabilecektir.

KAYNAKÇA

Ahmed, T., Curcio, C. L., Auais, M., Vafaei, A., Pirkle, C. M., Guerra, R. O., & Gomez, F. (2021). Falls and life-space mobility: longitudinal analysis from The International Mobility in Aging Study. *Aging Clinical and Experimental Research*, 33(2), 303–310. <https://doi.org/10.1007/s40520-020-01540-0>

Atti, A. R., Forlani, C., De Ronchi, D., Palmer, K., Casadio, P., Dalmonte, E., & Fratiglioni, L. (2010). Cognitive impairment after age 60: clinical and social correlates in the Faenza Project. *Journal of Alzheimer's Disease*, 21(4), 1325–1334. <https://doi.org/10.3233/jad-2010-091618>

Auais, M., Alvarado, B., Guerra, R., Curcio, C., Freeman, E. E., Ylli, A., Guralnik, J., & Deshpande, N. (2017). Fear of falling and its association with life-space mobility of older adults: a cross-sectional analysis using data from five international sites. *Age and Ageing*, 46(3), 459–465. <https://doi.org/10.1093/ageing/afw239>

Auger, C., Demers, L., Gélinas, I., Routhier, F., Jutai, J., Guérette, C., & Deruyter, F. (2009). Development of a French-Canadian version of the Life-Space Assessment (LSA-F): content validity, reliability and applicability for power mobility device users. *Disability and Rehabilitation Assistive Technology*, 4(1), 31–41. <https://doi.org/10.1080/17483100802543064>

Baker, P. S., Bodner, E. V., & Allman, R. M. (2003). Measuring life-space mobility in community-dwelling older adults. *Journal of the American Geriatrics Society*, 51(11), 1610–1614. <https://doi.org/10.1046/j.1532-5415.2003.51512.x>

Barnes, L. L., Wilson, R. S., Bienias, J. L., de Leon, C. F., Kim, H. J., Buchman, A. S., & Bennett, D. A. (2007). Correlates of life space in a volunteer cohort of older adults. *Experimental Aging Research*, 33(1), 77–93. <https://doi.org/10.1080/03610730601006420>

Bentley, J. P., Brown, C. J., McGwin, G., Jr, Sawyer, P., Allman, R. M., & Roth, D. L. (2013). Functional status, life-space mobility, and quality of life: a longitudinal mediation analysis. *Quality of Life Research: An International Journal of Quality of Life Aspects of Treatment, Care and Rehabilitation*, 22(7), 1621–1632. <https://doi.org/10.1007/s11136-012-0315-3>

Boyle, P. A., Buchman, A. S., Barnes, L. L., James, B. D., & Bennett, D. A. (2010). Association between life space and risk of mortality in advanced age. *Journal of the American Geriatrics Society*, 58(10), 1925–1930. <https://doi.org/10.1111/j.1532-5415.2010.03058.x>

Chung, J., Boyle, J., & Wheeler, D. C. (2022). Relationship Between Life-Space Mobility and Health Characteristics in Older Adults Using Global Positioning System Watches. *Journal of Applied Gerontology: The Official Journal of the Southern Gerontological Society*, 41(4), 1186–1195. <https://doi.org/10.1177/07334648211054834>

Collins, K. J., Schrack, J. A., VanSwearingen, J. M., Glynn, N. W., Pospisil, M. C., Gant, V. E., & Mackey, D. C. (2018). Randomized Controlled Trial of Exercise to Improve Walking Energetics in Older Adults. *Innovation in Aging*, 2(3), 1–10. <https://doi.org/10.1093/geroni/igy022>

Curcio, C. L., Alvarado, B. E., Gomez, F., Guerra, R., Guralnik, J., & Zunzunegui, M. V. (2013). Life-Space Assessment scale to assess mobility: validation in Latin American older women and men. *Aging Clinical and Experimental Research*, 25(5), 553–560. <https://doi.org/10.1007/s40520-013-0121-y>

Donoghue, O. A., Cronin, H., Savva, G. M., O'Regan, C., & Kenny, R. A. (2013). Effects of fear of falling and activity restriction on normal and dual task walking in community dwelling older adults. *Gait & Posture*, 38(1), 120–124. <https://doi.org/10.1016/j.gaitpost.2012.10.023>

- Dunlap, P. M., Rosso, A. L., Zhu, X., Klatt, B. N., & Brach, J. S. (2022). The Association of Mobility Determinants and Life Space Among Older Adults. *The Journals of Gerontology. Series A, Biological Sciences and Medical Sciences*, 77(11), 2320–2328. <https://doi.org/10.1093/gerona/glab268>
- Enroth, L., Raitanen, J., Hervonen, A., & Jylhä, M. (2013). Do socioeconomic health differences persist in nonagenarians?. *The Journals of Gerontology. Series B, Psychological Sciences and Social Sciences*, 68(5), 837–847. <https://doi.org/10.1093/geronb/gbt067>
- Eronen, J., von Bonsdorff, M., Rantakokko, M., Portegijs, E., Viljanen, A., & Rantanen, T. (2016). Socioeconomic Status and Life-Space Mobility in Old Age. *Journal of Aging and Physical Activity*, 24(4), 617–623. <https://doi.org/10.1123/japa.2015-0196>
- Fristedt, S., Kammerlind, A. S., Fransson, E. I., & Ersth Bravell, M. (2022). Physical functioning associated with life-space mobility in later life among men and women. *BMC Geriatrics*, 22(1), 364. <https://doi.org/10.1186/s12877-022-03065-9>
- Gill, T. M., Murphy, T. E., Gahbauer, E. A., & Allore, H. G. (2013). Association of injurious falls with disability outcomes and nursing home admissions in community-living older persons. *American Journal of Epidemiology*, 178(3), 418–425. <https://doi.org/10.1093/aje/kws554>
- Glass TA, Balfour JL. (2003). Neighborhoods, aging, and functional limitations. In Kawachi I, Berkman L. F. (Eds.) *Neighborhoods and health*. New York: Oxford University Press, (Pp: 303-334).
- Groffen, D. A., Koster, A., Bosma, H., van den Akker, M., Aspelund, T., Siggeirsdóttir, K., Kempen, G. I., van Eijk, J. T., Eiriksdottir, G., Jónsson, P. V., Launer, L. J., Gudnason, V., & Harris, T. B. (2013). Socioeconomic factors from midlife predict mobility limitation and depressed mood three decades later; findings from the AGES-Reykjavik Study. *BMC Public Health*, 13, 101. <https://doi.org/10.1186/1471-2458-13-101>
- Hajek, A., & König, H. H. (2017). The association of falls with loneliness and social exclusion: evidence from the DEAS German Ageing Survey. *BMC Geriatrics*, 17(1), 204. <https://doi.org/10.1186/s12877-017-0602-5>
- James, B. D., Boyle, P. A., Buchman, A. S., Barnes, L. L., & Bennett, D. A. (2011). Life space and risk of Alzheimer disease, mild cognitive impairment, and cognitive decline in old age. *The American Journal of Geriatric Psychiatry: Official Journal of the American Association for Geriatric Psychiatry*, 19(11), 961–969. <https://doi.org/10.1097/JGP.0b013e318211c219>
- Kammerlind, A. S., Fristedt, S., Ersth Bravell, M., & Fransson, E. I. (2014). Test-retest reliability of the Swedish version of the Life-Space Assessment Questionnaire among community-dwelling older adults. *Clinical Rehabilitation*, 28(8), 817–823. <https://doi.org/10.1177/0269215514522134>
- Kennedy, R. E., Sawyer, P., Williams, C. P., Lo, A. X., Ritchie, C. S., Roth, D. L., Allman, R. M., & Brown, C. J. (2017). Life-Space Mobility Change Predicts 6-Month Mortality. *Journal of the American Geriatrics Society*, 65(4), 833–838. <https://doi.org/10.1111/jgs.14738>
- Lo, A. X., Brown, C. J., Sawyer, P., Kennedy, R. E., & Allman, R. M. (2014). Life-space mobility declines associated with incident falls and fractures. *Journal of the American Geriatrics Society*, 62(5), 919–923. <https://doi.org/10.1111/jgs.12787>
- Lo, A. X., Flood, K. L., Kennedy, R. E., Bittner, V., Sawyer, P., Allman, R. M., & Brown, C. J. (2015). The Association Between Life-Space and Health Care Utilization in Older Adults with Heart Failure. *The Journals of Gerontology. Series A, Biological Sciences and Medical Sciences*, 70(11), 1442–1447. <https://doi.org/10.1093/gerona/glv076>
- Lo, A. X., Rundle, A. G., Buys, D., Kennedy, R. E., Sawyer, P., Allman, R. M., & Brown, C. J. (2016). Neighborhood Disadvantage and Life-Space Mobility Are Associated with Incident Falls in Community-Dwelling Older Adults. *Journal of the American Geriatrics Society*, 64(11), 2218–2225. <https://doi.org/10.1111/jgs.14353>
- May, D., Nayak, U. S., & Isaacs, B. (1985). The life-space diary: a measure of mobility in old people at home. *International Rehabilitation Medicine*, 7(4), 182–186. <https://doi.org/10.3109/03790798509165993>
- Mortenson, W. B., Miller, W. C., Backman, C. L., & Oliffe, J. L. (2012). Association between mobility, participation, and wheelchair-related factors in long-term care residents who use wheelchairs as their primary means of mobility. *Journal of the American Geriatrics Society*, 60(7), 1310–1315. <https://doi.org/10.1111/j.1532-5415.2012.04038.x>

Parker, M., Baker, P. S., & Allman, R. M. (2002). A life-space approach to functional assessment of mobility in the elderly. *Journal of Gerontological Social Work*, 35(4), 35-55.

Peel, C., Sawyer Baker, P., Roth, D. L., Brown, C. J., Brodner, E. V., & Allman, R. M. (2005). Assessing mobility in older adults: the UAB Study of Aging Life-Space Assessment. *Physical Therapy*, 85(10), 1008–1119.

Polku, H., Mikkola, T. M., Portegijs, E., Rantakokko, M., Kokko, K., Kauppinen, M., Rantanen, T., & Viljanen, A. (2015). Life-space mobility and dimensions of depressive symptoms among community-dwelling older adults. *Aging & Mental Health*, 19(9), 781–789. <https://doi.org/10.1080/13607863.2014.977768>

Portegijs, E., Iwarsson, S., Rantakokko, M., Viljanen, A., & Rantanen, T. (2014). Life-space mobility assessment in older people in Finland; measurement properties in winter and spring. *BMC Research Notes*, 7, 323. <https://doi.org/10.1186/1756-0500-7-323>

Portegijs, E., Rantakokko, M., Mikkola, T. M., Viljanen, A., & Rantanen, T. (2014). Association between physical performance and sense of autonomy in outdoor activities and life-space mobility in community-dwelling older people. *Journal of the American Geriatrics Society*, 62(4), 615–621. <https://doi.org/10.1111/jgs.12763>

Portegijs, E., Tsai, L. T., Rantanen, T., & Rantakokko, M. (2015). Moving through Life-Space Areas and Objectively Measured Physical Activity of Older People. *PloS One*, 10(8), e0135308. <https://doi.org/10.1371/journal.pone.0135308>

Portegijs, E., Rantakokko, M., Viljanen, A., Sipilä, S., & Rantanen, T. (2016). Identification of Older People at Risk of ADL Disability Using the Life-Space Assessment: A Longitudinal Cohort Study. *Journal of the American Medical Directors Association*, 17(5), 410–414. <https://doi.org/10.1016/j.jamda.2015.12.010>

Rantakokko, M., Portegijs, E., Viljanen, A., Iwarsson, S., & Rantanen, T. (2013). Life-space mobility and quality of life in community-dwelling older people. *Journal of the American Geriatrics Society*, 61(10), 1830–1832. <https://doi.org/10.1111/jgs.12473>

Rantakokko, M., Portegijs, E., Viljanen, A., Iwarsson, S., Kauppinen, M., & Rantanen, T. (2016). Changes in life-space mobility and quality of life among community-dwelling older people: a 2-year follow-up study. *Quality of life research: an international journal of quality of life aspects of treatment, care and rehabilitation*, 25(5), 1189–1197. <https://doi.org/10.1007/s11136-015-1137-x>

Rosso, A. L., Metti, A. L., Faulkner, K., Brach, J. S., Studenski, S. A., Redfern, M., & Rosano, C. (2019). Associations of Usual Pace and Complex Task Gait Speeds With Incident Mobility Disability. *Journal of the American Geriatrics Society*, 67(10), 2072–2076. <https://doi.org/10.1111/jgs.16049>

Satariano, W. A., Guralnik, J. M., Jackson, R. J., Marottoli, R. A., Phelan, E. A., & Prohaska, T. R. (2012). Mobility and aging: new directions for public health action. *American Journal of Public Health*, 102(8), 1508–1515. <https://doi.org/10.2105/AJPH.2011.300631>

Sawyer, P., & Allman, R. M. (2010). Resilience in mobility in the context of chronic disease and aging. *New Frontiers in Resilient Aging*, 310-339.

Scheffer, A. C., Schuurmans, M. J., van Dijk, N., van der Hooft, T., & de Rooij, S. E. (2008). Fear of falling: measurement strategy, prevalence, risk factors and consequences among older persons. *Age and Ageing*, 37(1), 19–24. <https://doi.org/10.1093/ageing/afm169>

Schrack, J. A., Simonsick, E. M., & Ferrucci, L. (2010). The energetic pathway to mobility loss: an emerging new framework for longitudinal studies on aging. *Journal of the American Geriatrics Society*, 58 Suppl 2(Suppl 2), S329–S336. <https://doi.org/10.1111/j.1532-5415.2010.02913.x>

Scott, H. M., Coombes, L., Braybrook, D., Roach, A., Harðardóttir, D., Bristowe, K., Ellis-Smith, C., Higginson, I., Gao, W., Bluebond-Langner, M., Farsides, B., Murtagh, F. E., Fraser, L. K., & Harding, R. (2022). COVID-19: Impact on Pediatric Palliative Care. *Journal of Pain and Symptom Management*, 64(1), e1–e5. <https://doi.org/10.1016/j.jpainsymman.2022.02.330>

Seinsche, J., Zijlstra, W., & Giannouli, E. (2020). Motility in Frail Older Adults: Operationalization of a New Framework and First Insights into Its Relationship with Physical Activity and Life-Space Mobility: An Exploratory Study. *International Journal of Environmental Research and Public Health*, 17(23), 8814. <https://doi.org/10.3390/ijerph17238814>

Sekaran, N. K., Choi, H., Hayward, R. A., & Langa, K. M. (2013). Fall-associated difficulty with activities of daily living in functionally independent individuals aged 65 to 69 in the United States:

a cohort study. *Journal of the American Geriatrics Society*, 61(1), 96–100. <https://doi.org/10.1111/jgs.12071>

Sheppard, K. D., Sawyer, P., Ritchie, C. S., Allman, R. M., & Brown, C. J. (2013). Life-space mobility predicts nursing home admission over 6 years. *Journal of Aging and Health*, 25(6), 907–920. <https://doi.org/10.1177/0898264313497507>

Spaniolas, K., Cheng, J. D., Gestring, M. L., Sangosanya, A., Stassen, N. A., & Bankey, P. E. (2010). Ground level falls are associated with significant mortality in elderly patients. *The Journal of Trauma*, 69(4), 821–825. <https://doi.org/10.1097/TA.0b013e3181efc6c6>

Stel, V. S., Smit, J. H., Pluijm, S. M., & Lips, P. (2004). Consequences of falling in older men and women and risk factors for health service use and functional decline. *Age and Ageing*, 33(1), 58–65. <https://doi.org/10.1093/ageing/afh028>

Taylor, J. K., Buchan, I. E., & van der Veer, S. N. (2019). Assessing life-space mobility for a more holistic view on wellbeing in geriatric research and clinical practice. *Aging Clinical and Experimental Research*, 31(4), 439–445. <https://doi.org/10.1007/s40520-018-0999-5>

Tinetti, M. E., & Powell, L. (1993). Fear of falling and low self-efficacy: a case of dependence in elderly persons. *Journal of Gerontology*, 48 Spec No, 35–38. https://doi.org/10.1093/geronj/48.special_issue.35

Tsai, L. T., Portegijs, E., Rantakokko, M., Viljanen, A., Saajanaho, M., Eronen, J., & Rantanen, T. (2015). The association between objectively measured physical activity and life-space mobility among older people. *Scandinavian Journal of Medicine & Science in Sports*, 25(4), e368–e373. <https://doi.org/10.1111/sms.12337>

VanSwearingen, J. M., Perera, S., Brach, J. S., Wert, D., & Studenski, S. A. (2011). Impact of exercise to improve gait efficiency on activity and participation in older adults with mobility limitations: a randomized controlled trial. *Physical Therapy*, 91(12), 1740–1751. <https://doi.org/10.2522/ptj.20100391>

VanSwearingen, J. M., & Studenski, S. A. (2014). Aging, motor skill, and the energy cost of walking: implications for the prevention and treatment of mobility decline in older persons. *The Journals of Gerontology. Series A, Biological Sciences and Medical Sciences*, 69(11), 1429–1436. <https://doi.org/10.1093/gerona/glu153>

Vellas, B. J., Wayne, S. J., Romero, L. J., Baumgartner, R. N., & Garry, P. J. (1997). Fear of falling and restriction of mobility in elderly fallers. *Age and Ageing*, 26(3), 189–193. <https://doi.org/10.1093/ageing/26.3.189>

Viljanen, A., Kulmala, J., Rantakokko, M., Koskenvuo, M., Kaprio, J., & Rantanen, T. (2012). Fear of falling and coexisting sensory difficulties as predictors of mobility decline in older women. *The Journals of Gerontology. Series A, Biological Sciences and Medical Sciences*, 67(11), 1230–1237. <https://doi.org/10.1093/gerona/gls134>

Webber, S. C., Porter, M. M., & Menec, V. H. (2010). Mobility in older adults: a comprehensive framework. *The Gerontologist*, 50(4), 443–450. <https://doi.org/10.1093/geront/gnq013>

Wert, D. M., Brach, J. S., Perera, S., & VanSwearingen, J. (2013). The association between energy cost of walking and physical function in older adults. *Archives of Gerontology and Geriatrics*, 57(2), 198–203. <https://doi.org/10.1016/j.archger.2013.04.007>

Wilkie, R., Peat, G., Thomas, E., & Croft, P. (2006). The prevalence of person-perceived participation restriction in community-dwelling older adults. *Quality of Life Research: An International Journal of Quality of Life Aspects of Treatment, Care and Rehabilitation*, 15(9), 1471–1479. <https://doi.org/10.1007/s11136-006-0017-9>

Xue, Q. L., Fried, L. P., Glass, T. A., Laffan, A., & Chaves, P. H. (2008). Life-space constriction, development of frailty, and the competing risk of mortality: The Women's Health And Aging Study I. *American Journal of Epidemiology*, 167(2), 240–248. <https://doi.org/10.1093/aje/kwm270>

**YAŞLI BAKIMI HİZMETLERİ PROGRAMI ÖĞRENCİLERİNDE DİYABETİK AYAK FARKINDALIK EĞİTİMİNİN DİYABET BİLGİ DÜZEYLERİNE ETKİSİ
EFFECT OF DIABETIC FOOT AWARENESS TRAINING ON DIABETES KNOWLEDGE LEVELS OF ELDERLY CARE SERVICES PROGRAM STUDENTS**

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ÖZET

Sağlık Teknikerleri, özellikle yaşlı bireylerin ve toplumun diyabetik ayak konusunda bilinçlendirilmesinde ve bu duruma eşlik eden sağlık sorunların önlenmesinde önemli bir rol oynayabilir. Bu çalışmanın amacı, 'Diyabetik Ayak Farkındalık Eğitiminin' öğrencilerin diyabet ve diyabetik ayak bilgi düzeylerine etkisini incelemek ve sağlık hizmetlerinde ön lisans düzeyinde bulunan öğrencilerde diyabetin en önemli komplikasyonu olan diyabetik ayak konusunda farkındalık kazanmalarını sağlamaktır. Bu çalışma, Yaşlı Bakımı Hizmetleri programı birinci ve ikinci sınıf öğrencilerinde gerçekleştirildi (yaş=21,32 ±3,34, n=50, K/E=41/9). Verilerin toplanmasında araştırmacı tarafından literatür bilgileri doğrultusunda geliştirilen anket formu kullanıldı. Çalışmada Yaşlı Bakımı Hizmetleri programı birinci ve ikinci sınıf öğrencilerine iki oturum halinde 'Diyabetik Ayak Farkındalık Eğitimi' verildi. Öğrencilerin eğitim öncesi ve sonrası olmak üzere Diyabet ve diyabetik ayak bilgi düzeyi değerlendirildi. Öğrencilerin %52'si (n=26) birinci sınıf iken, %48'i (n=24) ikinci sınıfta idi. Öğrencilerin demografik özellikler bakımından eğitim öncesi ve eğitim sonrası puanlarının ortalamalarına göre istatistiksel olarak anlamlı bir farklılık yoktu (p>0,05). Öğrencilerin eğitim öncesi ve eğitim sonrası anketten aldıkları puan ortalamaları arasında istatistiksel olarak anlamlı bir farklılık olduğu görüldü (p<0,05). Buna göre; öğrencilerin aldıkları eğitim sonrasında diyabet ve diyabetik ayak bilgi düzeylerinin anlamlı derecede yükseldiği tespit edildi (p<0,001). Eğitime katılan tüm öğrencilerin diyabet ve diyabetik ayak hakkında bilgi düzeyleri artırılarak bu konuda bir farkındalık oluşturulmuştur. Bu tarz eğitimlerin düzenli aralıklarla tekrar edilmesi, yaşlı bireylere hizmet sağlayıcılar başta olmak üzere toplumun diyabetik ayak konusunda bilinçlendirilmesi açısından son derece önemlidir. Diyabetik ayağın yaşlanmayla birlikte görülme sıklığının arttığı düşünülürse bu eğitimlerin ön lisans düzeyinde sağlık hizmeti veren kuruluşlarda yaygınlaştırılması, diyabetik ayak komplikasyonları ile mücadelede elimizi güçlendirecektir.

Anahtar kelimeler: Yaşlı bakımı, Diyabetik Ayak, Eğitim.

ABSTRACT

Health Technicians can play an important role in raising awareness of especially elderly individuals and society about diabetic foot and preventing the health problems that accompany this condition. The aim of this study is to examine the effect of 'Diabetic Foot Awareness Training' on the knowledge levels of students about diabetes and diabetic foot and to ensure that students at the associate degree level in health services gain awareness about diabetic foot, which is the most important complication of diabetes. This study was conducted on first and second year students of the Elderly Care Services program (age=21.32 ±3.34, n=50, F/M=41/9). A questionnaire form developed by the researcher in line with literature information was used to collect data. In the study, 'Diabetic Foot Awareness Training' was given to first and second year students of the Elderly Care Services program in two sessions. The students' knowledge level about diabetes and diabetic foot was evaluated before and after the training. While 52% (n=26) of the students were in the first year, 48% (n=24) were in the second year. There was no

statistically significant difference between the mean scores of the students before and after the training in terms of demographic characteristics ($p>0.05$). It was observed that there was a statistically significant difference between the mean scores of the students from the questionnaire before and after the training ($p<0.05$). Accordingly; it was determined that the knowledge levels of the students about diabetes and diabetic foot increased significantly after the training they received ($p<0.001$). The knowledge levels of all students who participated in the training about diabetes and diabetic foot were increased and an awareness was created on this subject. It is extremely important to repeat such trainings at regular intervals in order to raise awareness of society, especially of service providers to elderly individuals, about diabetic foot. Considering that the frequency of diabetic foot increases with aging, the dissemination of these trainings in institutions providing health services at the associate degree level will strengthen our hand in the fight against diabetic foot complications.

Keywords: Elderly Care, Diabetic Foot, Education.

GİRİŞ

Dünya çapında 65 yaş ve üstü yaşlı birey sayısının 617,1 milyon (dünya nüfusunun yaklaşık %20'si) olduğu bildirilmiştir (He, Goodkind ve Kowal, 2016). Dünyadaki yaşlı nüfus oranının 2022 yılı itibariyle %9,8 olduğu, ülkemizde ise bu oranın %9,9 olduğu rapor edilmiştir (Türkiye İstatistik Kurumu, 2023). Dünyada doğum oranlarının azalmasının yanı sıra yaşam beklentisinin artmasının bir sonucu olarak ayak sorunları insidansının da artış gösterdiği ifade edilmiştir (Anaforoğlu Külünkoğlu ve Toraman Karagülmez, 2021).

Diyabet, vücudun hemen hemen her yerini etkileyen sistemik bir hastalıktır ve genellikle ilk etkilenen bölge ayaklardır. Diyabet tedavisinin anahtarı, hastalığın ilerlemesinin azaltılması ve hastalığın yönetilmesi için risklerin ve komplikasyonların önüne geçilmesidir. Diyabet salgını ilerledikçe, alt ekstremitte amputasyonlarının çoğundan önce gelen ayak komplikasyonları ve ülserler de ilerlemektedir. Diyabetik ayak diyabeti olan bireylerde hastaneye yatışın nedenleri arasında ilk sırada yer almaktadır (İbrahim, 2017). Bunun nedeni diyabetli yaşlı bireylerde diyabetik ayak görülme sıklığının giderek artması ve bu durumun amputasyonla sonuçlanmasıdır (Scheen, Paquot ve Bauduceau, 2014).

Diyabetli tüm bireylerde nöropati varlığından bağımsız olarak, plantar duyuusal kaybın yanı sıra ayak bileği eklem propriosepsiyonunda önemli bozulmalar olduğu tespit edilmiştir (Yıldız, 2019). Özellikle diyabeti olan yaşlı bireylerde diyabetik nöropatiye bağlı tekrarlayan kronik travmalar ve ayak deformiteleri sebebiyle plantar basınçta artış meydana geldiği ve bu durumda kallus oluşumuna neden olduğu bildirilmiştir (Özdemir, 2023). Buna karşılık DM'li yaşlı bireylere kişiye özgü sunulan egzersiz programlarının plantar duyuusal kaybın yanı sıra postural salınımları azaltarak dengeyi iyileştirdiği rapor edilmiştir (Santos, Bertato, Montebelo ve Guirro, (2008). Yaşlı bireylerde Diyabet prevalansının yaşla birlikte arttığı bildirilmiştir (Scheen, Paquot ve Bauduceau, 2014). Bu nedenle diyabetli yaşlı bireylerin ayak bakımının sağlanmasının yanı sıra ayak sağlığının korunması toplum sağlığı açısından son derece önemlidir. Bunun sağlanması için sağlık teknikerlerinin diyabet ve diyabetik ayak bilgi düzeylerini arttırmaya ihtiyaç olduğu düşünülmektedir.

Diyabet eğitimlerinin genellikle Diabetes Mellitus'lu (DM) hastalara ve hasta tıbbi tedavi modelinden evde tedavi modeline geçene kadar evde ve hastanede eğitim programlarının yürütülmesinden sorumlu hemşirelere yönelik olduğu bildirilmiştir (Zaworski ve Kubińska, 2021). Ancak Diyabete yönelik eğitim programlarının sadece DM'li bireyleri ve hemşireleri kapsamı yeterli olmamaktadır. Diyabet tedavisi kapsamında, diyabet eğitimi konusunda hemşirelerin yanı sıra sağlık teknikerlerinin de yetiştirilmesi ile DM'li hastalar ve ailelerine daha fazla destek sağlanabilir. Aynı zamanda bu eğitimlerin doktorları/aile hekimlerini, diyabet hemşirelerini, çocuk doktorlarını, fizyoterapistleri ve bu alanla yakından ilişkili sağlık teknikerlerini de içine alacak şekilde genişletilmesinin diyabetin komplikasyonları ile

mücadelede son derece önemli olduğu belirtilmiştir (Zaworski ve Kubińska, 2021). Klinik Uygulama Kılavuzlarında, sağlık profesyonellerinin diyabetli tüm bireyleri ve yakınlarını diyabetik ayağın önlenmesi konusunda eğitmeleri tavsiye edilmektedir (İbrahim, 2017). Sağlık teknikerlerinden, özellikle Yaşlı Bakımı Hizmetleri Programı öğrencileri, yaşlı bireylerin ve toplumun diyabetik ayak konusunda bilinçlendirilmesinde ve bu duruma eşlik eden diğer sağlık sorunlarının (ayak ülseri, amputasyon vs.) önlenmesinde önemli rol oynayabilirler.

Bildiğimiz kadarıyla çalışmamız üniversite öğrencilerinde ön lisans düzeyinde bu eğitimin verildiği ve etkilerinin değerlendirildiği tek çalışmadır. Çalışmamız sayesinde üniversite öğrencilerinin ön lisans düzeyinde diyabetin en önemli komplikasyonu olan diyabetik ayak konusunda farkındalık oluşturulabilir. Bunun yanı sıra öğrencilerin diyabet ve diyabetik ayak bilgi düzeyleri üzerinde verilen eğitimlerin etkinliğinin belirlenmesi ile literatüre bu alanda katkı sağlanabilir. Bilgimiz dâhilinde Türkçe ve İngilizce literatürde, Yaşlı Bakımı Hizmetleri öğrencilerine verilen diyabetik ayak farkındalık eğitiminin diyabet bilgi düzeylerine etkisi inceleyen bir çalışmaya rastlanmamıştır. Bu nedenle bu çalışmanın amacı; Sağlık Hizmetleri Meslek Yüksekokulu Yaşlı Bakımı Hizmetleri öğrencilerine verilen ‘Diyabetik Ayak Farkındalık Eğitiminin’ diyabet bilgi düzeylerine etkisini incelemek, sağlık hizmetlerinde ön lisans düzeyinde bulunan öğrencilerin diyabet bilgi düzeylerine ilişkin verilere katkıda bulunmak ve öğrencilerin diyabetin en önemli komplikasyonu olan diyabetik ayak konusunda farkındalık kazanmalarını sağlamaktır.

YÖNTEM

Evren ve Örneklem

Tanımlayıcı kesitsel nitelikte planlanan araştırmamıza, katılım tamamen gönüllülük esasına dayandı. Çalışmaya 18 yaş ve üzeri, 2023-2024 Eğitim-Öğretim Yılı Bahar yarıyılında Zonguldak Bülent Ecevit Üniversitesi Ahmet Erdoğan Sağlık Hizmetleri Meslek Yüksekokulu, Yaşlı Bakımı Hizmetleri Programına kayıtlı 1. ve 2. sınıf öğrencileri dâhil edildi. Yapılan araştırmada evrenin tamamına ulaşmak hedeflendiğinden örneklem seçimi yapılmadı. Katılımcılara çalışmanın içeriği ve kapsamı hakkında bilgi, Diyabetik Ayak Farkındalık eğitim programına başlamadan önce verildi. Yaşlı Bakımı Hizmetleri programına kayıtlı 100 öğrenciye eğitim duyurusu yapıldı. Bu öğrencilerden eğitime katılmak için 52 öğrenci gönüllü oldu ve anketi doldurmak için onam verdi. Öğrencilerin %52’si (n=26) birinci sınıf iken %48’i (n=24) ise ikinci sınıftaydı. Eğitim 3 Nisan 2024 tarihinde iki oturum (40 dk+40 dk) halinde gerçekleştirildi. Anket, verilen diyabetik ayak farkındalık eğitimi öncesi ve sonrası olmak üzere öğrenciler tarafından iki kez dolduruldu.

Veri Toplama Araçları

Veriler yüz yüze görüşme yöntemi ile toplandı. Verilerin toplanmasında araştırmacı tarafından literatür bilgisinden yararlanılarak hazırlanan anket formu kullanıldı. Anket formunda bireylerin sosyo-demografik özellikleri ve ayak bakımı davranışlarını belirlemeye yönelik sorular yer aldı. Ayrıca ankette kişisel soruların yanı sıra (yaş, cinsiyet, okuduğu sınıf) ve Diyabet ve Diyabetik Ayak Bilgi Testinden (tek seçim) oluştu. Katılımcılar her doğru cevap için bir puan, yanlış cevap için sıfır puan aldılar (Zaworski ve Kubińska, 2021). Araştırmamızda bağımsız değişken olarak eğitim öncesi ve eğitim sonrası gruplar, bağımlı değişken olarak da Diyabet ve Diyabetik ayak bilgi testi ele alındı.

Verilerin Analizi

Çalışmanın verileri SPSS Versiyon 26.0 (Armonk, NewYork: IBM Corp.) programına aktarılarak istatistiksel analizler tamamlandı. Verilerin analizinde tanımlayıcı istatistiksel metotlar (frekans, ortalama, yüz, standart sapma, minimum ve maksimum değerler) kullanıldı. Uygulanacak analizlere karar verebilmek için öncelikle puanlara normal dağılım varsayımı için Kolmogorow Smirnov Testi (n>30) uygulandı. Test sonucunda puanların normal dağılım varsayımını sağladığı görüldü. Bu nedenle karşılaştırmalarda parametrik testler kullanıldı. İki bağımsız grup (örneğin, cinsiyet) arasında puanlara göre farklılık olup olmadığı Bağımsız

Örneklem T Testi ile ikiden fazla bağımsız grup (örneğin, yaş grubu) arasında puanlara göre farklılık olup olmadığı Tek yönlü Varyans Analizi (ANOVA) ile incelendi. İki bağımlı grup (Eşleştirilmiş T Testi; eğitim öncesi ve sonrası) arasında puanlara göre farklılık olup olmadığı ise Bağımlı Örneklem T Testi ile incelendi. Yapılan tüm analizlerde $p < 0,05$ istatistiksel olarak anlamlı kabul edildi.

BULGULAR

Katılımcıların yaş ortalaması $21,32 (\pm 3,341)$ idi. Katılımcıların %42'si ($n=21$) 20 yaş ve altında iken %32'si ($n=16$) 21 yaşında, %26'sının ($n=13$) ise 22 yaş ve üstünde olduğu görüldü. Katılımcıların %82'sini ($n=41$) kadın, %18'ini ($n=9$) ise erkek öğrenciler oluşturdu. Katılımcıların %96'sı ($n=48$) bekâr, %4'ü ($n=2$) ise evliydi. Katılımcıların %52'si ($n=26$) birinci sınıf iken %48'i ($n=24$) ise ikinci sınıftaydı. Katılımcıların demografik özellikler bakımından eğitim öncesi ve eğitim sonrası puanlarının ortalamalarına göre istatistiksel olarak anlamlı bir farklılık tespit edilmedi ($p > 0,05$) (Tablo 1).

Tablo 1. Katılımcıların Demografik Özelliklerin Dağılımları

Değişkenler	Kişi Sayısı (n=50)	Yüzde (%)
Yaş	$21,32 \pm 3,341$ (Ort±SS)	18-38 (Min-Maks)
20 yaş ve altı	21	42
21 yaş	16	32
22 yaş ve üstü	13	26
Cinsiyet		
Kadın	41	82
Erkek	9	18
Medeni Durum		
Bekâr	48	96
Evli	2	4
Okuduğu Sınıf		
Birinci sınıf	26	52
İkinci sınıf	24	48

Ort; Ortalama, SS; Standart Sapma, Min; Minimum, Maks; Maksimum

Katılımcıların diyabet ve diyabetik ayak bilgi testindeki ifadelerine verdikleri yanıtların dağılımları Tablo 2'de sunuldu. Buna göre hem eğitim öncesi hem de eğitim sonrası en fazla yanlış yapılan maddenin 14. Madde (Diyabetli bireyler parmak arası da dahil tüm ayağı günlük rutin olarak nemlendirmelidir.) olduğu tespit edilirken, en az yanlış yapılan maddenin 15. Madde (Diyabetli bireyler egzersize başlamadan önce ilk olarak ayaklarına uygun rahat bir spor ayakkabı tercih etmelidir.) olduğu tespit edildi. Eğitim öncesi ile eğitim sonrası doğru cevap verme oranı karşılaştırıldığında en büyük farkın %34 ile 4. Madde de (İnsülin

eksikliğinde kan şekeri seviyesi yüksek izlenir.) olduğu görüldü. Tablo 2’de ifadelere verilen doğru yanıtların oranı %50’nin üzerinde ise kalın (*bold*) yapılarak işaretlendi.

Tablo 2. Katılımcıların Diyabet ve Diyabetik Ayak Bilgi Testindeki İfadelere Verdikleri Yanıtların Dağılımları

		Eğitim Öncesi				Eğitim Sonrası			
		Yanlış		Doğru		Yanlış		Doğru	
		n	%	n	%	n	%	n	%
1	Diyabet insülin hormonu fazlalığında görülür.	37	74	13	26	25	50	25	50
2	İnsülin hormonu pankreas adlı organımızdan salgılanır	4	8	46	92	1	2	49	98
3	Diyabette uzuv kaybı en çok el parmaklarında yaşanır.	13	26	37	74	7	14	43	86
4	İnsülin eksikliğinde kan şekeri seviyesi yüksek izlenir.	26	52	24	48	9	18	41	82
5	Diyabetin 2 tipi vardır.	39	78	11	22	16	32	34	68
6	Diyabetli bireyler 6 ayda 1 defa ayak kontrolü için bir sağlık kurumuna başvurmalıdır.	11	22	39	78	16	32	34	68
7	Ayakta aşırı tüylenme enfeksiyon belirtisini gösterir.	21	42	29	58	18	36	32	64
8	Diyabette ayakkabı seçiminde öni acık ayakkabılar tercih edilmelidir.	27	54	23	46	27	54	23	46
9	Diyabetli bireyler ev içinde kesinlikle çıplak ayak ile dolaşmamalıdır.	13	26	37	74	2	4	48	96
10	Diyabette ayak zemini kontrolü el yordamı ile yapılması yeterlidir	21	42	29	58	9	18	41	82
11	Diyabetli bireylerin ayak yıkama suyu derecesi en fazla 37 derece olmalıdır.	13	26	37	74	3	6	47	94
12	Diyabetli bireyler ayaklarının dayanabileceği ısıda ayaklarını yıkamalıdır.	14	28	36	72	6	12	44	88
13	Ayak tırnakları mutlaka düz kesilmelidir.	9	18	41	82	0	0	50	100
14	Diyabetli bireyler parmak arası da dahil tüm ayağı günlük rutin olarak nemlendirmelidirler.	43	86	7	14	31	62	19	38
15	Diyabetli bireyler egzersize başlamadan önce ilk olarak ayaklarına uygun rahat bir spor ayakkabı tercih etmelidirler.	1	2	49	98	0	0	50	100
16	Diyabetli bireylerde egzersiz kolesterol artışına sebep olabilir.	22	44	28	56	20	40	30	60
17	Diyabetli bireyler egzersize mutlaka ana öğünden 1-2 saat önce başlamalıdır.	29	58	21	42	25	50	25	50
18	10 yılı aşkın diyabeti olan bireyler günde sadece 1 defa kan şekeri takibi yapmaları yeterlidir.	7	14	43	8	3	6	47	94
19	Kan şekeri izlemi kan şekerinin ölçülüp kayıt altına alınması işlemidir.	4	8	46	92	2	4	48	96
20	Kan şekeri ölçümü yapılırken eller yıkanır, parmak ucu alkol ile silinip cihaz iğnesi ile parmak ucu delindikten sonraki ilk damla kan ile yapılır.	22	44	28	56	16	32	34	68

n; Katılımcı sayısı, %; Yüzde

Katılımcıların eğitim öncesi ve eğitim sonrası anketten aldıkları puan ortalamaları arasında istatistiksel olarak anlamlı bir farklılık olduğu görüldü ($p < 0,05$). Buna göre; katılımcıların aldıkları eğitim sonrasında diyabet ve diyabetik ayak bilgi düzeylerinin anlamlı derecede yükseldiği tespit edildi ($p < 0,001$) (Tablo 3.).

Tablo 3. Katılımcıların Eğitim Öncesi ve Sonrası Aldıkları Puanların Karşılaştırılması

	Pre		Post		t; p
	Ort±SS	Min-Maks	Ort±SS	Min-Maks	
DAFE (Diyabetik Ayak Farkındalık Eğitimi)	62,5±10,985	30-80	76,5±10,558	50-95	-7,472; 0,000***

*** $p < 0,001$, Ort; Ortalama, SS; Standart Sapma, Min; Minimum, Maks; Maksimum, t; Bağımlı Örneklem T Testi, p; Anlamlılık Düzeyi

TARTIŞMA VE SONUÇ

Eđitime katılan tüm katılımcıların diyabet ve diyabetik ayak hakkında bilgi düzeyleri arttırılarak bu konuda bir farkındalık oluşturulmuştur. Diyabet, 21. yüzyılın salgını olarak anılmakta ve Dünya Sağlık Örgütü'nün 2019 verilerine göre, dünya çapında 463 milyon kişi diyabet hastası. 2030 yılına kadarda bu sayının 578 milyona ulaşacağı ifade edilmiştir (Williams, Colagiuri, Chan, Gregg, Ke ve Lim, 2019). Türkiye'de ise 6,5 milyon kişinin diyabet hastası olduğu ve bunların neredeyse yarısının diyabetli olduğunun farkında olmadığı bildirilmiştir (Satman, Omer, Tutuncu, Kalaca, Gedik, Dincçag, Karsidag, Genc, Telci, Canbaz, Turker, Yılmaz, Cakir, Tuomilehto ve TURDEP-II Study Group, 2013).

Sağlık bakımı çalışanları, özellikle diyabetli bireylere sağlıklı yaşam tarzını kazandırmak ve diyabetin ikincil sonuçlarını önlemek için gerekli ihtiyaçların karşılanmasını sağlamaya yönelik oldukça önemli roller üstlenebilir (Zaworski ve Kubińska, 2021). Ramova ve Macedonia (2018) tarafından fizyoterapistlerin diyabetin komplikasyonları hakkındaki bilgi seviyeleri incelenmiştir. Çalışmanın sonucunda, diyabet ve diyabetin komplikasyonlarına yönelik fizik tedavi programlarının planlanması gerektiği, planlanan programlarında fizyoterapi öğretim planlarında öğrencilere sunulmasına ihtiyaç duyulduğu belirtilmiştir (Ramova ve Macedonia, 2018). Çalışmamızda Diyabet ve diyabetik ayak konusunda Yaşlı Bakımı Hizmetleri öğrencilerinin bilgi düzeylerinin arttırılmasının yanı sıra diyabete dair en temel bilgilerden olan insülinin vücuttaki etkisine yönelik bilgi ve farkındalık düzeyi en fazla artış gösteren parametre olmuştur. Bu nedenle çalışmamız sayesinde diyabet ve diyabetik ayak konusunda bir farkındalık oluşturularak Yaşlı Bakımı Hizmetleri Programının öğretim planında Diyabetik Ayak dersine yer verilmesi gerektiği düşünülebilir.

Zaworski ve Kubińska (2021) tarafından yapılan çalışmada da fizyoterapistlere sistematik diyabet eğitimi verilmesi gerektiği vurgusu yapılmıştır (Zaworski ve Kubińska, 2021). Bildiğimiz kadarıyla yaşlı bakımı teknikerliği öğrencilerine verilen diyabet eğitiminin, öğrencilerin bilgi düzeylerine etkisine ilişkin yapılmış herhangi bir çalışma bulunmamaktadır. Bu nedenle çalışmamızda verilen eğitimlerin sistematik olarak devam ettirilmesi sayesinde diyabetli yaşlı bireylerle yakın ilişkide çalışan yaşlı bakımı teknikerlerinin, bu bireylerin yaşam kalitelerini iyileştirmede oynayabileceği önemli rolün altını çizmek önemlidir. Fizyoterapistlere yönelik yapılan çalışmalarda bu tarz eğitimlerin diyabetin tedavi aşamalarının tümünü olumlu anlamda etkileyeceği bildirilmiştir (Zaworski ve Kubińska, 2021). Benzer şekilde yaşlı bakımı teknikerlerinin yaşlı bireylerde diyabetik ayak oluşumunu önleme çalışmalarında yer almaları ampütasyona giden sürecin durdurulmasını sağlayabilir.

Günümüze kadar yapılan çalışmalarda diyabetle ilgili eğitimlerin lisans düzeyinde eğitim gören sağlık profesyonellerine ya da hastalara verildiği görülmektedir (Zaworski ve Kubińska, 2021). Ancak bildiğimiz kadarıyla ön lisans düzeyinde diyabetin yaygın komplikasyonlarından biri olan diyabetik ayağın farkındalığını arttırmaya yönelik verilen hiçbir eğitime rastlanmamıştır. Bu çalışmamızın güçlü yönlerinden biridir.

Sonuç olarak bu eğitimlerin düzenli aralıklarla tekrar edilmesi, yaşlı bireylere hizmet sağlayıcılar başta olmak üzere toplumun diyabetik ayak konusunda bilinçlendirilmesi açısından son derece önemlidir. Diyabetik ayağın yaşlanmayla birlikte görülme sıklığının arttığı düşünülürse bu eğitimlerin ön lisans düzeyinde sağlık hizmeti veren kuruluşlarda yaygınlaştırılması, diyabetik ayak komplikasyonları ile mücadelede elimizi güçlendirecektir.

KAYNAKLAR

Anaforođlu Külünkođlu, B., & Toraman Karagülmez, A. (2021). Yaşlanmayla birlikte ayak ve ayak bileğinde meydana gelen biyomekanik deđişiklikler. In Y. Güneş Gencer (Ed.), Yaşlılarda rehabilitasyon (1. Baskı, s. 213–230). Nobel Akademik Yayıncılık.

He, W., Goodkind, D., & Kowal, P. (2016). An aging world: 2015. International population reports, P95/16-1. Retrieved September 23, 2024, from <https://www.census.gov/content/dam/Census/library/publications/2016/demo/p95-16-1.pdf>

Han, J., Anson, J., Waddington, G., Adams, R., & Liu, Y. (2015). The role of ankle proprioception for balance control in relation to sports performance and injury. *BioMed Research International*, 2015, 842804. <https://doi.org/10.1155/2015/842804>

Ibrahim, A. (2017). IDF Clinical Practice Recommendation on the Diabetic Foot: A guide for healthcare professionals. *Diabetes research and clinical practice*, 127, 285–287. <https://doi.org/10.1016/j.diabres.2017.04.013>

Özdemir, Z. M. (2023). Diyabetik ayak ve osteomyelit. *Türk Radyoloji Seminerleri*, 11(2), 170–179. https://cms.turkradyolojiseminerleri.org/Uploads/Article_61113/TRS-11-170.pdf.

Pecoraro, R. E., Reiber, G. E., & Burgess, E. M. (1990). Pathways to diabetic limb amputation. Basis for prevention. *Diabetes care*, 13(5), 513–521. <https://doi.org/10.2337/diacare.13.5.513>

Ramova, E. R., Macedonia, B. R. (2018). Knowledge of physiotherapist about physical therapy treatment of diabetes complications. *International Journal of Medical Science in Clinical Research and Review*, (1), 1–8.

Santos, A., Bertato, F., Montebelo, M., & Guirro, E. (2008). Effect of proprioceptive training among diabetic women. *Brazilian Journal of Physical Therapy*, 12, 183–187.

Satman, I., Omer, B., Tutuncu, Y., Kalaca, S., Gedik, S., Dinccag, N., Karsidag, K., Genc, S., Telci, A., Canbaz, B., Turker, F., Yilmaz, T., Cakir, B., Tuomilehto, J., & TURDEP-II Study Group (2013). Twelve-year trends in the prevalence and risk factors of diabetes and prediabetes in Turkish adults. *European Journal of Epidemiology*, 28(2), 169–180. <https://doi.org/10.1007/s10654-013-9771-5>

Türkiye İstatistik Kurumu. İstatistiklerle yaşlılar, 2022. Erişim tarihi (20-Temmuz-2024). <https://data.tuik.gov.tr/Bulten/Index?p=%C4%B0statistiklerle-Ya%C5%9F1%C4%B1lar-2022-49667&di>

Williams, R., Colagiuri, S., Chan, J., Gregg, E., Ke, C., & Lim, L. L. (2019). *IDF Atlas 9th Edition*. International Diabetes Federation.

Yıldız, N. N. (2019). Tip 2 diyabetli bireylerde eklem pozisyon hissi, plantar duyu, denge ve çift görev performansı arasındaki ilişkilerin araştırılması [Yüksek lisans tezi]. Ankara Yıldırım Beyazıt Üniversitesi. <https://acikbilim.yok.gov.tr/handle/20.500.12812/264903>

Zaworski, K., & Kubińska, Z. (2021). Level of type 1 diabetes education of physiotherapists based on selected factors. *Poziom edukacji diabetologicznej na temat cukrzycy typu 1 fizjoterapeutów z uwzględnieniem wybranych uwarunkowań*. *Pediatric Endocrinology, Diabetes and Metabolism*, 27(2), 109–116. <https://doi.org/10.5114/pedim.2021.107164>

**HAYAT BOYU ÖĞRENME, ULUSAL YETERLİLİKLER ÇERÇEVESİ VE MİKRO
YETERLİLİKLER
LIFELONG LEARNING, NATIONAL QUALIFICATIONS FRAMEWORK, MICRO-
CREDENTIALS**

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Özet

Bir önceki yüzyıl itibariyle insan yaşamında sosyal, ekonomik ve kültürel anlamda şiddetli değişimler yaşanmaktadır. Bu sebeple değişime maruz kalan bireyler topluma ayak uydurabilmek için hayatlarının belirli noktalarında eğitime başvurma ihtiyacı hissetmektedir. Bireyler uyum sağlamayı sağlayacak becerileri hayat boyu öğrenme (HBÖ) kapsamında edinmektedir. Hayat boyu öğrenme, öğrenmede yeni ve kapsamlı fırsatlar yaratarak, katılımcıların gelişimini desteklemek, toplumsal kenetlenmeyi güçlendirmek ve ekonomik gelişmeye katkı sunmak üzere üç önemli amaç belirlemiştir. Hayat boyu öğrenmenin köklerinde beşikten mezara eğitim felsefesinin yatıyor olması örgün eğitimin kurallarına bağlı olmadan, eğitim yoluyla kazanılan her türlü bilgiyi ve edinilen davranışı eğitim kapsamına almayı sağlamaktadır. HBÖ, uygulanan eğitim sistemini temelinden yapılandırarak her alanda ihtiyaca göre fayda sağlayabilecek tüm avantajları geliştirmeyi hedeflemektedir. Bu sebep doğrultusunda ülkeler, ulusal eğitim sistemlerinin iyileştirilmesini sağlamak adına bir enstrüman olarak Ulusal Yeterlilik Çerçevelerini oluşturmaya, zaman içerisinde en başından en sonuna dek eğitim sistemlerinde kullanmaya başlamıştır. UYÇ sayesinde eğitim sistemi, bireyin eğitim sonunda kazanması yahut geliştirmesi muhtemel olan yetkinliklerini mesleklerle eşleştirmekte, hayat boyu öğrenmeyi teşvik etmektedir. Özellikle 21. yüzyılda Endüstri 4.0, kişisel becerilere yönelik artan ihtiyaçla birlikte genişlerken, küreselleşen bilgi ekonomisi, üretken kalabilmek için tüm yetişkinlerin sürekli ve yaşam boyu öğrenmesini teşvik etmektedir. Bu durum da endüstri ve talep odaklı, 'mikro' boyutlu, kişiselleştirilmiş kurslar ve sertifikalar olarak eğitim ortamlarını dönüştürmüştür. Hem örgün hem de yaygın eğitim içerisinde değerlendirilen ve 'mikro yeterlilik' olarak adlandırılan bu kavram, bireyin becerilerinin ve başarılarının tanındığı mesleki gelişime farklı bir bakış açısı olarak tanımlanmaktadır. Bu üç kavram arasında görülen organik bağ, alan yazında bulunan mevcut çalışmaların incelenmesi ile sorgulanmıştır. Dolayısıyla nitel araştırmalardan doküman incelemesi yöntemi kullanılmıştır. Bu noktada mikro yeterliliklerin tanınması için gerekli olan standartların mesleki gelişim ve hayat boyu öğrenme odağında belirlenmesine ve eğitim veren kurum ile kuruluşların mikro yeterliliklerini UYÇ'lere net bir şekilde dahil etmelerine dair olan ihtiyaç ortaya konmuştur.

Anahtar Kelimeler: hayat boyu öğrenme, yeterlilik, ulusal yeterlilik çerçevesi, mikro yeterlilikler

Abstract

Since the previous century, significant social, economic, and cultural changes have occurred in human life. Consequently, individuals affected by these changes feel the need to turn to education at certain points in their lives to keep up with society. Individuals acquire the skills necessary to adapt through lifelong learning (LLL). Lifelong learning aims to provide new and comprehensive opportunities for learning, contribute to the development of individuals in all aspects, promote social cohesion, and support economic growth. The roots of lifelong learning lie in the philosophy of education from the cradle to the grave, which allows for including all knowledge and behaviors acquired through education, irrespective of formal educational rules, into the scope of education. LLL aims to fundamentally restructure the educational system to develop all advantages that can benefit needs in every field. In this context, countries have started to develop and use National Qualifications Frameworks (NQFs) as a tool to improve their national education systems from beginning to end. Through NQFs, the education system

aligns the competencies that individuals are expected to acquire or develop by the end of their education with professions, thus encouraging lifelong learning. Especially in the 21st century, with the expansion of Industry 4.0 and the increasing need for personal skills, the global knowledge economy encourages continuous and lifelong learning for all adults to remain productive. This has transformed educational environments into industry and demand-oriented, 'micro' level, personalized courses and certifications. The concept of 'micro-credentials,' assessed within both formal and informal education, represents an alternative approach to career and professional development, where individual skills and achievements are recognized. The organic connection between these three concepts has been investigated through existing studies in the literature. Thus, a qualitative research method, specifically document analysis, has been used. This has highlighted the need to establish standards for recognizing micro-credentials in the context of professional development and lifelong learning and to clearly integrate the micro-credentials of educational institutions into NQFs.

Keywords: lifelong learning, qualification, national qualifications framework, micro-credentials

1. Giriş

İçinde bulunduğumuz çağda yaşamın her alanında yaşanan değişimlere bağlı olarak, bireyler gerek sosyal gerek ekonomik kaygılar dolayısıyla eğitime başvurmaktadır. Bireyler bu yolla hızlı değişimlere uyum sağlamaya çalışmaktadır (Güleç, Çelik ve Demirhan, 2012). Bireyler topluma uyum sağlayabilmelerini sağlayacak becerileri edinmeyi hayat boyu öğrenme (HBÖ) ile sağlamaktadır. HBÖ, bireylerin öğrenmeyi öğrenmesini hedefleyerek bilgi ve becerilerin, formal ya da informal yollar kullanılarak istenilen doğrultuda gelişmesini amaçlamaktadır. (Gündoğan, 2003). HBÖ, mevcut eğitim sistemini en başından itibaren yapılandırarak kullanılabilir tüm avantajları geliştirmeye odaklanmıştır ve her alanda ihtiyaç temelli olarak uygulanan tüm eğitimleri bünyesinde bulundurmaktadır. (Güleç, Çelik ve Demirhan, 2012). Bu sebeple eğitimi sistemlerinde kalite güvencesi ve bunma bağlı yeniden yapılanmayı sağlayarak yeterlilikleri saptamak amacıyla ulusal yeterlilik çerçeveleri geliştirilmiştir.

Ulusal Yeterlilik Çerçevelerinin (UYÇ) ilerlemesi, 1990'ların sonlarından bu yana ulusal eğitim sistemlerinin iyileştirilmesinde dikkate değer bir küresel model olmuştur (Tuck, 2007). Bu bağlamda, birçok ülke eğitim sistemlerini iyileştirmek amacıyla UYÇ'ler geliştirmiştir. Tuck, ülkeleri sistemlerini UYÇ'lere uygulayan üç jenerasyona ayırmıştır. Birinci jenerasyon olarak adlandırılan Avustralya, Yeni Zelanda, Güney Afrika ve Birleşik Krallık, sistemlerini 1980 ve 1990 yılları arasında geliştirmiştir. İrlanda, Malezya, Meksika ve Namibya'yı içeren ikinci jenerasyon, 1990'dan 2000'e kadar UYÇ'lerini yayınlamıştır ve Arnavutluk, Brezilya, Bosna, Hersek ve Türkiye'den oluşan üçüncü jenerasyon, 2000'den sonra çerçevelerini geliştirmeye ve uygulamaya başlamıştır. Küreselleşen dünyada, eğitim sistemleri ve yeterlilikler çerçeveleri, bireylerin mesleki ve akademik becerilerinin tanımlanması, değerlendirilmesi ve geliştirilmesi açısından önemli bir rol oynamaktadır. 1980'lerde Avrupa ülkeleri arasında var olan ekonomik anlamda rekabet eğitim dünyasında bazı değişikliklere neden olmuştur. (Fletcher, 1991). Bu sebeple, ABD'de 1960'lı yıllarda yeterliliğe dayalı öğretmen eğitimi olarak başlanan 'Yetkinlik Temelli Eğitim ve Öğretim' 80'li yıllarda Avrupa'da özellikle İngiltere'de giderek dikkate alınmaya başlanmıştır (Hyland, 1994). Bu yaklaşım en temel ifadeyle bireysel ve toplumsal olarak avantaj sağlamak için diyalogun, teknik yeteneklerin ve bilginin mantıklı kullanımını sağlamaktadır. Genel bakış açısıyla ise bu yaklaşım eğitim programlarında yüksek esneklik sağlanması, ihtiyaçların belirlenmesine ilişkin iyileştirme ve organizasyonun genel performansına tam personel katılımı, ebeveynler-çocuklar ve okullar için daha düşük maliyet ile program kalitesinin ve ölçütlerinin iyileştirilmesi gibi avantajları sağlayabilmektedir ve bunun çıktılarında biri de Ulusal Yeterlilikler Çerçevesi olarak karşımıza çıkmaktadır (Fletcher, 1997).

Beceri ve yetkinlik kazanımının hem HBÖ hem de yeterlilik çerçeveleri için önem arz ettiği söylenebilir. Bu noktada mikro kredi kavramından da bahsetmekte fayda bulunmaktadır. Milligan ve Kennedy (2017; akt. Orman, Şimşek ve Kozak Çakır, 2023) mikro kredileri küçültülmüş diploma ve sertifikalara benzetmektedir. Esnek yapıda olan mikro kredilendirme aslında kişinin ihtiyacı olan becerilerin kazanılması ve bunun tanınması için önemlidir. Orman, Şimşek ve Kozak Çakır'ın (2023) da belirttiği üzere mikro kredilendirme aslında öğrenmenin fiziksel sınırlarını okul sıralarından alıp genişleterek kişiyi HBÖ'ye aktarmak için önemli bir araçtır. Görüldüğü üzere kavramlar arasında doğası gereği bir bağ bulunmaktadır. Ancak alanyazında bu bağa yönelik açıklamalar sınırlıdır. Dolayısıyla bu çalışmada HBÖ, UYÇ ve mikro yeterlilikler arasındaki bağı açıklamak amaçlanmıştır.

2. Yöntem

Çalışmada kavramlar arasındaki bağ tartışılacaktır. Dolayısıyla bu kavramlara ilişkin dokümanların incelenmesi gerekmektedir. İncelenen dokümanları anlamlandırmak ve konu hakkında bir fikir sahibi olmak için doküman analizi yöntemi uygun bir yöntemdir (Corbin ve Strauss, 2008; akt. Kırıl, 2020). Bu doğrultuda doküman incelemesi yöntemi çalışma için uygun bulunmuş, kavramlara ilişkin bilimsel yayınlar ile kurum raporları taranmış ve analiz edilmiştir.

3. Tartışma

Ulusal Yeterlilik Çerçeveleri (UYÇ), 1980'lerden bu yana birçok ülke için önemli bir unsur olmuştur. Tuck'a (2007) göre yeterliliklerin ulusların finansal ve sosyal gereksinimlerini karşıladığını, genel kaliteyi iyileştirdiğini, esnek eğitim ve öğrencilerin gelişimi için fırsatlar sağladığını ve dünya çapında tanındığını göstermek için birçok ülke kendi UYÇ'lerini ilan etmiştir. 'Yeterlilikler çerçevesi' kavramı, 'ulaşılabilir öğrenme düzeyleri için bir dizi kritere göre yeterliliklerin geliştirilmesi ve sınıflandırılması için bir araç' olarak tanımlanmaktadır. Dünyadaki birçok ülke tarafından çeşitli UYÇ türleri uygulanmaktadır. Bu nedenle, bir ülkenin UYÇ'sinin amacı diğerlerinden farklılık göstermektedir. Bazı ülkeler sistemlerinde tutarlılık ve basitlik sağlamanın bir yolu olarak çerçevelerini ortaya koyarken, diğerleri hem çalışanlar hem de öğrenciler için eğitime erişilebilirlik sağlamaya çalışmaktadır (Behringer ve Coles, 2003). Tuck'a (2007) göre, ülkeler, insanları hayat boyu öğrenmeye katılmaya teşvik etmek, sosyal adaleti teşvik etmek ve kalite iyileştirmesini garanti altına almak için UYÇ'lerini uygulamaya koymuştur. Bu bağlamda UYÇ'lerin amaçları şu şekilde sıralanabilmektedir (Behringer ve Coles, 2003):

- Nitelikleri bilgi, beceri ve yeterliliklerle daha iyi eşleştirmek ve nitelikleri mesleki (ve daha geniş işgücü piyasası) ihtiyaçlarla daha iyi ilişkilendirmek;
- Yükseköğrenim, yetişkin öğrenimi, okul ödülleri ve özellikle mesleki eğitim ve öğretim nitelikleri gibi yeterliliklerin alt sistemlerine kapsayıcı bir çerçeve oluşturarak tutarlılık getirmek;
- Yaşam boyu öğrenmeyi desteklemek (erişim sağlayarak, yatırımları hedefleyerek, yaygın ve gayri resmi öğrenmeyi tanıyarak);
- Siyasi aktörlerin ve paydaşların mesleki eğitim süreçlerine katılımını kolaylaştırmak.

Basitçe söylemek gerekirse, UYÇ'ler niteliklerin mesleklerle eşleştirilmesine, tutarlı bir sistem kurulmasına ve hayat boyu öğrenmeyi ve sosyal adaletin teşvik edilmesine yardımcı olmaktadır. Ayrıca, UYÇ'lerin uluslararası bir amacı da vardır. Avrupa Mesleki Eğitimi Geliştirme Merkezi'ne (CEDEFOP, 2013) göre, UYÇ'ler entegrasyon yoluyla ülkeler arasında uluslararası düzeyde bağlantı kurma fırsatı sunmaktadır.

Avrupa Parlamentosu ile Avrupa Konseyi Avrupa Yeterlilikler Çerçevesini (AYÇ) 23 Nisan 2008'de resmi olarak kabul etmiştir. AYÇ yeterliliklerin işverenlerce, bireylerce ve kurumlarca anlaşılmasının önünü açmakta, çalışanların ve öğrencilerin kendi yeterliliklerini başka ülkelerde kullanabilmesine olanak sağlamaktadır (Mesleki Yeterlilik Kurumu [MYK], 2024). AYÇ, Avrupa'daki farklı ülke ve sistemlerdeki yeterliliklerin daha anlaşılır ve açık olmasını sağlamak için bir karşılaştırma aracı işlevi görme, ulusal yeterlilik çerçeve ve sistemlerinin birbirleriyle bağlantısını sağlayan ortak Avrupa referans çerçevesi olma, bireylerin ülkeler arasında hareketliliğini teşvik etme, hayat boyu öğrenmeyi destekleme olarak dört hedefe sahiptir (YÖK, t.y.a). AYÇ, Avrupa ülkeleri için zorunlu bir çerçeve değildir; daha ziyade bir referans sistemi olarak görülmektedir. Ancak Avrupa Mesleki Eğitimin Geliştirilmesi Merkezine (CEDEFOP, 2013) göre ülkeler AYÇ seviyeleri ile ilişkilendirebilmek için kendi çerçevelerini geliştirmelidir. AYÇ, bilgi, yeterlilik, beceri ve öğrenme kazanımlarına dayalı sekiz seviyeden oluşmaktadır. Bu seviyelerin her birinde kazanılması gereken bilgi, beceri ve yetkinlerin belirtildiği seviye tanımlayıcıları bulunmaktadır. Seviye belirlenirken teorik ve pratik bilginin genişliği ve derinliği; kavramaya, yaratıcılığa ve pratiğe ilişkin becerilerin karmaşıklığı; entelektüel becerilerin karmaşıklığı, kişinin aldığı sorumluluğun miktarı; problem çözme ve/veya yaratıcılığın derecesi; ekip çalışması miktarı, liderlik ve hesap sorulabilirliğin kapsamı gibi ölçütler dikkate alınmaktadır. Türkiye, AYÇ kapsamında oluşturduğu Ulusal Yeterlilikler Çerçevesini (UYÇ) 2015 yılında kabul etmiştir. Türkiye Yeterlilikler Çerçevesinin (TYÇ) sekiz seviyesi vardır ve her tür ve seviyedeki yeterlilik ve sertifikaları içermektedir. Mesleki Yeterlilik Kurumu (MYK), Millî Eğitim Bakanlığı (MEB) ve Yükseköğretim Kurulu (YÖK) ortaklaşa bu çerçeveyi geliştirmiştir ve uygulamaktadır. TYÇ'de Avrupa Yeterlilikler Çerçevesine (AYÇ) atıfta bulunmaktadır ve Avrupa Yükseköğretim Alanı Yeterlilikler Çerçevesine (QF-EHEA) göre işlemler yürütülmektedir. TYÇ öğrenme kazanımlarının kullanılması,

yeterliliklerin sürekli gözden geçirilmesi, yenilenmesi ve yeterliliklerin seviyelere tahsisi için bir referans noktası olmaktadır. TYÇ veri tabanında yaklaşık 29.000 yeterlilik bulunmaktadır ve bunların büyük çoğunluğu çıktılara dayanmaktadır (CEDEFOP, 2021). TYÇ ülkemiz eğitim ve öğretim sistemi içerisinde ve diğer öğrenme ortamlarında kazanılan kalite güvencesi sağlanmış tüm yeterlilikleri kapsamaktadır. TYÇ'nin hedefleri ülkemizdeki yeterliliklerin kapsamlı bir şekilde bir araya getirilmesi, yeterliliklerin kalitesinin artırılması, HBÖ'nün yaygınlaştırılması ve sistematik olarak desteklenmesi, ulusal ve uluslararası şeffaflık ve tanınabilirliğin en üst düzeyde karşılanması, toplumun tüm bireyleri için eğitim ve istihdam fırsatları yaratılması olarak sıralanmaktadır (YÖK, t.y.b). Bu hedefler açısından ele alındığında halihazırda 21. yüzyıl becerileri bireylerin içine bulunan bilgi toplumunda nitelikli iş görenler ve iyi vatandaşlar olmalarını sağlamayı amaçlamaktadır. Geleceğe odaklanıldığında, şu an okul çağında olan çocukların ileride yetişkin bireyler olduklarında toplumun normlarının değişeceği ve şu anda var olan meslek gruplarının dönüşeceği ve hatta bir kısım mesleklerin tamamen kaybolacağı öngörülmektedir. Bu sebeple öğrencilerin değişime hazır olmaları ve duruma uyum sağlamaları için beceriler edinmeleri ve bu becerilerini sürekli geliştirmeleri gerekmektedir. Eğitim kurumlarının salt bilgi aktarma görevinden ziyade etkin öğrenme alanları oluşturarak ilgili beceri kazanımlarını gerçekleştirmeleri kritik görülmektedir. Çağın gerekliliklerini kapsayan bu becerilerin kazandırılmadığı bir nesil ile ise küresel ekonomide ülke bazlı başarının gelmeyeceği ifade edilebilmektedir (Cansoy, 2018). Eleştirel düşünme, yaratıcılık, inisiyatif alma, problem çözme, risk değerlendirmesi yapma, karar alma ve duyguların yapıcı bir şekilde yönetilmesine odaklanan, HBÖ kapsamında her bireyin kazanması beklenen tanımlanmış sekiz yetkinlik olan anahtar yeterlilikler (Avrupa Birliği Konseyi, 2018), TYÇ öğrenme kazanımlarında somut olarak ifade edilmemiş olsa da çoğu seviye tanımlayıcısı bu anahtar yeterlilikler ile örtüşmektedir. Bu anahtar yetkinlikler vatandaşlık yetkinliği, çoklu dil yetkinliği, teknoloji ve mühendislikte yetkinlik, okuma yazma yetkinliği, dijital yetkinlik, kişisel, sosyal ve öğrenmeyi öğrenme yetkinliği, matematiksel yetkinlik ve bilim, girişimcilik yetkinliği ve kültürel farkındalık ve ifade yetkinliği olarak tanımlanmıştır. Ülkemiz eğitim politikalarında, anahtar yetkinliklerin kazandırılmasına öncelik verilmektedir.

Dijital çalışma yöntemleri, Endüstri 4.0'da kişisel ve kişisel becerilere yönelik artan ihtiyaçla birlikte genişlerken, küreselleşen bilgi ekonomisi, üretken kalabilmek için tüm yetişkinlerin sürekli ve yaşam boyu öğrenmesini teşvik etmektedir. Endüstri ve talep odaklı, küçük boyutlu, kişiselleştirilmiş olarak çevrimiçi kurslar ve sertifikalar eğitim ortamını dönüştürmüştür (Hudak & Camilleri, 2018). Bu noktada mikro yeterliliklerin kazandırılması da önem kazanmıştır. Mikro yeterlilik bireyin becerilerinin ve başarılarının tanındığı mesleki gelişime farklı bir bakış açısı olarak tanımlanmaktadır. Akademik içeriğe pratiklik eklemenin yanı sıra becerileri geliştirme ve kariyer yollarını yönetme imkânı sunmaktadır. Ayrıca, mikro yeterlilikler çalışanların eğitim maliyetini ve süresini önemli ölçüde en aza indiren uygun maliyetli profesyonel gelişim stratejileri içermektedir. Yükseköğretim kurumlarındaki mikro yeterlilik öğrencilerin, eğitimcilerin ve toplulukların resmi öğrenim ortamlarında mesleki gelişimi için bağlantılı ve yaşam boyu öğrenmeye ilham vermek için üniversite müfredatı ve topluluk katılım faaliyetleri içinde dijital rozetlerin entegrasyonuna izin vermektedir. Dolayısıyla mikro yeterlilikler yetkinlik temelli profesyonel öğrenmeyi takip eden sertifikalandırma sistemleridir ve kişinin becerilerini, başarılarını ve başarılarını tanımak için dijital rozetleri kullanmaktadırlar. Mikro yeterlilikler hem örgün hem de yaygın eğitim kapsamında değerlendirilmektedir. Aslında mikro yeterlilikler yaygın eğitim içinde en uygun şekilde konumlandırılmıştır. Çünkü bunlar bir eğitim sağlayıcı tarafından kasıtlı, planlı ve hayat boyu öğrenme sürecinde örgün eğitime 'ek, alternatif ve/veya tamamlayıcı' niteliktedir. Öte yandan, resmi bir yeterlilik için kredi kazandıklarında, mikro yeterlilikler 'örgün eğitim' alanına da girer. Bu doğrultuda mikro yeterlilikler Oliver (2019) tarafından şu şekilde tanımlanmaktadır:

“Bir mikro yeterlilik, resmi bir yeterliliğin ek, alternatif, tamamlayan veya tamamlayıcı bir parçası olan değerlendirilmiş öğrenmenin bir sertifikasıdır”

Mikro-yeterliliklerin tanımı AB yükseköğretim danışma grubuna katılan uzmanlar arasında yapılan tartışmalar sonucunda şu şekilde belirtilmiştir:

“Mikro yeterlilik bilgisi, bir öğrencinin kısa bir öğrenme deneyiminin ardından edindiği öğrenme çıktılarının kanıtıdır. Bu öğrenme çıktıları şeffaf standartlara göre değerlendirilmiştir” (Hudak & Camilleri, 2018). Mikro yeterlilikler, yüz yüze, karma veya uzakta eğitim formatında düzenlenebilir, bağımsız yetkinlikler olarak tanınmaz, başarı veya öğrenme çıktılarından bir sertifikası veya tanınması olarak kendi başlarına değere sahiptirler, kalite güvencesine genellikle sahiptirler ve daha fazla öğrenme

ve istihdam edilebilirlik için tanınırlar, istiflenebilirlerdir. Mikro-yeterlilik üç farklı sınıflandırma ile karşımıza çıkmaktadır. Bunlar:

Beceri-Yeterlilik Bilgileri

"Beceri Yeterlilik bilgileri", insanların becerilerini, bilgilerini, yeteneklerini ve başarılarını tanımının ve belgelendirmenin yeni bir yoludur ve öğrencilerin işe alım görevlileri ve yeni fırsatlarla bağlantı kurmasına olanak tanımaktadır. Bunlar tipik olarak 4-12 saatlik öğrenmeyi içermektedir, yaygın eğitim bağlamında verilmektedir, dış kalite güvence kuruluşları tarafından açıkça kalite güvencesi sağlanmamıştır, belirli bir yetkinliğin kazanılmasıyla bağlantı kurulmuştur.

Mikro Yeterlilik Modülleri

Mikro Yeterlilik modülleri tipik olarak 1-5 AKTS arasındadır ve akademik becerilere odaklanmaktadır. Lisans programlarından ayrılmıştır ve diğer programların bölümlerini oluşturmak için "yeniden birleştirilebilmektedir". Genellikle 25-150 saatlik öğrenmeyi içermektedir, örgün eğitim bağlamında verilir ve değerlendirme seçenekleri içermektedir, genellikle dış kalite güvence kuruluşları tarafından açıkça kalite güvencesi verilmektedir, bir dizi akademik öğrenme çıktısının edinilmesiyle bağlantılanmıştır.

Kısa Öğrenme Programları

Kısa Öğrenim Programları, mikro yeterlilikler alanına yapılan en son eklemedir. Terim, mikro yeterlilik ile eş anlamlıdır ve bir dizi kurs yoluyla akademik yeterliliğin kazanılmasını kapsamaktadır. Bu tür kurs paketleri iki şekilde sunulabilmektedir:

- Bağımsız olarak alınabilen ancak aynı zamanda daha büyük bir mikro yeterlilik bilgisine eklenebilen bir dizi 'modül tabanlı' dersler;
- Yalnızca kısa öğrenim programının bir parçası olarak var olan bir dizi ders.

Bu tür kısa öğrenim programları genellikle kariyer aşamalarıyla bağlantılıdır ve belirli mesleklere erişmek için veya sürekli mesleki gelişim senaryolarında kullanılabilir. Bu nedenle kısa bir öğrenme programı tipik olarak 150-1500 saatlik öğrenmeyi kapsamaktadır, örgün eğitim bağlamında verilerek ve değerlendirme seçenekleri içermektedir, dış kalite güvence kuruluşları tarafından her zaman açıkça kalite güvencesi verilmektedir, "kısmi yeterlilikler" veya özel bir mikro yeterlilik kategorisi olarak yeterlilik çerçeveleriyle eşleştirilmektedir (Hudak & Camilleri, 2018). Mikro yeterlilikler ulusal yeterlilik çerçeveleri ile kolay uyum sağlayabilecek niteliktedir. Yükseköğretim bağlamında düşünüldüğünde bir kurum diğer kurumlarla, mikro yeterlilik bilgilerinin kullanımlarını düzenleyen ve aynı zamanda ev sahibi kurumda kredi vermek amacıyla kalitelerini tanıyan bir tür anlaşmaya sahip olması gerekmektedir. Yaygın eğitim yoluyla edinilen mikro yeterlilikler ise sınav benzeri yöntemlerle yükseköğretimde tanınma olanağına sahip olabilecektir. Öğrenciler böylelikle yükseköğretimdeki eşdeğer dersleri almış olarak kabul edilecektir (Hudak & Camilleri, 2018). Ayrıca akredite yükseköğretim kurumlarından kalite güvenceli kısa öğrenim kursları yoluyla elde edilen mikro yeterlilikler hem daha fazla öğrenim hem de istihdam edilebilirlik için tanınma konusunda daha az zorluk sunacaktır (Orr, Pupinis, & Kirdulyte, 2020).

4. Sonuç

Değişken ve dinamik işgücü piyasası günümüzde hızlı ve güvenilir yeterlilik kazanımının gerekliliğini göstermektedir. HBÖ ise bu hususta önemli bir araç konumundadır (Gözübüyük Tamer, 2013). Ulusal yeterlilik çerçeveleri yaşam boyu öğrenme ve mikro yeterlilikler karşımıza birbirleri ile bağlantılı kavramlar olarak ortaya çıkmaktadır. Bu bağlantıda HBÖ merkezi rolde görünmektedir. Çünkü hem mikro yeterlilikler hem de UYÇ'lerin HBÖ'ye fırsatlar yaratma fonksiyonu vurgulanmaktadır. UYÇ'ler HBÖ'ye erişim sağlarken aynı zamanda tanınma fonksiyonu da tanımaktadır. Mikro yeterlilikler de tanınma fonksiyonu için önemli bir araç olarak görülebilir. Orman, Şimşek ve Kozak Çakır'ın (2023) da belirttiği üzere mikro yeterlilikler konusunda ortaya çıkan en büyük problem güven problemidir. Lang (2023) mikro yeterliliklerde ortaya çıkan bu güven sorununa çözüm olarak UYÇ'lerin sunabileceği kalite güvencesi sisteminin etkili olabileceğinden bahsetmektedir. Bu doğrultuda üç kavram arasındaki ilişki aşağıdaki şekil ile gösterilebilir.

Şekil 1. HBÖ, UYÇ ve Mikro Yeterlilik İlişkisi



Şekilden de anlaşılacağı üzere etkili bir sistem için kalite güvencesi sağlanmış mikro yeterliliklerin HBÖ'ye erişimi kolaylaştırması ve UYÇ ile de ulusal düzeyde tanınırlığın sağlanması önemlidir. Bu noktada mikro yeterliliklerin tanınması için gerekli olan standartların mesleki gelişim ve hayat boyu öğrenme odağında belirlenmesine ve eğitim veren kurum ile kuruluşların mikro yeterliliklerini UYÇ'lere net bir şekilde dahil etmeleri önemlidir.

Kaynakça

- Avrupa Birliği Konseyi. (2018). Hayat Boyu Öğrenme için Anahtar Yetkinlikler Hakkında Tavsiye Kararı. Avrupa Birliği Resmî Gazetesi.
- Behringer, F., & Coles, M. (2003). The Role of National Qualifications Systems in Promoting Lifelong Learning. OECD Publishing. <https://eric.ed.gov/?id=ED503821> adresinden alındı
- Cansoy, R. (2018). Uluslararası çerçevelere göre 21.yüzyıl becerileri ve eğitim sisteminde kazandırılması. İnsan ve Toplum Bilimleri Araştırmaları Dergisi, 7(4), 3112-3134.
- CEDEFOP. (2013). Analysis and overview of NQF developments in European countries - Annual Report 2012. Luxembourg: European Centre for the Development of Vocational Training. 09 09, 2024 tarihinde https://www.cedefop.europa.eu/files/6117_en.pdf adresinden alındı
- Fletcher, S. (1991). NVQs Standards and Competence: A Practical Guide for Employers, Managers and Trainers. London: Kogan Page.
- Fletcher, S. (1997). Planning and Implementing Your NVQ System: A practical Guide for Employers, Managers and Trainers. London: Kogan Page.
- Gözübüyük Tamer, M., (2013). Yaşamboyu Öğrenme İçin Ulusal Yeterlilikler Çerçevesi: Avrupa ve Türkiye Örneği. Uluslararası Eğitim Programları ve Öğretim Çalışmaları Dergisi, vol.3, no.5, 16-36.
- Güleç, İ., Çelik, S., & Demirhan, B. (2012). Yaşam Boyu Öğrenme Nedir? Kavram ve Kapsamı Üzerine Bir Değerlendirme. Sakarya University Journal of Education, 2(3), 34-48.
- Gündoğan, N. (2003). Avrupa Birliği'ne üye ülkelerde bir istihdam politikası aracı olarak yaşam boyu öğrenme ve bazı örnek program ve uygulamalar. Kamu-İş Hukuku ve İktisat Dergisi, 7(2), 2-15.
- Hyland, T. (1994). Competence, Education and NVQs: Dissenting Perspectives. London: Cassell.
- Hudak, R., & Camilleri, A. F. (2018). The Micro-Credential Users' Guide. The MicroHe Consortium.
- Kıral, B. (2020). Nitel bir veri analizi yöntemi olarak doküman analizi. Siirt Üniversitesi Sosyal Bilimler Enstitüsü Dergisi, 8(15), 170-189.
- Lang, J. (2023), "Workforce upskilling: can universities meet the challenges of lifelong learning?", International Journal of Information and Learning Technology, 40 (5), pp. 388-400. <https://doi.org/10.1108/IJILT-01-2023-0001>
- Mesleki Yeterlilik Kurumu [MYK] (t.y.). Hayat Boyu Öğrenme için Avrupa Yeterlilikler Çerçevesi. <https://www.myk.gov.tr/tr/haberler/ayc/avrupa-yeterlilik-cercevesi>
- Oliver, B. (2019). Making micro-credentials work for learners, employers and providers. Deakin University.
- Orman, R., Şimşek, E. and Kozak Çakır, M.A. (2023), "Micro-credentials and reflections on higher education", Higher Education Evaluation and Development, 17(2), pp. 96-112. <https://doi.org/10.1108/HEED-08-2022-0028>
- Orr, D., Pupinis, M., & Kirdulyte, G. (2020). Towards a European approach to micro credentials: a study of practices and commonalities in offering micro-credentials in European higher education. NESET report. Luxembourg: Publications Office of the European Union. doi:10.2766/7338

- Tuck, R. (2007). An Introductory Guide to National Qualifications Frameworks: Conceptual and Practical Issues for Policy Makers. 09 07, 2024 tarihinde https://www.ilo.org/sites/default/files/wcmsp5/groups/public/@ed_emp/@ifp_skills/document/s/instructionalmaterial/wcms_103623.pdf adresinden alındı
- TYÇ. (2015). Türkiye Yeterlilikler Çerçevesi. Ankara: Mesleki Yeterlilik Kurumu.
- YÖK. (2024). *Yükseköğretim Kurumu*, <https://www.yok.gov.tr/>
- YÖK. (t.y.a). Avrupa Yeterlilikler Çerçevesi (AYÇ). <https://www.myk.gov.tr/tr/haberler/ayc/avrupa-yeterlilik-cercevesi>
- YÖK. (t.y.b). Türkiye Yeterlilikler Çerçevesi (TYÇ). <https://uluslararasi.yok.gov.tr/Sayfalar/avrupa-yuksekogretim-alani-ile-uyum-projesi/yeterlikler-cercevesi/turkiye-yeterlikler-cercevesi-tyc.aspx>

**R410A ALTERNATİFİ OLARAK R32 İÇEREN SOĞUTUCU AKIŞKAN KARIŞIMLARIN
TERMODİNAMİK ÖZELLİKLERİ ÜZERİNE BİR İNCELEME
A STUDY ON THERMODYNAMIC PROPERTIES OF REFRIGERANT MIXTURES
CONTAINING R32 AS AN ALTERNATIVE TO R410A**

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Özet

Bu çalışmada, R410A soğutucu akışkanına alternatif olabilecek karışım soğutucu akışkanların (R454B, R447B, R452B ve R455A) başta yoğunluk ve basınç olmak üzere termodinamik özellikleri R410A ile karşılaştırmalı olarak incelenmiştir. R410A, soğutma sistemlerinde ve ısı pompalarında uzun yıllardır tercih edilen ve yaygın bir şekilde kullanılan enerji verimliliği yüksek bir soğutucu akışkandır. R410A'nın termodinamik performansı, kimyasal yapısında yarı yarıya R125 ve R32 bulunması ve bu iki bileşenin dengeli bir şekilde karışımı sayesinde yüksektir. Öte yandan, çevresel kaygılar nedeniyle daha düşük küresel ısınma potansiyeline (GWP) sahip alternatif olabilecek soğutucu akışkanların araştırılmasına ihtiyaç artmıştır. R32, birçok modern soğutucu akışkan içeriğinde yer almakta olup, düşük GWP değeri ve iyi termodinamik özellikleri nedeniyle tercih edilmektedir. Çalışmada incelenen R454B, R447B, R452B ve R455A alternatif soğutucu akışkan karışımları R32 içermektedir ve daha düşük küresel ısınma potansiyeline sahip olmakla birlikte, R410A'nın yerini alabilecek potansiyele sahiplerdir. Özellikle R455A, düşük GWP değerine sahip soğutucu akışkan olarak öne çıkmaktadır. Dikkate alınan soğutucu akışkanların buharlaşma ve yoğunlaşma sıcaklıklarındaki yoğunluk ve basınç değerleri kıyaslanmıştır. Buharlaşma sıcaklığında, yoğunluk değerleri üzerine yapılan analizlerde, R410A'ya en yakın soğutucu akışkanın R447B ve R452B olduğu belirlenmiştir. Yoğunlaşma sonrasında ise yoğunluk açısından R410A'ya en yakın akışkanın R447B olduğu tespit edilmiştir. Ayrıca, buharlaşma ve yoğunlaşma sıcaklıklarındaki mutlak basınç değerlerine göre R410A'ya en yakın soğutucu akışkanın R455A olduğu saptanmıştır. Çalışmada 40°C yoğunlaşma sıcaklığı sabit tutularak farklı buharlaşma sıcaklıklarında kuruluk derecesi ve birim kütle başına enerji değeri incelenmiştir. Soğutma sistemlerinin enerji tüketimi ve soğutma performansları soğutucu akışkan türüne bağlı olarak doğrudan etkilendiği için elde edilen analizlerin sonuçları büyük önem taşımaktadır. Bulgular R410A'nın değerlerine en yakın soğutucu akışkanın R455A olduğunu ancak diğer alternatif soğutucu akışkanların R410A'dan daha yüksek değerlere sahip olduğunu göstermiştir. Bu sonuçlar, alternatif soğutucu akışkanlar dahilinde R410A'nın termodinamik özellikler bakımından en yakın alternatifinin R447B'nin olduğunu vurgulamaktadır. Bu çalışma, düşük GWP değerlerine sahip alternatif soğutucu akışkanların R410A kullanılan sistemlerde alternatif olarak kullanabileceğini göstermektedir.

Anahtar kelimeler: R410A, Alternatif soğutucu akışkan, Düşük GWP

Abstract

In this study, the thermophysical properties, especially the density and pressure, of alternative refrigerant mixtures (R454B, R447B, R452B, and R455A) to the refrigerant R410A were comparatively examined with R410A. R410A is a refrigerant that has been widely preferred and used in cooling systems and heat pumps for many years due to its high energy efficiency. The thermodynamic performance of R410A is high due to its chemical composition, which contains 50% R125 and 50% R32, and the balanced mixture of these two components. On the other hand, due to environmental concerns, there has been an increasing need to investigate alternative refrigerants with lower global warming potential (GWP). R32 is included in the composition of many modern refrigerants and is preferred due to its low GWP value and good thermophysical properties. The alternative refrigerant mixtures R454B, R447B, R452B, and R455A

examined in this study contain R32 and have lower global warming potentials, with the potential to replace R410A. In particular, R455A stands out as a refrigerant with a low GWP value. The density and pressure values at evaporation and condensation temperatures of the considered refrigerants were compared. In the analyses conducted on the density values at the evaporation temperature, R447B and R452B were determined to be the refrigerants closest to R410A. After condensation, R447B was identified as the closest fluid to R410A in terms of density. Furthermore, according to the absolute pressure values at the evaporation and condensation temperatures, R455A was found to be the refrigerant closest to R410A. In the study, by keeping the condensation temperature constant at 40°C, the dryness fraction and energy value per unit mass were examined at different evaporation temperatures. Since the energy consumption and cooling performance of cooling systems are directly affected by the type of refrigerant, the results of the analyses obtained are of great importance. The findings showed that R455A is the closest refrigerant to the values of R410A, but the other alternative refrigerants had higher values than R410A. These results highlight that, among the alternative refrigerants, R447B is the closest alternative to R410A in terms of thermophysical properties. This study demonstrates that alternative refrigerants with low GWP values can be used as alternatives in systems using R410A.

Keywords: R410A, Alternative refrigerant, Low GWP

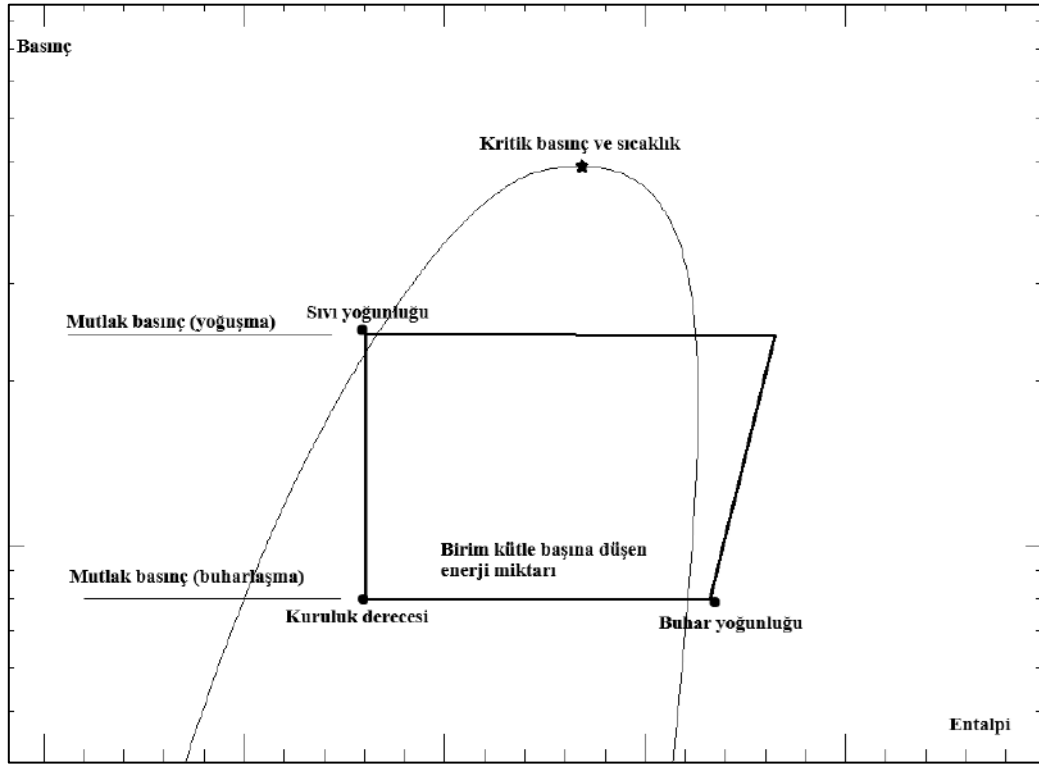
GİRİŞ

Soğutma sistemlerinde ve ısı pompalarında yaygın olarak kullanılan R410A soğutucu akışkanı, yüksek küresel ısınma potansiyeli (GWP) nedeniyle çevresel açıdan olumsuz etkilere sahiptir. Bu nedenle, daha düşük GWP değerlerine sahip alternatif soğutucu akışkanların bulunması ve geliştirilmesi, soğutma sektöründe önemli bir araştırma alanı haline gelmiş olup R410A, R134A ve R404A gibi yaygın kullanılan soğutucu akışkanların düşük GWP değerlerine sahip alternatifleri geniş yelpazede değerlendirilmiştir (Guilherme vd., 2022; Heredia-Aricapa vd., 2020). Yıldırım vd. (2021) tarafından yürütülen araştırmada R410A'ya alternatif olarak R454B ve R452B soğutucu akışkanları test edilmiştir. Alternatif akışkanların çok daha düşük GWP değerine sahip olmasına rağmen soğutma tesir katsayılarının hemen hemen aynı olduğu sonucuna ulaşılmıştır. Liu vd. (2024), ısı transfer mekanizmalarını analiz ederek R452B soğutucu akışkanının R410A alternatifi olarak kullanılabileceğini tespit etmişlerdir.

Alternatif soğutucu akışkanların R410A'ya kıyasla benzer termodinamik özellikler göstermesi, mevcut sistemlerle uyumlu çalışabilmesi ve enerji verimliliğini artırması beklenmektedir. Bu çalışmada, R410A'ya alternatif olabilecek soğutucu akışkanların (R454B, R447B, R453B, R455A) buharlaştırıcı ve yoğuşurucu çıkış noktalarındaki yoğunlukları mutlak basınç değerleri gibi termodinamik özellikleri karşılaştırmalı olarak incelenmiştir.

YÖNTEM

R410A'ya alternatif olarak seçilen soğutucu akışkanların termodinamik özellikleri, belirli sıcaklık aralıklarında hesaplanmıştır. Buharlaşma sıcaklıkları -10°C'den +10°C'ye kadar 5°C'lik artışlarla incelenmiş ve her durumda 10°C aşırı kızdırma değeri kullanılmıştır. Yoğuşma sıcaklıkları ise 30°C'den 50°C'ye, yine 5°C'lik artışlarla değerlendirilmiş olup, aşırı soğutma 3°C olarak sabit tutulmuştur. Bu yöntemle yoğunluk ve mutlak basınç değerleri elde edilmiştir. Kuruluk derecesi ve birim kütle başına enerji miktarı hesaplamalarında ise 40°C sabit yoğuşma sıcaklığı kullanılarak, farklı buharlaşma sıcaklıklarına göre değerlendirme yapılmıştır. Şekil 1'de, tespit edilen termodinamik özelliklerin basınç-entalpi diyagramında gösterildiği noktalar yer almaktadır.



Şekil 1. Soğutucu akışkanların karşılaştırıldıkları noktaların basınç-entalpi diyagramındaki yerleri.

Çalışmada yer alan soğutucu akışkanların termodinamik özellikleri ve GWP değerleri Tablo 1'de verilmiştir. Soğutucu akışkanların değerleri, Refprop 10.0 programı ile hesaplanmış olup, alternatif karışımlar Tablo 1'deki veriler doğrultusunda oluşturulmuştur.

Tablo 1. Soğutucu akışkanların termodinamik özellikleri ve GWP değerleri.

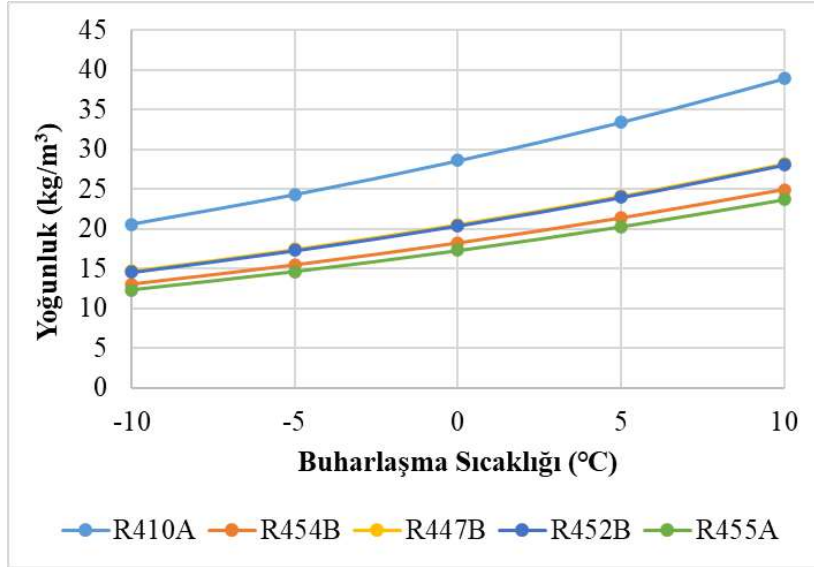
Akışkan	R410A	R454B	R447B	R452B	R455A (Lee vd., 2021)
İçeriğindeki soğutucu akışkanlar	R125/R32	R1234yf/ R32	R125/R32 /R1234ze(E)	R125/R32/ R1234yf	R32/ R1234yf/ R744
Karışım yüzdesi	0,5/0,5	0,311/0,689	0,08/0,68/ 0,24	0,07/0,67/ 0,26	0,215/0,755/0,03
GWP	1924	466	710	677	146
Kritik basınç (kPa)	4901	5333	5644	5220	4653
Kritik sıcaklık (°C)	71,35	83,7	82,8	77,5	85,5

ARAŞTIRMA BULGULARI

Bu çalışmada, R410A soğutucu akışkanına alternatif olabilecek soğutucu akışkanların bazı özellikleri değerlendirilmiştir. Farklı soğutucu akışkanlar için elde edilen değerler, alternatifi olarak düşünülen R410A ile kıyaslanarak analiz edilmiştir.

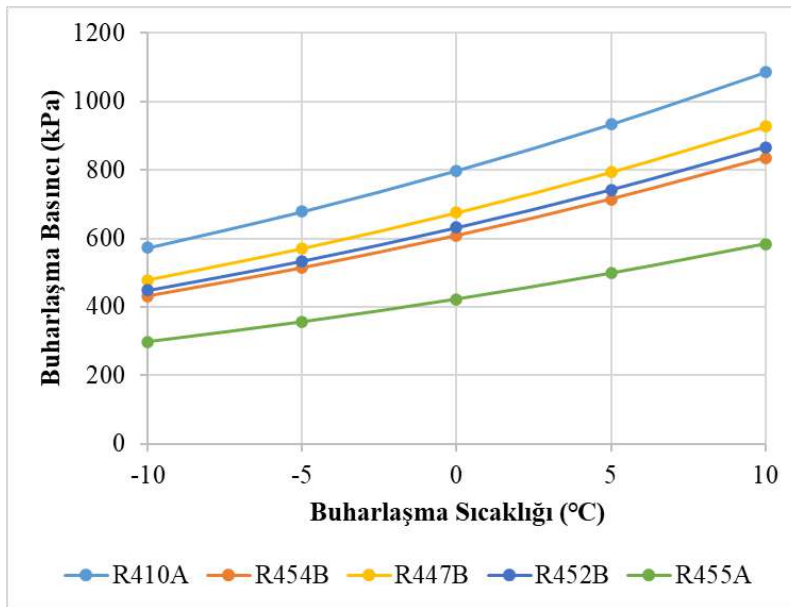
Farklı buharlaştırma sıcaklıkları için soğutucu akışkanların evaporatör çıkış yoğunlukları Şekil 2'de verilmiştir. Buharlaşma sıcaklıklarına göre R410A soğutucu akışkanına çıkış yoğunluğu açısından en yakın akışkanların R452B ve R447B olduğu belirlenmiştir. Örneğin -10°C buharlaşma sıcaklığında R410A'nın yoğunluğu R454B'nin yoğunluğundan yaklaşık olarak %40 daha yüksek değere sahipken

R454B'den %60 daha yüksek değere sahiptir. Bu durum kompresördeki volümetrik verim değerlerini etkilemektedir. Volümetrik verim değerleri soğutucu akışkanın debisini etkileyen parametrelerden biridir. R410A soğutucu akışkanının kullanılması için tasarlanan kompresörlerin alternatif soğutucu akışkanlarla da benzer şekilde çalışabilmesi için volümetrik verim değerleri önem taşımaktadır.



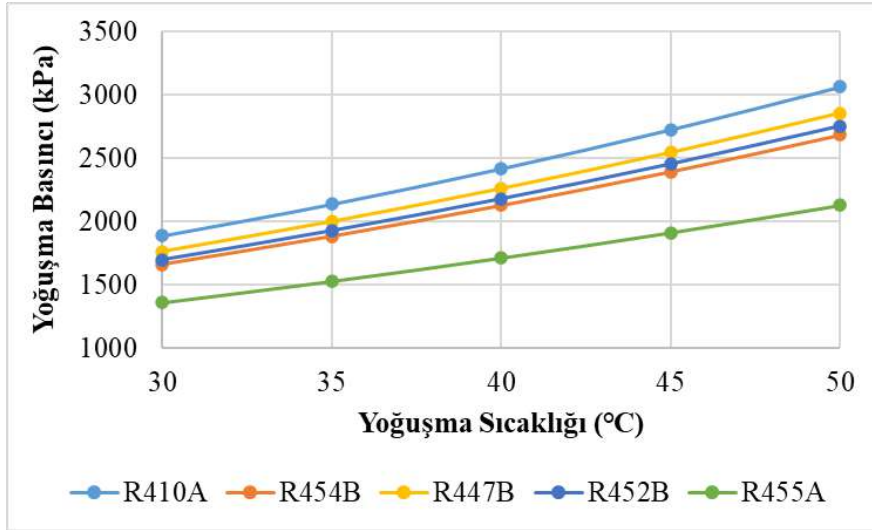
Şekil 2. Buharlaşma sıcaklıklarına göre evaporatör çıkış yoğunlukları.

Şekil 3'te farklı buharlaşma sıcaklıklarında farklı soğutucu akışkanların mutlak basınç değerleri görülmektedir. Soğutucu akışkanların buharlaşma sıcaklıklarındaki farklar nedeniyle buharlaşma basınçlarında da farklılıklar meydana gelmiştir. Buharlaşma sıcaklıklarındaki mutlak basınç değerlerine göre R410A'ya en yakın soğutucu akışkan R447B olarak tespit edilmiştir. Ancak R454B ve R452B'nin de oldukça yakın değere sahip olduğu belirlenmiştir. Buharlaşma sıcaklıklarındaki mutlak basınç değerlerinin yakın olması kompresör sıkıştırma oranları ve kompresörde tüketilecek güç değerlerinin de yakın olması sonucunu doğurabilir. Aynı zamanda soğutucu akışkan seçimi soğutma sistemlerinde kullanılan kısılma vanası gibi yardımcı ekipmanların kullanılabilirliği bakımından da oldukça önemlidir. Dolayısıyla R410A için üretilmiş kısılma vanalarında alternatif soğutucu akışkanların da etkin ve verimli şekilde kullanılabilmesi için mutlak basınç değerlerinin yakın olması önemlidir.



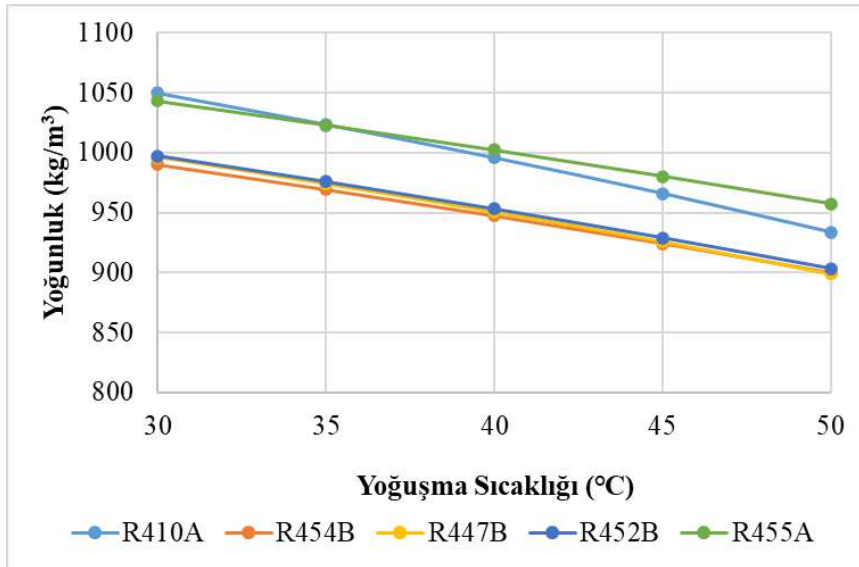
Şekil 3. Buharlaşma sıcaklıklarına göre mutlak basınç değerleri.

Şekil 4'te farklı yoğuşma sıcaklıklarında soğutucu akışkanların mutlak basınç değerleri gösterilmektedir. Belirtilen yoğuşma basınçlarında R410A'ya en yakın değerlerin R447B'de elde edildiği saptanmıştır. Yoğuşma sıcaklıklarındaki basınç değerleri ekipmanların kullanma limitleri için oldukça önemlidir. Dolayısıyla Şekil 4'te verildiği gibi alternatifler soğutucu akışkanların tamamının R410A'nın kullanıldığı bir kondenserde kullanılabileceği belirlenmiştir.



Şekil 4. Yoğuşma sıcaklıklarına göre mutlak basınç değerleri.

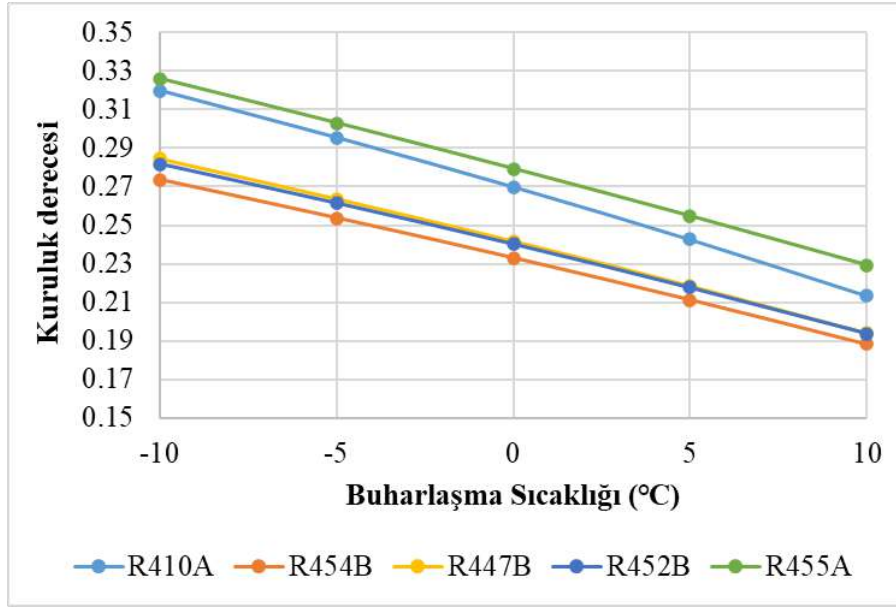
Farklı yoğuşma sıcaklıklarında soğutucu akışkanların yoğunluk değerleri Şekil 5'te verilmiştir. Şekil incelendiğinde R455A'nın R410A'ya en yakın yoğunluk değerlerine sahip olduğu görülmektedir. Her iki soğutucu akışkan için düşük yoğuşma sıcaklıklarında neredeyse aynı yoğunluklar elde edilirken yoğuşma sıcaklığı arttıkça farklılıklar meydana gelmiştir. Debi değerleri soğutma ve ısıtma kapasitesini doğrudan etkileyen bir faktör olduğu için elde edilen sonuçlar aynı zamanda soğutucu akışkan debisini büyük oranda etkilemektedir.



Şekil 5. Yoğuşma sıcaklıklarına göre yoğunluk değerleri.

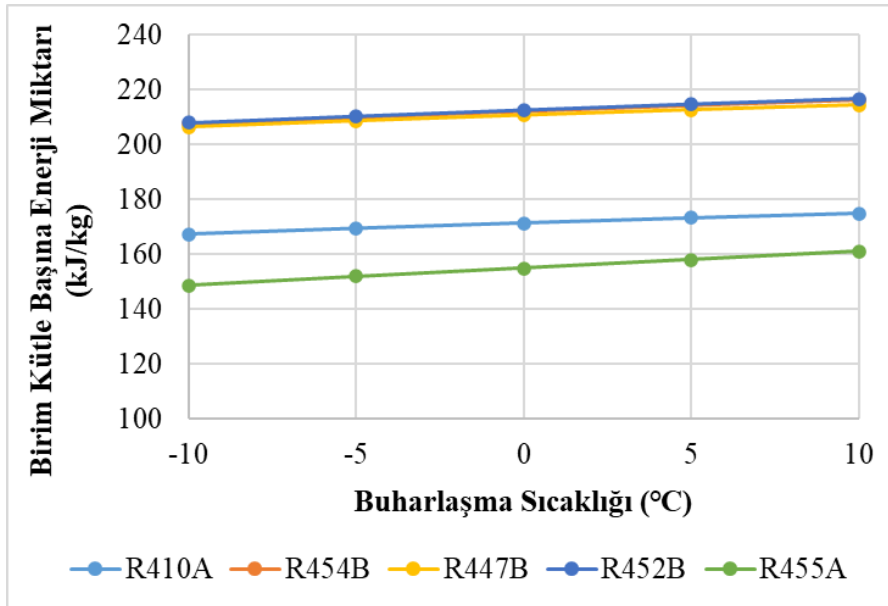
40°C yoğuşma sıcaklığında ve farklı buharlaşma sıcaklıklarında soğutucu akışkanların evaporatör girişindeki kuruluk dereceleri Şekil 6'da verilmiştir. Elde edilen kuruluk derecesi bulguları özellikle soğutma kapasitesi için önemlidir. R410A soğutucu akışkanına en yakın değerler R455A'da görülmektedir. Diğer alternatif soğutucu akışkanlarda ise aynı buharlaşma sıcaklıklarında daha düşük

kuruluk dereceleri elde edilmiş olup bu durum soğutma kapasitelerinin daha yüksek olabileceğini göstermektedir.



Şekil 6. Buharlaşma sıcaklıklarına göre kuruluk dereceleri.

Şekil 7’de farklı buharlaşma sıcaklıklarında soğutucu akışkanların 40°C yoğuşma sıcaklığı için birim kütle başına sahip oldukları enerji gösterilmektedir. Bu değerler debi ile çarpılınca kW cinsinden güç kapasitelerini vermektedir. Birim kütle başına enerji değeri açısından R410A’ya en yakın olan soğutucu akışkan R455A olarak belirlenmiş olup diğer alternatif soğutucu akışkanların hepsi daha yüksek birim kütle başına soğutma kapasitesine sahiptir.



Şekil 7. Buharlaşma sıcaklıklarına göre birim kütle başına enerji miktarları.

SONUÇLAR

Sistem performansı üzerinde büyük bir etkiye sahip olduğu için soğutma sistemlerinde özellikle soğutucu akışkanların seçimi oldukça önemlidir. Bu sebeple sunulan çalışmada, R32 içeren R454B, R447B, R452B ve R455A soğutucu karışım akışkanların yoğuşma ve buharlaşma sıcaklıkları baz alınarak yoğunluk, buharlaşma basıncı, yoğuşma basıncı, kuruluk derecesi ve birim kütle başına enerji miktarı açısından kıyaslamaları yapılmış ve soğutma sistemlerinde yaygın şekilde kullanılan R410A

soğutucu akışkanına alternatif olabilecek karışım soğutucu akışkanın tespit edilmesi amaçlanmıştır. Çalışmanın sonuçları R410A'ya en yakın olan alternatif soğutucu akışkanın R455A olduğunu göstermektedir. Ayrıca alternatif soğutucu akışkanların çoğu soğutma sistemi için daha yüksek soğutma kapasitesine sahip olabileceği belirlenmiştir.

Gelecek çalışmalarda, belirtilen akışkanlarla çalışacak bir kompresörün temin edilerek izantropik ve volümetrik verim üzerine deneysel çalışmaların yürütülmesine odaklanılmalıdır. Ayrıca alternatif soğutucu akışkan karışımlarının denenerek uygun akışkanların seçilmesi için bir simülasyon modelinin kurulması ve bir sistem üzerinde deneysel incelemelerin yapılması önerilmektedir.

KAYNAKÇA

- Guilherme, Í. F., Marcucci Pico, D. F., dos Santos, D. D. O., & Bandarra Filho, E. P. (2022). A review on the performance and environmental assessment of R-410A alternative refrigerants. *Journal of Building Engineering*, 47(December 2021). <https://doi.org/10.1016/j.jobe.2021.103847>
- Heredia-Aricapa, Y., Belman-Flores, J. M., Mota-Babiloni, A., Serrano-Arellano, J., & García-Pabón, J. J. (2020). Overview of low GWP mixtures for the replacement of HFC refrigerants: R134a, R404A and R410A. *International Journal of Refrigeration*, 111, 113–123. <https://doi.org/10.1016/j.ijrefrig.2019.11.012>
- Lee, B. M., Gook, H. H., Lee, S. B., Lee, Y. W., Park, D. H., & Kim, N. H. (2021). Condensation heat transfer and pressure drop of low GWP R-404A alternative refrigerants (R-448A, R-449A, R-455A, R-454C) in a 5.6 mm inner diameter horizontal smooth tube. *International Journal of Refrigeration*, 128(2021), 71–82. <https://doi.org/10.1016/j.ijrefrig.2020.12.025>
- Liu, H., Wu, Z., Yuan, C., Li, H., Li, H., Peng, J., & Huang, L. (2024). Experimental study of R410A and its low GWP alternative R452B flow boiling in a multiport microchannel tube. *International Journal of Heat and Mass Transfer*, 230(April), 125732. <https://doi.org/10.1016/j.ijheatmasstransfer.2024.125732>
- Yıldırım, R., Güngör, A., Kumaş, K., & Akyüz, A. (2021). Evaluation of Low GWP Refrigerants R452B and R454B as Alternative to R410a in the Heat Hump Systems. *J. Int. Environmental Application & Science*, 16(2), 47–52.

**MATEMATİK ÖĞRETMEN ADAYLARININ GEOMETRİ ÖĞRETİMİNDE GÜNLÜK HAYATLA İLİŞKİLENDİRME ÜZERİNE BELİRLEDİKLERİ MATERYALLER
THE MATERIALS IDENTIFIED BY PRE-SERVICE MATHEMATICS TEACHERS ON MAKING CONNECTIONS WITH DAILY LIFE IN GEOMETRY TEACHING**

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Abstract

Mathematics is a discipline that is present almost everywhere as an important necessity of daily life. It is seen that many professions require more or less mathematics and especially mathematical thinking. Therefore, mathematics has an important role as a discipline and intermediate discipline that affects the level of development of societies by forming individuals' thinking and problem solving skills. When the Mathematics Curricula are examined, it is known that geometry is an important learning area. The field of geometry, which has an important place both in mathematics teaching and in daily life, is objects and shapes. Geometric shapes are two-dimensional, geometric objects are three-dimensional, and teachers have an important role in eliminating confusion by providing basic information about the differences between them. In this context, this study was conducted to determine the thoughts of pre-service mathematics teachers about using the materials they identified to associate with daily life in teaching geometry. The study group of this research consisted of 54 pre-service teachers studying in the Elementary Mathematics Teacher Education program of a university in İstanbul in the spring semester of 2023-2024. The participants were asked to give examples of appropriate materials that can be used in daily life for teaching geometric shapes and objects through open-ended questions. The study was conducted using a qualitative research design. In this study, which was conducted with the case study method, one of the qualitative research types, the answers expressed in writing by the pre-service teachers were evaluated by content analysis. The geometric concepts that the pre-service teachers associated with the items-materials used in daily life were grouped and frequency distributions were made. In general, the findings showed that the pre-service teachers gave examples related to household items, nature, technology, school, and traffic signs. The findings were discussed within the framework of the literature and suggestions for this study and related researchers were given.

Keywords: Geometry, daily life, pre-service mathematics teacher

Özet

Matematik, günlük hayatın önemli bir gerekliliği olarak hemen her yerde var olan bir disiplin olarak karşımıza çıkmaktadır. Pek çok mesleğin az ya da çok matematik ve özellikle de matematiksel düşünmeyi gerektirdiği görülmektedir. Dolayısıyla matematiğin, bireylerin düşünme ve problem çözme becerilerini oluşturarak toplumların gelişmişlik seviyelerini etkileyen bir disiplin ve ara disiplin olarak da önemli bir rolü bulunmaktadır. Matematik Öğretim Programları incelendiğinde önemli bir öğrenme alanı olarak geometrinin yer aldığı bilinmektedir. Gerek matematik öğretiminde gerekse günlük hayatta önemli bir yeri olan geometrinin uğraş alanı cisimler ve şekillerdir. Geometrik şekiller iki boyutlu, geometrik cisimler ise üç boyutlu olup, arasındaki farklılıklarla ilişkili temel bilgiyi vererek kavram karışıklığını gidermede öğretmenlerin önemli bir rolü bulunmaktadır. Bu bağlamda, matematik öğretmen adaylarının günlük hayatla ilişkilendirmek üzere belirledikleri materyalleri geometri öğretilmede kullanmaya ilişkin düşüncelerini belirlemek amacıyla bu araştırma gerçekleştirilmiştir. Bu araştırmanın çalışma grubunu 2023-2024 bahar yarıyılında İstanbul ilindeki bir üniversitenin İlköğretim Matematik Öğretmenliği programında okumakta olan 54 öğretmen aday

oluşturmuştur. Katılımcılardan, geometrik şekiller ve cisimler öğretimi için günlük hayatta kullanılabilecek uygun materyaller ile ilgili örnekler vermelerine dair açık uçlu sorular yardımıyla görüş alınmıştır. Araştırma nitel araştırma deseni kullanılarak yürütülmüştür. Nitel araştırma türlerinden birisi olan durum çalışması yöntemi ile gerçekleştirilmiş olan bu çalışmada öğretmen adaylarının yazılı olarak ifade ettikleri cevaplar içerik analiziyle değerlendirilmiştir. Öğretmen adaylarının önerdiği günlük hayatta kullanılan eşyalar-materyaller ile ilişkilendirdikleri geometrik kavramlar gruplandırılmış ve frekans dağılımları yapılmıştır. Genel olarak bulgularda, öğretmen adaylarının günlük hayata ilişkin olarak; ev eşyaları, doğa, teknoloji, okul, ve trafik işaretleri ile ilgili örnekler verdikleri görülmüştür. Bulgular, alan yazın çerçevesinde tartışılarak bu araştırma ve ilgili araştırmacılara yönelik öneriler verilmiştir.

Anahtar Kelimeler: Geometri, günlük hayat, matematik öğretmen adayı

GİRİŞ

Bilgi ve teknoloji çağının yaşandığı günümüzde, problemlerin farkında olan ve problem çözebilen bireylerin yetişmesini esas alan bir eğitim anlayışı söz konusudur. Problem çözmede ise genel olarak matematik ve geometriden faydalanılmaktadır. Çünkü matematik, bireylerin düşünme ve problem çözme becerilerini etkileyerek toplumların gelişmişlik seviyelerine katkı sağlayan bir disiplin ve ara disiplin olarak önemli bir rol üstlenmektedir. Matematik öğretim programlarının en önemli öğrenme alanlarından biri olan geometri ise matematikle ve günlük hayatla ilgili problemleri çözmede önemli yer teşkil etmektedir.

Geometrinin sadece bir öğrenme alanı değil, bireylerin yaşadığı fiziksel ortamı tanıma ve anlamlandırmada önemli bir araç olduğu bilinmektedir (NCTM, 2000). Geometri ve geometrik düşünme; fiziksel dünyayı şekil, yer ve konum açısından inceleme olanağı ile matematiğin gelişimine önemli katkı sağlamaktadır (Olkun ve Uçar, 2007). Çünkü günlük hayatta bireylerin çözümü temel geometrik beceriler gerektiren basit problemlerle (çerçeve yapma, duvar kâğıdı kaplama, boya yapma gibi) karşılaştığı görülmektedir (Altun, 2008). Dolayısıyla, gerek matematiksel model oluşturmada gerekse problem çözmede geometrik düşüncelerden yararlanılması açısından geometrinin matematik eğitimindeki yerinin oldukça önemlidir. (Altun, 2004).

Geometri, öğrencilerin problem çözme ve eleştirel düşüncelerini geliştirmede önemli rol oynamaktadır (Pesen, 2006). Bununla birlikte geometri, öğrencilerin görsel algılarını ve akıl yürütme becerilerini geliştirmesinde öncelikli amaçlardan birisidir (Tapan ve Arslan, 2009). Bir yandan da geometrinin; günlük hayatta, mühendislikte ve diğer bilim alanlarında problem çözme ve matematiksel model oluşturmada geniş bir alanda kullanılan bir disiplin olarak görüldüğü bilinmektedir (Aksu, 2005).

Matematik öğretim programları incelendiğinde, her sınıf seviyesinde geometri kazanımlarının yer aldığı görülmektedir. Geometri; iki boyutlu şekiller ve üç boyutlu cisimler ile uğraşmakta olup, arasındaki farklılıklarla ilişkili temel bilgiyi vererek kavram karışıklığını gidermede öğretmenlere önemli bir rol düşüldüğü bilinmektedir (Çağırğan, Yavuz ve Deringöl, 2018). Bu bağlamda; geleceğin matematik öğretmeni adaylarının gerek matematik öğretiminde gerekse günlük hayatta önemli bir yeri olan geometriyi günlük hayatla ilişkilendirebilme becerileri öneminden hareketle bu araştırma planlanmıştır.

Araştırmanın amacı; ilköğretim matematik öğretmen adaylarının, geometri öğretiminde günlük hayatla ilişkilendirme üzerine belirledikleri materyallere ilişkin görüşlerinin belirlenmesidir. Bu amaç doğrultusunda öğretmen adaylarının; günlük hayatta kullanılan eşyalar-materyaller ile ilgili önerdikleri geometrik kavramların, ileride yetiştirecekleri öğrencilerin matematik ve geometri ile günlük hayatı ilişkilendirebilmeleri açısından bir öngörü teşkil edeceği düşünülmektedir.

ARAŞTIRMA

Araştırmanın Modeli

Bu araştırma; nitel araştırma yöntemlerinden, sorulara cevap aramada ayırt edici bir yaklaşım olarak kullanılmakta olan durum çalışması deseniyle yürütülmüştür. Nitel araştırma, bir ya da birkaç durumu derinlemesine incelemek suretiyle gerçeğin ortaya çıkarılmasında kullanılan detaycı bir yöntem olarak bilinmektedir (Yıldırım ve Şimşek, 2008). Durum çalışmasında, araştırmanın amacına yönelik olarak sınırlandırılmış bir veya birkaç durumu, ortamı veya bir sistemi derinlemesine inceleyerek analiz

yapılmaktadır (Creswell, 2007; Stake, 1995). Durum çalışmalarında daha geniş ve derinlemesine bilgi toplayabilmek için bir grup içinden bilgi toplanabilecek anahtar kişilerin seçilmesi söz konusudur. Çünkü derinlemesine çalışılabilmek için, grubun küçük seçilmesinin büyük gruplarla yüzeysel olarak çalışmaktan daha iyi olduğu öngörülmektedir (Büyüköztürk ve arkadaşları, 2008). Bu araştırmada da ilköğretim matematik öğretmen adaylarının, geometri öğretiminde günlük hayatta ilişkilendirme üzerine belirledikleri materyallere ilişkin görüşlerine açıklık getirmek amacıyla durum çalışması kullanılmıştır.

Çalışma Grubu

Araştırmanın çalışma grubunu 2023-2024 bahar yarısında İstanbul ilindeki bir üniversitenin İlköğretim Matematik Öğretmenliği programı ikinci sınıfında öğrenim gören 54 öğretmen adayı oluşturmuştur. Amaçlı örnekleme yöntemlerinden “kolay ulaşılabilir durum örnekleme” kullanılarak seçilen gönüllü 54 öğrenci “matematik öğretiminde materyal geliştirme” dersini almıştır. Kolay ulaşılabilir durum örnekleme yönteminde araştırmacı, yakın ve erişilmesi kolay olan bir durumu seçtiği için araştırmacıya hız ve pratiklik kazandırır (Yıldırım & Şimşek, 2008).

Veri toplama aracı

Nitel araştırmada görüşmenin, veri toplama araçlarından biri olarak birçok türü ve kullanımı bulunmaktadır. Görüşme; sıklıkla bireysel, yüz yüze, söz alış verişi şeklinde yapılmakla birlikte, kendi başına yanıtlanan soru formu veya telefon görüşmesi şeklinde de olabilmektedir (Punch, 2005). Bu araştırmada veri toplama aracı olarak, “Geometri öğretimi için günlük hayatta kullanılacak uygun materyaller nelerdir?” açık uçlu sorusu kullanılarak katılımcıların bu formu yazılı olarak yanıtlamaları istenmiştir. Ölçme aracındaki sorunun geçerlik çalışması için, kapsam geçerliğine bakılmış ve uzman görüşlerine başvurulmuştur.

Verilerin Analizi

Matematik öğretmen adaylarının önerdiği günlük hayatta kullanılan eşyalar-materyaller ile ilişkilendirdikleri matematik kavramlar gruplandırılmış ve frekans dağılımları yapılmıştır. Ayrıca, bu analiz sonuçlarını destekleyen, öğrenci görüşlerine de yer verilmiştir. Araştırma çerçevesinde yazılı formdan elde edilen veriler 2 farklı araştırmacı tarafında birbirinden bağımsız olarak tasnif edilip gruplandırılarak kodlanmış ve karşılaştırılarak aynı çatı altında toplanmıştır.

BULGULAR

Çalışma grubundaki öğretmen adaylarından elde edilen bulgular tablolar halinde sunulmuştur. Matematik öğretimine ilişkin günlük hayatta kullanılan eşyalar-materyaller ile ilgili önerilerine yönelik cevapları ortak kategoriler altında toplanarak frekans ile tablolarda yer almaktadır. Bazı kavramlar için bir katılımcının cevabı birden fazla kategoriye girebilmektedir. Ayrıca, bu analiz sonuçlarını destekleyecek nitelikte bazı öğretmen adaylarının görüşlerine de yer verilmiştir.

Tablo 1.

Önerilen geometrik kavramlar ve dağılımı

Önerilen Geometrik Şekil Kavramı	f
Çember	3
Daire	20
Dikdörtgen	70
Kare	28
Üçgen	12
Önerilen Geometrik Cisim Kavramı	f
Dikdörtgenler prizması	14
Küp	6
Silindir	5

Küre	1
Koni	1

Tablo 2.

Geometrik şekil ve cisim kavramına ilişkin önerilen günlük hayatla ilgili eşyalar-materyaller

Daire-Çember	f
Saat	7
Tabak	4
Düğme	3
Bardakaltı	2
Su şişesi kapağı	1
Tepsi	1
Demir Para	1
Oyuncak araba tekerleği yüzeyi	1
Hulahop (Çember)	2
Kibri kutusu	
Toka	1
TOPLAM	23
Dikdörtgen	f
Kağıt	14
Okul Tahtası yüzeyi	9
Lego parçaları (hacimsiz)	9
Defter sayfaları	7
Masa yüzeyi	7
Kapı yüzeyi	5
Gardırop yüzeyi	4
Oyuncak	4
Pencere yüzeyi	3
Halı	1
Cetvel	2
Spor sahaları	2
Buzdolabı yüzeyi	1
Televizyon yüzeyi	1
Mektup zarfı	1
TOPLAM	70
Kare	f
Lego parçaları (hacimsiz)	9

Kare kutu yüzeyleri	6
Tangram	6
Oyuncak	4
Kare kağıt	1
Peçete	1
Fayans	1
TOPLAM	28
Üçgen	f
Tangram	6
Trafik işaretler	2
Üçgen kalıplar	2
Üçgen lego	1
Marka logoları	1
TOPLAM	12
Dikdörtgenler prizması	f
Cep telefonu	4
Tablet	2
Legolar	2
Çamaşır makinesi	2
Kalem kutusu	1
Silgi	1
Baklava	1
Kutu süt	1
TOPLAM	14
Küp	f
Oyun hamuru	3
Küp şeklinde doğranmış sebze-meyve	1
Küp şeker	1
Oyuncak	1
TOPLAM	6
Silindir	f
Silindir Kutular	2
Pet şişe	1
Bardak	1
Oyuncak	1

TOPLAM	5
Küre	f
p	
Oyuncak	1
TOPLAM	1
Koni	f
p	
Oyuncak	1
TOPLAM	1

Örnek alıntılar:

K1: Duvar saatleri: Daire şeklindeki duvar saatlerini kullanarak daire konusunu anlatabiliriz.

K12: Ev ve okul gereçleri : masa ,tahta ,televizyon yüzeyinin hangi geometrik şekiller olduğu söylenir.

Oyuncaklar: oyuncak arabanın tekerleğinin yüzeyinin daire olduğu söylenebilir.

K22: Küp, Küre, Koni, Silindir vb. Oyuncaklar: Farklı geometrik cisimleri temsil eden oyuncaklar, öğrencilerin bu cisimlerin özelliklerini keşfetmelerine ve tanımalarına yardımcı olur.

K28: Öğrencilerden evde buldukları 1 geometrik şekli derse getirmelerini isteyebiliriz. Evde kullandığımız yemek tabakları daireye, cetvelin kenarlarını düşünerek dikdörtgene, bloklar ve lego parçalarını dikdörtgen ve kareye benzetebilirler (hacim olarak düşünmüyoruz) , günlük hayatlarda ilişkilendirmelerini sağlamış oluruz.

K30: Evimizde olan geometrik şekillere bakarak geometrik şekillerin özellikleri bulunur. Örneğin deftere bakarak dikdörtgenin, saate bakarak dairenin.

SONUÇ, TARTIŞMA VE ÖNERİLER

Araştırmaya katılan ilköğretim matematik öğretmen adaylarının geometrik şekil kavramına ilişkin önerdikleri kavramlar; dikdörtgen (70), kare (28), daire (20), üçgen (12) ve çember (3) şeklindedir. Öğretmen adaylarının geometrik cisim kavramına ilişkin önerdikleri kavramlar ise dikdörtgenler prizması (14), küp (6), silindir (5), küre (1), koni (1) şeklinde olmuştur. Buna göre öğretmen adaylarının geometri öğretimi için günlük hayatta kullanılacak uygun materyallere ilişkin önerilerinin sınırlı sayıda olduğu söylenebilir. Çünkü katılımcılar en fazla dikdörtgen, kare ve daireye ilişkin örnek vermiş, diğer geometrik şekillere ise az sayıda örnek vermiş ya da hiç vermemiştir. Örnek olarak, sıklıkla kullanılan eşkenar dörtgen, paralelkenar, beşgen, altıgen gibi düzlemsel geometrik şekillerden hiç bahsetmemişlerdir. Bununla birlikte, üçgen prizma ve piramit de geometrik cisim olarak sıklıkla kullanılmakla birlikte öğretmen adaylarının bu kavrama ilişkin önerdikleri kavramlar arasında rastlanmamaktadır. Dolayısıyla bu araştırmaya katılan öğretmen adaylarının geometrik cisimler hakkında günlük hayatta kullanılacak uygun materyallerle ilgili önerilerinin de sınırlı sayıda olduğu görülmektedir. Araştırmanın diğer bir bulgusu olarak, öğretmen adaylarının ifade ettikleri kavramlara dair günlük hayatta kullanılan eşyalar-materyaller ile ilgili önerilerini içeren bulguların da (bakınız tablo2) sınırlı sayıda olduğu söylenebilir.

Bulgular genel olarak değerlendirildiğinde öğretmen adaylarının geometri öğretiminde günlük hayata ilişkin olarak; ev eşyaları (mutfak, odalar, banyo vb.), okul, oyuncaklar, teknoloji, trafik işaretleri ve yiyecek ile ilgili örnekler verdikleri görülmüştür. Ancak; araştırmaya 54 öğretmen adayı katılmıştır ve önerilen geometrik şekil-cisim kavram sayısına bakıldığında bu kavramlar altında ilişkilendirilen eşya-materyallere ilişkin önerilerin oldukça az sayıda olduğu görülmektedir. Bu bağlamda; Çağırğan (2018) tarafından ifade edilen söyleme benzer şekilde, ilköğretim matematik öğretmen adaylarının geometri öğretimi için günlük hayatta kullanılacak uygun materyalleri kullanmaya ilişkin düşüncelerinin geliştirilmesi yönünde ihtiyaç olduğu söylenebilir.

Bilindiği üzere, hayatın tüm kesiminde yani bireyin yaşadığı çevreyi öğrenmesi ve kontrol etmesinde matematiği görmek mümkün olup (Hacısalihioğlu, Mirasyedioğlu ve Akpınar, 2004), kendi

çevresinden yani gerçek hayatından problemi örneklendirmek, öğrencilerin dersi somutlaştırmasını sağlamaktadır (Korkmaz & Tutak, 2017). O halde öğretme etkinliklerinin, öğrencinin öğrenmeye ilişkin tüm beklenti ve gereksinimlerini uyumlu bir biçimde karşılayacak yeterli ve zenginlikte olması gerekir (Aydın, 2008). Buna göre de geleceğin matematik öğretmeni olacak öğretmen adaylarının henüz mesleğin başındayken geometri öğretiminde günlük hayatla ilişkilendirme konusunda bilinçlenmeleri önem arz etmektedir.

Araştırmada elde edilen bulgular ışığında aşağıdaki öneriler getirilebilir:

- Geometri öğretimini kapsayan, farklı programları da içeren benzer araştırmalar yapılabilir.
- Farklı değişkenler göz önüne alınarak ve daha geniş örnekleme bu çalışma nicel olarak yapılandırılabilir.
- İlköğretim matematik öğretmen adaylarının eğitimi sürecinde günlük hayatın dikkate alınacağı çalışmalar yapılabilir.

KAYNAKÇA

Aksu, H. H. (2005). İlköğretimde aktif öğrenme modeli ile geometri öğretiminin başarıya, kalıcılığa, tutuma ve geometrik düşünme düzeyine etkisi. Yayınlanmamış Doktora Tezi, Dokuz Eylül Üniversitesi, İzmir.

Altun M. (2004). Matematik Öğretimi. İstanbul: Alfa Yayıncılık.

Altun, M. (2008). İlköğretim İkinci Kademe (6, 7 ve 8. Sınıflarda) Matematik Öğretimi (6. Baskı), Aktüel Yayınları.

Aydın, A. (2008). *Eğitim Psikolojisi* (9. Baskı). Ankara: Pegem Akademi.

Büyüköztürk, Ş., Kılıç Çakmak E., Akgün, Ö. E., Karadeniz, Ş., ve Demirel, F. (2008). Bilimsel araştırma yöntemleri. Ankara: Pegem A Yayıncılık.

Creswell, J. (2007). *Qualitative inquiry and research design: Choosing among five approaches*. 2nd ed. Thousand Oaks, CA: Sage.

Çağırğan, D. (2018). Öğretmen Adaylarının Günlük Hayatta Kullanılan Eşyaları Matematik Kavram Öğretimde Kullanmaya İlişkin Düşünceleri, Sözlü Sunum, 2.Uluslararası Bilim ve Eğitim Kongresi 2018 (UBEK2018), 297 - 303.

Çağırğan, D., Yavuz, G., & Deringöl, Y. (2018). Matematik Öğretmen Adaylarının Geometrik Cisimler Konusuna Yönelik Tutumları ve Geometriye Yönelik Öz-Yeterlikleri. *Ege Eğitim Dergisi*, 19(2), 369-387. <https://doi.org/10.12984/egeefd.421345>

Hacısalıhoğlu H.H. & Mirasyedioğlu, ğ. ve Akpınar, A. (2004). *Matematik Öğretimi*. Ankara: Asil Yayın Dağıtım.

Korkmaz, E. & Tutak, T. (2017). Dönüşüm Geometrisi Konusunun Öğretiminde Öğrencilerin Gerçekçi Matematik Eğitimi Yaklaşımına ve Yapılandırmacı Yaklaşımına İlişkin Görüşleri. *İnsan ve Toplum Bilimleri Araştırmaları Dergisi*, 6 (5), 2980-3002.

Retrieved from <http://www.dergipark.gov.tr/itobiad/issue/31500/343092>

NCTM (2000). *Principles and standards for school mathematics*. Reston, VA: National Council of Teachers of Mathematics.

Olkun, S. ve Uçar, Toluk, Z. (2007) .İlköğretimde etkinlik temelli matematik öğretimi.(3.Baskı). Ankara: Maya Akademi.

Pesen, C. (2006). Matematik Öğretimi. Ankara: Pegem Akademi Yayıncılık.

Punch, Keith. F. (2005), *Sosyal Araştırmalara Giriş. Nicel ve Nitel Yaklaşımlar*, (Çeviri: Zeliha Etöz). Ankara: Siyasal Kitabevi Yayınları.

Stake, R.E. (1995). *The art of case study research*. Sage Publications

Tapan, M. ve Arslan, Ç. (2009). Preservice teachers' use of spatio-visual elements and their level of justification dealing with a geometrical construction problem. *US-China Education Review*, 6(3), 54-60.

Yıldırım, A., & Şimşek, H. (2008). *Sosyal Bilimlerde Nitel Araştırma Yöntemleri* (6. Baskı). Ankara: Seçkin Yayıncılık.

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ÖZET

Göç olgusu, tarihin ilk dönemlerinden bu yana insanlığın gündeminde olmuştur. Tarih boyunca, ekonomik, sosyal ihtiyaçlar ile güvenli bir yaşam arayışı başta olmak üzere birçok neden insanların yaşadıkları mekânları kitleler halinde ya da bireysel olarak terk etmelerine yol açmıştır. Bugün dünyadaki bütün ülkeler ve toplumlar, büyük ölçüde göçlerle oluşmuştur. Zaman zaman hızlanan ülke içi ve ülkeler arası göçler, küreselleşme, bilimsel gelişmeler, teknolojiye hızlı ilerleyiş ve ulaşım olanaklarına erişilebilirliğin artması ile birlikte hız kazanmış, insanların, ülke içindeki, ülkeler ve kıtalar arası hareketliliği kolaylaşmıştır. Dünyanın baş etmek için yoğun çaba gösterdiği ekonomik, sosyal, toplumsal ve çevresel sorunlar, insan hareketliliğinin temelinde yatan nedenleri oluşturmaktadır. İnsanlığın yeni risklerle her an karşılaşma olasılığı öngörüsü, 2019 yılında dünyanın çözüm bulmakta zorlandığı bir virüsle bir kez daha doğrulanmıştır. Çin'in Wuhan kentinden başlayarak, küresel ilişkiler ağının da etkisiyle, kısa sürede dünyanın neredeyse her yerinde görülen ve 2020 yılının başında Dünya Sağlık Örgütü tarafından pandemi ilan edilen COVID-19 salgını, sadece ulusal sınırlar içindeki ülke vatandaşlarını değil, göçmenleri ve göç yönetimini de olumsuz etkilemiştir. Bu çalışmanın amacı, Türkiye İstatistik Kurumu tarafından 2021 yılında yapılmış olan Yaşam Memnuniyeti Araştırması'nın mikro veri setlerinden yararlanılarak Gompit regresyon analizi ile COVID-19 döneminde Türkiye'deki göç davranışlarında etkili olan faktörleri belirlemektir. Model sonuçları incelendiğinde yaş, medeni durum, eğitim düzeyi, gelecekte umut durumu, dini inanç baskısı, hanehalkı büyüklüğü ve konut mülkiyeti değişkenlerinin anlamlı olduğu görülmektedir. Çalışmanın frekans analizleri incelendiğinde çalışmaya katılanların %19,3'ünün hiç evlenmemiş olduğu, %70,8'inin ise evli olduğu görülmektedir. Ayrıca çalışmaya katılanların %64,8'i yaşadığı konutun sahibidir. Çalışmaya katılan bireylerin %6,6'sı dini inanç baskısı yaşadığını belirtmiştir. Çalışmanın sonucunda üniversite mezunu olan bireylerin bir okul bitirmeyen bireylere göre son bir yılda göç etme olasılığının %0,4 daha fazla olduğu tespit edilmiştir.

Anahtar kelimeler: Göç, Gompit Regresyon, Türkiye

FACTORS AFFECTING MIGRATION BEHAVIORS IN TURKEY DURING THE COVID-19 PERIOD

ABSTRACT

The phenomenon of migration has been on the agenda of humanity since the early periods of history. Throughout history, many reasons, primarily economic and social needs and the search for a safe life, have led people to leave their places in masses or individually. Today, all countries and societies in the world have largely been formed by migration. The migrations within and between countries, which have accelerated from time to time, have gained momentum with globalization, scientific developments, rapid advances in technology and increased accessibility to transportation facilities, and the mobility of people within countries, between countries and continents has become easier. The economic, social, communal and environmental problems that the world is working hard to cope with constitute the underlying reasons for human mobility. The prediction that humanity is likely to encounter new risks at any moment was confirmed once again in 2019 with a virus that the world has difficulty finding a solution for. Starting from Wuhan, China, with the influence of the global network, the COVID-19 outbreak, which was seen almost everywhere in the world in a short time and declared a pandemic by the World Health

Organization at the beginning of 2020, has negatively affected not only the citizens of the countries within national borders, but also immigrants and migration management. The aim of this study is to determine the factors affecting migration behaviors in Turkey during the COVID-19 period using Gompit regression analysis using the micro data sets of the Life Satisfaction Survey conducted by the Turkish Statistical Institute in 2021. When the model results are examined, it is seen that the variables of age, marital status, level of education, hope for the future, religious belief pressure, household size and housing ownership are significant. When the frequency analyzes of the study are examined, it is seen that 19.3% of the participants in the study have never been married, while 70.8% are married. In addition, 64.8% of the participants in the study own the house they live in. 6.6% of the individuals participating in the study stated that they experienced religious belief pressure. As a result of the study, it was determined that individuals who graduated from university were 0.4% more likely to migrate in the last year than individuals who did not complete a school.

Keywords: Migration, Gompit Regression, Türkiye

1. GİRİŞ

İnsanoğlunun varlığından beri mevcut olan ve toplumsal, siyasi ve ekonomik gerekçelerle ortaya çıkan göç kavramı uluslararası bir sınırı geçerek ya da bir ülke/bölge içinde süresi, yapısı ve nedeni ne olursa olsun insanların yer değiştirdiği nüfus hareketleri şeklinde tanımlanmaktadır. Buna, mülteciler, yerinden edilmiş kişiler ve ekonomik göçmenler dâhil edilmektedir (Portes, 2010; Akıncı vd., 2015). Göçmen ya da göç eden kişiler ise, hem maddi ve sosyal durumlarını iyileştirmek hem de kendileri veya ailelerinin gelecekte beklenenlerini arttırmak için başka bir ülkeye veya bölgeye göç eden kişi ve aile fertlerini ifade etmektedir (Işık & Çilhoroz, 2021; Türk Dil Kurumu, 2018).

Göç olgusu tarihin ilk dönemlerinden itibaren insanlığın gündeminde olmuştur. Tarih boyunca birçok neden, özellikle ekonomik, sosyal ve güvenlik kaygıları, insanların yaşadıkları yerleri gruplar halinde veya bireysel olarak terk etmelerine yol açmıştır. Günümüzde tüm ülkeler ve toplumlar esas olarak göçle oluşmuştur. Zaman zaman hızlanan ülkeler arası ve ülkeler arası göç, küreselleşme, bilimsel ve teknolojik alanlardaki gelişmeler, ulaşım imkânlarının iyileşmesi ve insanların ülke içinde, ülkeler arasında ve kıtalar arası hareketliliğinin daha erişilebilir hale gelmesiyle hız kazanmıştır. Türkiye jeo-politik konumu gereği tarih boyunca göç yollarının odak noktasında yer almaktadır. Gerek göç veren gerek göç alan gerekse transit anlamında bir geçiş ülkesi olarak önemli bir yer teşkil etmektedir. Türkiye son yıllarda güvenlik, ekonomik ve sosyal nedenlerle ve izlenen politikaların etkisiyle Ortadoğu, Asya ve Afrika ülkelerinden gelen göçmenlerin yoğunlaştığı bir merkez haline gelmiştir (Emeç & Şengün, 2022).

Topluluk halinde yaşayan insanlar açısından göç, bir mekânsal değişikliği ifade etmenin yanı sıra toplumun ve bireyin anlam ve değer sisteminde değişim ve dönüşüm yaşamasına da kaynaklık etmektedir (Ekici ve Tuncel, 2015; Kurt, 2006). Göç farklı dönemlerde, farklı konjonktürlere bağlı olarak çeşitli nedenlerle ortaya çıkmaktadır. Dolayısıyla göç hareketini ele alırken eylemin gerçekleştiği dönem ve şartların yakından incelenmesi gerekmektedir. İnsanlığın her an yeni risklerle karşılaşabileceği öngörüsü, 2019 yılında dünyanın çözüm bulmakta zorlandığı bir virüsle bir kez daha doğrulandı. Çin'in Wuhan kentinden başlayarak küresel ilişkiler ağının etkisiyle kısa sürede neredeyse tüm dünyaya yayılan ve 2020 yılı başında Dünya Sağlık Örgütü tarafından ilan edilen COVID-19 pandemi süreciyle birlikte tüm Dünya ülkelerinde genç, yaşlı, çalışan, işsiz, öğrenci, emekli vb. birçok kesim bu süreçten etkilendi ve göçmen ve mülteci olarak adlandırılan kişiler ve aileleri olumsuz etkilenmiştir (Alkan, Küçükoğlu & Ünver, 2024).

Bu çalışmanın amacı, Türkiye İstatistik Kurumu (TÜİK) tarafından 2021 yılında yapılmış olan Yaşam Memnuniyeti Araştırması'nın mikro veri setinden yararlanarak Gompit Regresyon Modeli ile COVID-19 döneminde Türkiye'de bireylerin göç davranışlarını etkileyen faktörleri belirlemektir.

2. MATERYAL VE METOT

2.1. Veri

Bu çalışmanın veri seti TÜİK'in 2021 yılında yaptığı Yaşam memnuniyeti araştırmasından elde edilmiştir. Yaşam Memnuniyeti Araştırmasının kapsamına Türkiye Cumhuriyeti sınırlarında yaşayan 18 ve daha üzeri yaş grubundaki hanehalkı fertleri alınmaktadır (TÜİK, 2021).

Bu çalışmada Yaşam Memnuniyeti Araştırması'na 2021 yılında katılmış olan 10073 bireyin verisi kullanılmıştır.

2.2. Değişkenler

Çalışmada bağımlı değişken, bireyler son bir yılda göç ettiyse 1, göç etmediyse 0 kodunu alan bireylerin göç etme durumudur.

Çalışmada yer alan bağımsız değişkenler ise Yaşam Memnuniyeti Araştırması'nda mevcut olup, yapılan literatür taraması sonucunda ön plana çıkan değişkenlerdir. Çalışmada yer alan bağımsız değişkenler; yaş (24 ve altı, 25-34, 35-44, 45-54, 55-64 ve 65+), medeni durum (hiç evlenmedi, evli, boşandı/eşi öldü), eğitim düzeyi (bir okul bitirmeyen, ilköğretim, lise ve üniversite), gelecekte umut (çok umutlu, umutlu, umutlu değil, hiç umutlu değil), dini inanç baskısı (evet, hayır), konut sahipliği (ev sahibi, ev sahibi değil) ve hanehalkı büyüklüğü (1-3 kişi, 4-5 kişi, 6 ve üstü)'dür.

Tablo 3.1'de bağımlı ve bağımsız değişkenlere ait tanımlayıcı istatistikler verilmiştir. Bağımsız değişken referans sınıfları elde edilecek en iyi modele göre seçilmiştir. Ordinal ve nominal değişkenler, modele alınacak bütün değişkenlere ilişkin kategorilerin etkilerinin gözlemlenmesi amacıyla kukla değişken olarak tanımlanmıştır (Ünver, Tekmanlı & Alkan, 2023).

Tablo 3.1 incelendiğinde, Çalışmada bireylerin %70,8'inin evli olduğu görülmektedir. Eğitim düzeyine göre bireylerin %31,2'si ilköğretim mezunu iken, %20,6'sı üniversite mezunudur. Ayrıca çalışma incelendiğinde bireylerin %64,7'sinin ev sahibi olduğu görülmektedir.

Tablo 3.1. Tanımlayıcı İstatistikler

Değişkenler	Sayı	Yüzde	
Yaş	24 ve altı	1260	12,5
	25-34	1925	19,1
	35-44	2171	21,6
	45-54	1825	18,1
	55-64	1520	15,1
	65+	1372	13,6
Eğitim düzeyi	Bir okul bitirmeyen	1164	11,6
	İlköğretim	3147	31,2
	İlköğretim	1408	14,0
	Lise	2282	22,7
	Üniversite	2072	20,6
Medeni durum	Hiç evlenmedi	1943	19,3
	Evli	7128	70,8
	Boşandı /eşi öldü	1002	9,9
Gelecekte umut	Çok umutlu	427	4,2
	Umutlu	5763	57,2
	Umutlu değil	2779	27,6
	Hiç umutlu değil	1104	11,0
Dini inanç baskısı	Evet	662	6,6
	Hayır	9411	93,4
Hanehalkı büyüklüğü	1-3 kişi	5217	51,8
	4-5 kişi	3724	37,0
	6 ve üstü	1132	11,2
Konut sahipliği	Ev sahibi	6515	64,7
	Ev sahibi değil	3558	35,3

2.3. İstatistiksel Analiz

İstatistiksel çıkarımın temel alanlarından biri, istatistiksel hipotezlerin test edilmesidir (Alkan & Ünver, 2021). Verileri analiz etmek için SPSS 20 ve Stata 14 programları kullanılmıştır. Öncelikle araştırmaya

katılan bireylerin göç etme durumuna göre frekans ve yüzdeleri elde edilmiştir. Daha sonra bireylerin son bir yılda göç etme durumunu etkileyen faktörler gompit regresyon analizi ile belirlenmiştir.

2.4. Model Tahmini

Çalışmada yer alan bireylerin COVID-19 döneminde göç etme durumlarını etkileyen faktörleri belirlemek için Gompit Regresyon Modeli kullanılmıştır. Kurulan modele ait tahmin katsayıları Tablo 3.2’de verilmiştir. Tablo 3.2’de tahmin sonuçları incelendiğinde; yaş, medeni durum, eğitim düzeyi, gelecekte umut, dini inanç baskısı, konut sahipliği ve hanehalkı büyüklüğü değişkenlerinin anlamlı olduğu görülmektedir.

Tablo 3.2. Gompit Regresyon Modeli Katsayılarının Tahmin Sonuçları

Değişkenler	β	Standart Hata	t	Güven Aralığı (%95)	
				Alt sınıır	Üst sınıır
Yaş (referans kategori: 65+)					
24 ve altı	1,977 ^a	0,643	3,08	0,717	3,237
25-34	1,144 ^c	0,612	1,87	-0,056	2,344
35-44	0,959	0,618	1,55	-0,253	2,171
45-54	1,014 ^c	0,615	1,65	-0,191	2,22
55-64	0,598	0,623	0,96	-0,623	1,819
Medeni durum (referans kategori: hiç evlenmedi)					
Evli	0,658 ^a	0,244	2,69	0,179	1,136
Boşandı/Eşi öldü	0,824 ^b	0,378	2,18	0,084	1,565
Eğitim düzeyi (referans kategori: bir okul bitirmeyen)					
İlkokul	0,575	0,503	1,14	-0,41	1,560
İlköğretim	0,885 ^c	0,495	1,79	-0,085	1,855
Lise	1,148 ^b	0,478	2,4	0,212	2,084
Üniversite	1,449 ^a	0,498	2,91	0,473	2,425
Gelecekte umut (referans kategori: çok umutlu)					
Umutlu	-0,372	0,308	-1,21	-0,976	0,232
Umutlu değil	-0,613 ^c	0,329	-1,87	-1,258	0,031
Hiç umutlu değil	-0,352	0,344	-1,02	-1,026	0,322
Dini inanç baskısı (referans kategori: hayır)					
Evet	0,436 ^c	0,234	1,86	-0,022	0,894
Hanehalkı büyüklüğü (referans kategori: 1-3 kişi)					
4-5 kişi	-0,339 ^c	0,181	-1,87	-0,693	0,016
6 ve üstü	-0,469	0,34	-1,38	-1,135	0,196
Konut sahipliği (referans kategori: ev sahibi değil)					
Ev sahibi	-1,558 ^a	0,201	-7,76	-1,951	-1,164

^a $p < .01$; ^b $p < .05$; ^c $p < .10$

Tablo 3.2’de katsayı değerlerine bakıldığında burada sadece bağımlı ve bağımsız değişkenler arasındaki ilişkinin yönüne dair bilgi edinebildiğinden Gompit Regresyon Modeline ait yorumlar tablo 3.3’te hesaplanan marjinal etki değerleri üzerinden yapılmıştır. Ayrıca çalışmada bağımsız değişkenlerin VIF değerleri incelenerek modelin çoklu doğrusal bağlantı içerip içermediği test edilmiştir (Alkan & Ünver, 2020). VIF değerleri 5 ve üzerinde olanların orta derecede, 10 ve üzeri olanların ise yüksek derecede çoklu doğrusal bağlantıya sebep olduğu düşünülmektedir (Ünver & Alkan, 2020). Çalışmada, değişkenlerin aralarında çoklu doğrusal bağlantı sorunu oluşturacak herhangi bir değişken bulunmamaktadır. VIF değerleri Tablo 3.3’te görülmektedir.

Tablo 3.3. Gompit Regresyon Modeli Marjinal Etki Sonuçları

Değişkenler	M.E	Standart Hata	t	Güven Aralığı (%95)		VIF
				Alt sınıır	Üst sınıır	
Yaş (referans kategori: 65+)						
24 ve altı	1,958 ^a	0,639	3,06	0,706	3,211	3,36
25-34	1,137 ^c	0,610	1,87	-0,058	2,333	2,90
35-44	0,954	0,616	1,55	-0,254	2,162	2,76
45-54	1,009 ^c	0,613	1,65	-0,192	2,21	2,25
55-64	0,595	0,621	0,96	-0,621	1,812	1,92
Medeni durum (referans kategori: hiç evlenmedi)						
Evli	0,652 ^a	0,242	2,69	0,177	1,127	2,63
Boşandı/Eşi öldü	0,817 ^b	0,374	2,19	0,085	1,549	2,17
Eğitim düzeyi (referans kategori: bir okul bitirmeyen)						
İlkokul	0,572	0,501	1,14	-0,409	1,554	2,78
İlköğretim	0,880 ^c	0,493	1,79	-0,086	1,847	2,24
Lise	1,141 ^b	0,476	2,40	0,208	2,073	2,90
Üniversite	1,439 ^a	0,954	2,90	0,467	2,41	2,83
Gelecekte umut (referans kategori: çok umutlu)						
Umutlu	-0,368	0,304	-1,21	-0,964	0,229	6,25
Umutlu değil	-0,607 ^c	0,325	-1,87	-1,243	0,029	5,46
Hiç umutlu değil	-0,348	0,34	-1,02	-1,013	0,318	3,21
Dini inanç baskısı (referans kategori: hayır)						
Evet	0,431 ^c	0,231	1,87	-0,021	0,884	1,03
Hanehalkı büyüklüğü (referans kategori: 1-3 kişi)						
4-5 kişi	-0,336 ^c	0,179	-1,87	-0,687	0,016	1,30
6 ve üstü	-0,465	0,337	-1,38	-1,126	0,195	1,26
Konut sahipliği (referans kategori: ev sahibi değil)						
Ev sahibi	-1,544 ^a	0,199	-7,75	-1,935	-1,153	1,1

^a $p < .01$; ^b $p < .05$; ^c $p < .10$; M.E:Marjinal Etki

Tablo 3.3'te verilen Gompit Regresyon Modeline göre, 24 ve altı yaş aralığındaki bir bireyin referans gruba göre son bir yılda göç etme olasılığı %195,8 daha fazladır. 25-34 yaş aralığındaki bir bireyin referans gruba göre göç etme olasılığı %113,7 daha fazladır. 45-54 yaş aralığındaki bir bireyin referans gruba göre göç etme olasılığı %100,9 daha fazladır. Evli olan bir bireyin referans gruba göre son bir yılda göç etme olasılığı %65,2 daha fazladır. Medeni durumu boşandı/eşi öldü olan bir bireyin referans gruba göre son bir yılda göç etme olasılığı %81,7 daha fazladır. İlköğretim mezunu olan bir bireyin referans gruba göre son bir yılda göç etme olasılığı %88 daha fazladır. Ayrıca lise mezunu olan bir bireyin referans gruba göre son bir yılda göç etme olasılığı %114,1 daha fazladır. Tablo 3.3 incelendiğinde üniversite mezunu olan bir bireyin referans gruba göre son bir yılda göç etme olasılığı %143,9 daha fazladır.

Tablo 3.3'e göre gelecekte umutlu olmayan bir bireyin referans gruba göre son bir yılda göç etme olasılığı %60,7 daha azdır. Dini inanç baskısı yaşayan bir bireyin referans gruba göre son bir yılda göç etme olasılığı %43,1 daha fazladır. Hanehalkı büyüklüğü 4-5 kişi olan bireylerin referans gruba göre son bir yılda göç etme olasılığı %33,6 daha azdır. Ev sahibi olan bir bireyin referans gruba göre son bir yılda göç etme olasılığı %154,4 daha azdır.

3. TARTIŞMA VE SONUÇ

Bu çalışmada, TÜİK tarafından 2021 yılında yapılan Yaşam Memnuniyeti Araştırması'nın mikro veri setleri kullanılmıştır. Çalışmanın amacı Gompit Regresyon Modeli kullanılarak bireylerin COVID-19 döneminde bireylerin göç etme davranışlarını etkileyen faktörleri belirlemektir. Analiz sonuçlarına göre yaş, medeni durum, eğitim düzeyi, gelecekteki umut, dini inanç baskısı, konut sahipliği ve hanehalkı büyüklüğü değişkenlerinin anlamlı olduğu görülmektedir.

Çalışmaya göre evli bireylerin hiç evlenmemiş bireylere göre göç etme olasılığı daha fazladır. Çalışmada bireylerin eğitim düzeyleri arttıkça göç etme olasılıklarının da arttığı görülmektedir. Çalışmaya göre umutlu olmayan bireylerin çok umutlu olan bireylere göre göç etme olasılığı daha fazladır. Dini inanç baskısı yaşayan bireylerin dini inanç baskısı yaşamayan bireylere göre göç etme olasılığı daha fazladır. Çalışmada hanehalkı büyüklüğü azaldıkça göç etme olasılığının da daha azaldığı tespit edilmiştir. Ev sahibi olan bireylerin ev sahibi olmayan bireylere göre göç etme olasılığı daha azdır.

COVID-19 Pandemisi'nin dünyada etkili olmaya başlamasıyla ortaya çıkan süreçte hemen her ülke kendi vatandaşlarını bu salgından korumak için birçok çözüm ve politika arayışına girmiştir. COVID-19 Pandemisi, her ne kadar bir sağlık problemi olarak ortaya çıkmış olsa da sosyal, siyasal ve ekonomik birçok problemin ana kaynağı olmuştur. Özellikle kamusal hizmetlere erişim, birçok hizmetin karşılanmasında eşitliğin sağlanmaya çalışılması, ekonomik sorunlar, güvenlik ile ilgili problemler, işsizlik, altyapı, ulaşım gibi kent özelinde birçok sorunun ortaya çıkmasına neden olmuştur.

Göç, birçok yönüyle incelenmesi gereken bir konu olmasının yanında, etkilerinin öngörülmemesi nedeniyle, çözümü çok zor, neredeyse imkânsız olan, çok sayıda farklı soruna zemin hazırlama potansiyeli taşıyan bir olgu olarak kabul edilmektedir (Ekici ve Tuncel, 2015, s. 20). Küreselleşmenin de etkisiyle, teknolojiye bağlı olarak ulaşım olanaklarının gelişmesi, düzenli göçü artırırken; insanlık var oldukça bitmesi olası görülmeyen, ekonomik, sosyal, siyasal ve insani nedenlere bağlı olarak ortaya çıkan düzensiz göç hareketlerinin de artarak devam etmesini kaçınılmaz kılmıştır. Küresel salgın sürecinde Türkiye'de sürekli kalmak amacıyla ya da başka ülkelere geçmek üzere, geçici olarak gelenlerin büyük kısmının eğitim seviyesinin düşük olması gerek göç yönetimi gerekse salgın sürecinde büyük sorunların yaşanmasına neden olmuştur (Emeç & Şengün, 2022). Her zaman dinamik bir konu olan göçün, yönetilmesi gereken bir alan olduğu anlayışıyla politika üretimi ve ortaya konan politikaların etkin şekilde uygulanabilmesi büyük bir önem arz etmektedir.

KAYNAKÇA

- Akıncı, B., Nergiz, A., & Gedik, E. (2015). Uyum süreci üzerine bir değerlendirme: göç ve toplumsal kabul. *Göç Araştırmaları Dergisi*, 1(2), 58-83.
- Alkan, Ö., Küçükkoğlu, U., & Ünver, Ş. (2024). Comparison of factors affecting Turkish citizens' search for online health information before and during the COVID-19 pandemic. *BMC Public Health*;24(2054), 1-11.
- Alkan, Ö., & Ünver, Ş. (2021). Determination of Factors That Affect Use of E-Commerce in Eastern Turkey Through Categorical Data Analysis. *Toros University FEASS Journal of Social Sciences*, 8(Special Issue), 22-36.
- Alkan, Ö., & Ünver, Ş. (2020). Türkiye'de E-Devlet Hizmetlerinin Kullanımını Etkileyen Faktörlerin Analizi. *Atatürk Üniversitesi İktisadi ve İdari Bilimler Dergisi*;34(4), 1431-1453.
- Ekici, S. & Tuncel, G. (2015), Göç ve insan, *Birey ve Toplum*, 5(9), 9-22.
- Emeç, B., & Şengün, H. (2022). Covid-19 Küresel Salgınının (Pandemi) Türkiye'nin Göç Yönetimine Etkisi. *Kent Araştırmaları Dergisi*;37(13), 2083-2107.
- Işık, O., & Çilhoroz, Y. (2021). Uluslararası Göçün Sağlık Statüsüne Etkisinin İncelenmesi. *Journal of Society & Social Work*;32(4), 1389-1402.
- Kurt, H. (2006). Göç eğilimleri ve olası etkileri. *Yönetim Bilimleri Dergisi*, 4(1), 148-178.
- Portes, A. (2010). Migration and social change: some conceptual reflections. *Journal of Ethnic and Migration Studies*, 36(10), 1537-1563.
- TÜİK. (2021). *Yaşam Memnuniyeti Araştırması Mikro Veri Seti*. Retrieved from https://www.tuik.gov.tr/Kurumsal/Mikro_Veri

- Türk Dil Kurumu (TDK). (2020). Göç. [Http://Www.Tdk.Gov.Tr/Index.Php?Option=Com_Gts&Arama=Gts&Guid=TDK.GTS.5c05023d0bd532.90453614](http://www.tdk.gov.tr/index.php?option=com_gts&arama=gts&guid=tdk.gts.5c05023d0bd532.90453614). Erişim Tarihi: 14.05.2020.
- Ünver, Ş., & Alkan, Ö. (2020). Türkiye’de Bireylerin Maddi Yoksunluk Durumlarını Etkileyen Faktörlerin Modellenmesi. *BMIJ*;8(2), 1334-1370.
- Ünver, Ş., Tekmanlı, H. H., & Alkan, Ö. (2023). Passive smoking as a risk factor among older adults: an ordered probability approach for Türkiye. *Front. Public Health*;11(1142635), 1-10.

ACCIDENTS IN ELECTRICAL TRANSFORMATION STATIONS

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ABSTRACT

The work of electricians who work in contact with the power electrical system is characterized by the presence of relevant physical and mental demands.

Ensuring the continuity of the electricity supply service is, nowadays, one of the most principal factors for its distributors and consumers, which is why efforts are increasingly being sought to promote, apply, and develop techniques and materials to optimize live line work, to minimize the impact of interventions in the electrical, transport and distribution grid networks.

However, nothing should override the safety of workers, as work plays a central role in the lives of these operators, and regardless of the importance of any organization's objectives, they have a legal and moral obligation to provide safe and healthy working environments to achieve its objectives.

Keywords: Life quality, Electrical Grid, Live Line Work, Occupational safety

1. INTRODUCTION

This study is part of a real problem experienced by organizations to understand, within the scope of occupational safety management, what is the balance between the needs and objectives of the business, because it is necessary for companies to have a clear vision of whether their investment translates into an effective return. This is even more evident when organizations, most of the work is carried out in facilities that, due to their characteristics are a source of danger, we are obviously talking about electrical installations, namely installations, particularly transformer substations, which have historically had the highest weight in accident rates.

Clark [1] suggests the need to clarify that the risks of operational work are not univocally linked to the individual actions of employees but are necessarily related to and interdependent on the directives issued by the chain of command, and with the modus operandi in terms of the administration and management of the service's operational organization.

The administrative and managerial decisions made upstream of the site of operations act significantly as determinants in the production of risks.

The administrative conception of work, prevalent among managers, entrepreneurs and consultants specializing in organization, assumes that standardization will mostly solve the problems identified and the difficulties of work. However, this is not the case in reality. Experience has shown that it is very difficult, when drawing up an operating procedure, to consider the many complex combinations of eventualities, events and likely scenarios [2].

Batista [3] analyzed the activity of a company in the printing industry, which employs 700 people, and the associated occupational accidents, to identify the most relevant direct and indirect causes of accidents at work in this sector of activity. To this end, a current and detailed analysis of the company's accidents was carried out, using both a management report and a history compiled in Excel files, applying the Retirement Income Advice Assessment Tool (RIAAT) methodology to the treatment of 29 non-fatal accidents.

After analyzing the data and the company's knowledge, the added value of applying an accident analysis methodology such as RIAAT became clear. Although the number of accidents analyzed was not very large and there were no serious consequences for the injured party, the results of the analysis provided an informed idea of the main safety problems in the sector.

The action plan was to implement several measures, such as training courses more focused on practical cases, greater responsibility on the part of both operators and, above all, foremen, and updating machinery whose functions can be carried out by newer machines.

The aim of Graça's [4] dissertation was to analyze the evolution of serious and fatal occupational accidents in the extractive industry, a sector where the incidence rate of accidents is very high compared to other sectors of activity in the years (2001 to 2012).

Based on surveys of accidents at work carried out by the Portuguese Authority for Working Conditions (ACT). The methodological process aimed to find out about the causes and evolution of occupational accidents, their circumstances and related occupational injuries/consequences by comparing the results obtained with statistics published by official sources and similar academic works. The RIAAT methodology was applied to the data obtained, with the necessary adaptations, to analyze the causality of accidents at work. The study has once again revealed how extremely important top-level training is in companies, aimed at improving the qualifications of the workers involved in the processes, with a view to changing behaviors and attitudes.

In his PhD thesis, Montemor [5] addressed the problem of accidents in the agriculture, livestock and forestry sector, where there is a significant volume of accidents, both at work and on the road. In this way, Montemor hoped to help solve the problem of underreporting and, consequently, contribute to the prevention and reduction of accidents by creating a single platform for registration.

By characterizing the environments in which accidents occur, namely the policy guidelines and regulations on occupational health and safety, the structure of the organizations, the traits, social relations and the workforce used, as well as the risk factors. The characterization of accidents was based on statistical data from different Portuguese authorities in order to cover all types of accident (at work, on the road and those occurring while carrying out tasks associated with hobbies, leisure time or to supplement income).

One of the conclusions drawn from the study by the author was that there is a trend towards the ageing of rural producers, where there is little information and training on occupational risks and the massive use of tractors, mostly old ones, leading to a notable volume of accidents in the sector.

More recently, Neto, et al. [6] addressed accidents in the road freight transport sector, where reducing accidents is one of the major challenges for companies in the sector today. The methodology focused on the application of questionnaires to around 30 organizations considered to be benchmarks in the sector.

It was then concluded that the issue of accidents in the road transport companies that were the subject of the study did not have the necessary management involvement, nor did they have initiatives in communication and training for their employees. To remedy this shortcoming, the authors proposed the creation of a conceptual model that would be easy for people to understand. This conceptual model proposes that companies draw up their policies and plans, including objectives and process design, focused on reducing accidents, and put into practice their communication, training and awareness-raising activities.

The various references presented above in various sectors of activity show that there is a commitment to information/training as a means of preventing and minimizing accidents. Various research approaches have been applied, such as the application of accident investigation methodologies and the application of questionnaires to certain population samples in quantitative approaches.

2. METHODOLOGY

2.1. The concept of indicators

Searching for information on indicators returns countless results, and from the most diverse categories: economic, social, financial, environmental, health, political, etc. However, all these indicators have one thing in common. This is that they refer to precise and constant information that allows top management to make organizational decisions. The importance of indicators is clear, and their role has become fundamental in decision-making, whether in small companies or multinationals.

In a report on environmental indicators, the Organization for Economic Cooperation and Development (OECD) defines indicators as follows: "(...) a parameter, or a value calculated from parameters,

providing indications about or describing the state of a phenomenon, the environment or a geographical area, of a wider range than the information directly linked to the value of a parameter." [7].

There are various definitions by various authors, but Hartmut Bossel defines indicators as something we live with every day. "Indicators are our connection to the world. They condense its enormous complexity into a manageable amount of meaningful information, into a subset of observations that inform our decisions and direct our actions. (...) Indicators represent valuable information. (...) Indicators are an expression of values" [8].

In summary, although different authors use different terms to define the concept of indicator (referring to it as a parameter, measure or value), they agree that indicators are a way of simplifying and summarizing phenomena by quantifying them.

2.2. Organizational indicators

According to APCER [9], there are various indicators that we can use to measure and monitor performance (table 1).

Proactive

- Supported by the management program;
- Based on operational criteria;
- Consistent with legal and regulatory requirements.

Reactive

Based on accidents, illnesses and other historical evidence of poor performance (such as statistical analyses of claims).

Table 1: Occupational safety indicators

Pro-Active Indicators	<ul style="list-style-type: none"> a) Number of people trained in OHS; b) Effectiveness of OSH training; c) Number of suggestions from workers for OSH improvements; d) Frequency of OSH audits; e) Time taken to implement OSH audit recommendations; f) Frequency and effectiveness of OSH committee meetings; g) Frequency and effectiveness of OSH meetings with employees; h) Reports from OSH specialists; i) Time taken to implement actions on complaints or suggestions; j) Number of health surveillance reports; k) Sample reports on personal exposure; l) Workplace exposure levels (e.g. noise, dust, gases, etc.); m) Use of personal protective equipment.
Reactive Indicators	<ul style="list-style-type: none"> a) Number of unsafe acts; b) Dangerous conditions; c) Number of "near misses"; d) Accidents that only cause material damage; e) Dangerous occurrences reported; f) Accidents involving absence from work for more than three days; g) Absences due to illness - employee absences due to illness (occupation-related) (occupation-related); h) Complaints made, for example, by members of society.

Indicators can be monitored qualitatively or quantitatively and, whenever possible, performance measures should be quantified so that comparisons can be made efficiently. Quantitative measures can be described in quantitative terms and recorded on a scale.

Qualitative measures, which are, for example, descriptions of conditions or situations that cannot be quantified, can be evaluated and recorded, for example, with a comment on the deliberations of an OSH committee [9].

Indicators that allow for active surveillance are indicators that allow for the monitoring of objectives and, above all, those that confirm the implementation of risk control measures. This continuous monitoring allows us to predict potentially unwanted events and preventive measures to be implemented and maintained before any occur.

2.3. Occupational safety and health indicators

Table 2 summarizes the accident index.

Table 2: Accident Index

Accident Index	
Frequency Index (IF)	Number of occupational accidents by one million hours worked
Severity Index (IS)	Number of lost days by one million hours worked
Incidence Index (II)	Number of occupational accidents for 1 000 employees

2.4. Workers

The success of a company in more competitive markets depends not only on the quality of its products and services and other factors, but largely directly on all employees.

In this way, it is important that management can count on teams that are organized and aligned with the management's objectives, but also that it promotes and guarantees the satisfaction and motivation of employees, ensuring that their dedication is increasingly better, increasing their productivity.

1.1. Professional training

Employers and their representatives are obliged to promote qualifying training, with the aim of promoting the creation of skills that allow preventive management to be integrated into the company's overall management. The training of workers and their representatives must also be training, whose primary objective is the creation of skills and the internalization of appropriate preventive behaviors.

1.2. Preventive Safety Observations

Preventive techniques, aimed at identifying and controlling unsafe acts/conditions, through the observation of workers during the development of their work, when compared with the values collected from work accidents, reveal to us that in years of greater focus on prevention and In anticipation of the most common risk situations and the discovery of new dangers, accident rates tend to decrease. The used was Audits, Inspections, Visits and Observations (AIVO).

1.3. Weather

The climate is constantly changing, and industrialization is increasingly polluting. The industry, in partnership with large energy utilities and some large equipment manufacturers, has tried to respond to these challenges by developing processes to improve the manufacturing of new technologies.

Electrical power distribution lines are frequently subject to overvoltages and atmospheric discharges that contribute to interruptions in the supply of electrical energy, caused by atmospheric conditions, namely salt fog.

2. FUTURE WORKS

The problem was identified, which is high voltage work that can cause serious accidents to workers.

The indicators to be used were identified in order to monitor security practices and predict future performance.

The next step is to collect information and apply the indicators indicated above.

In general, these indicators convey the importance of investment in safety, in the sense of the value of prevention in the lives of workers, in improving environmental conditions, in reducing risks in work processes, in qualification and in the adoption of control measures preventive.

REFERENCES

- [1] Clark, J. L. (1793). The Management Oversight and Risk Tree (MORT) - A New System Safety Program. <https://www.osti.gov/servlets/purl/4175026/>
- [2] Llory, M. (2013). A Investigação de Acidentes Industriais: uma entrevista com Michel Llory, pp. 262-269
- [3] Batista, G. A. (2013). Estudo Aprofundado da Sinistralidade numa Empresa da Indústria Gráfica em Portugal. https://run.unl.pt/bitstream/10362/10906/1/Batista_2013.pdf
- [4] Graça, M. J. (2014). Sinistralidade laboral no setor da indústria extrativa no triângulo do mármore. <https://repositorio.ipl.pt/bitstream/10400.21/4225/1/Sinistralidade%20laboral%20no%20setor%20da%20ind%20C3%BAstria%20extrativa%20no%20tri%20C3%A2ngulo%20do%20m%20C3%A1rmore.pdf>
- [5] Montemor, C. M. (2017). Sinistralidade laboral nos setores de atividade agrícola, pecuária e florestal. doi:978-989-8905-53-6
- [6] Neto, A. G., Silva, J. C., Reis, M. B., Ribeiro, M. F., Costa, M. F., & Brito, P. C. (2020). Redução da sinistralidade no transporte rodoviário de carga. <https://repositorio.itl.org.br/jspui/bitstream/123456789/497/1/Redu%C3%A7%C3%A3o%20da%20sinistralidade%20no%20transporte%20rodovi%C3%A1rio%20de%20carga.pdf>
- [7] OCDE. (2002). Rumo a um Desenvolvimento Sustentável – Indicadores Ambientais, 9, p. 191; 204. <https://www.oecd.org/env/indicators-modelling-outlooks/2345364.pdf>
- [8] Bossel, H. (1999). (I. I. Development, Ed.) Indicators for Sustainable Development: Theory, Method, Applications. DOI: ISBN 1-895536-13-8
- [9] APCER. (2003). Linhas de orientação para a interpretação da norma OHSAS 18001/NP 4397. Obtido em 26 de março de 2022

BENEFITS DRIVEN BY SUSTAINABLE DEVELOPMENT GOALS (SDGs) FOR DEVELOPING COUNTRIES: A SYSTEMATIC REVIEW (2016-2024)

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Abstract

This systematic review explores the specific benefits that developing countries have obtained through the adoption and execution of Sustainable Development Goals (SDGs) from 2016 to 2024. Utilizing an extensive search strategy, pertinent studies were identified and synthesized to offer insights into the economic, social, and environmental impacts of implementing SDGs in developing nations. The review underscores the diverse advantages accrued by these countries and delineates key trends, challenges, and opportunities linked to the progress of SDGs. The findings from this review contribute significantly to a more profound comprehension of the transformative capacity of SDGs and furnish valuable insights for policymakers, practitioners, and researchers engaged in advancing sustainable development objectives in developing countries. The study draws upon excerpts from the "Handbook of Sustainability Science and Research" published by Springer International in 2018, edited by Walter Leal Filho within the World Sustainability Series.

Keywords: Sustainable Development Goals, Developing countries, Benefits, and Impact.

Background of Issues

The adoption of the Sustainable Development Goals (SDGs) by the United Nations in 2015 marked a significant milestone in global efforts to address pressing socio-economic and environmental challenges (Nations, 2015). The 17 SDGs, encompassing 169 targets, provide a comprehensive framework for promoting sustainable development across economic, social, and environmental dimensions, with the overarching aim of eradicating poverty, reducing inequality, and protecting the planet. While all countries committed to working towards achieving the SDGs, developing nations face unique challenges in their pursuit of sustainable development. These challenges include limited financial resources, inadequate infrastructure, and vulnerability to environmental risks and climate change impacts (W. Bank., 2020a). Despite these challenges, developing countries have demonstrated a strong commitment to SDG implementation, recognizing the potential benefits of aligning national development agendas with the SDGs.

Over the past two decades, from 2016 to 2024, developing countries across different continents have embarked on various initiatives aimed at advancing SDG-related goals and targets. In Africa, countries such as Nigeria, Ethiopia, and Kenya have focused on poverty reduction, healthcare improvement, and education access (United Nations Development Programme, (U. N. D. Programme., 2020). Similarly, in Asia, nations like India and Indonesia have prioritized economic growth, social equity, and environmental sustainability through SDG implementation Asian Development Bank, (Bank.A. D., 2018).

In Europe, countries such as Kosovo and Albania have sought to address inequalities and promote environmental conservation within their unique geopolitical and economic contexts (European Union, 2020). Meanwhile, in North America, nations like Haiti and Honduras have made notable progress in advancing SDG-related initiatives despite facing challenges such as political instability and natural disasters (Inter-American Development Bank, (Bank I.-A. D., 2019).

However, despite the concerted efforts of developing countries to implement SDGs, there remains a gap in understanding the specific benefits derived from their engagement with the SDG framework. Existing research often focuses on aggregate assessments of global SDG progress or case studies of individual countries, overlooking the nuanced experiences and impacts of SDG implementation in developing countries. Therefore, there is a need for a systematic review that comprehensively examines the specific benefits driven by SDGs for developing countries from 2016 to 2024.

Introduction

The Sustainable Development Goals (SDGs), established by the United Nations in 2015, serve as a universal framework aimed at addressing pressing global challenges while fostering sustainable development United Nations, (Nations, 2015). These goals encompass a wide range of objectives, including poverty eradication, environmental conservation, and social inclusion, and are intended to guide international efforts towards a more equitable and sustainable future

While all nations are encouraged to pursue the SDGs, developing countries, in particular, stand to benefit significantly from their implementation World Bank, (Bank. W., 2020b). Over the past two decades, from 2016 to 2024, numerous developing countries across different continents have actively pursued SDGs as part of their national development agendas.

In Africa, countries such as Nigeria, Ethiopia, and Kenya have undertaken various initiatives aimed at achieving SDG targets related to poverty reduction, healthcare improvement, and education access United Nations Development Programme,(U. N. D. Programme., 2020). Similarly, in Asia, nations like India and Indonesia have grappled with diverse socio-economic challenges while striving to promote economic growth, social equity, and environmental sustainability through SDG implementation Asian Development Bank, (Bank. A. D., 2018).

In Europe, countries such as Kosovo and Albania have endeavoured to address inequalities and promote environmental conservation within their unique geopolitical and economic contexts (European Union, 2020). Meanwhile, in North America, nations like Haiti and Honduras have confronted development challenges exacerbated by political instability and natural disasters, yet have made notable progress in advancing SDG-related initiatives Inter-American Development Bank, (Bank. I.-A. D., 2019).

Likewise, in South America, countries such as Bolivia and Ecuador have prioritized efforts to tackle poverty, inequality, and environmental degradation through SDG implementation United Nations Economic Commission for Latin America and the Caribbean, (Caribbean., 2020). Finally, in Australia (or Oceania), nations like Papua New Guinea and Fiji have recognized the significance of sustainable resource management and climate change adaptation in achieving SDG objectives Pacific Community, (Community., 2021).

This systematic review seeks to delve into the specific benefits derived by developing countries across these continents from their engagement with SDGs. By providing insights into the progress, challenges, and opportunities associated with SDG implementation in diverse socio-economic contexts, this review aims to contribute to a deeper understanding of the transformative potential of SDGs for developing countries.

The study focuses on six continents Africa, Asia, Europe, North America, South America, and Australia and their respective countries.

Africa	Asia	Europe	North America	South America	Australia
Nigeria	India	Kosovo	Haiti	Bolivia	Papua New Guinea
Ethiopia	Bangladesh	Moldova	Honduras	Ecuador	Fiji
Kenya	Pakistan	Albania	Guatemala	Paraguay	Solomon Islands
Ghana	Indonesia	Bosnia and Herzegovina	Nicaragua	Guyana	Vanuatu
Tanzania	Philippines	North Macedonia	El Salvador	Suriname	Samoa
Uganda	Vietnam	Montenegro			
Zambia	Cambodia	Armenia			

Research Phenomenon

The research phenomenon under investigation in this systematic review is the specific benefits driven by Sustainable Development Goals (SDGs) for developing countries over the period from 2016 to 2024. This phenomenon encompasses the multifaceted impacts of SDG implementation on economic, social, and environmental dimensions of development in diverse socio-economic contexts.

Numerous studies and reports have documented the transformative potential of SDGs and their contributions to sustainable development outcomes in developing countries. For example, the United Nations Development Programme's (UNDP) "Africa Sustainable Development Goals Report 2020" provides insights into the progress, challenges, and opportunities associated with SDG implementation in Africa UNDP,(U. N. D. Programme., 2020). The report highlights the efforts of African countries in

pursuing SDGs and showcases success stories and best practices in areas such as poverty reduction, education, healthcare, gender equality, and environmental sustainability.

Similarly, the Asian Development Bank's (ADB) report titled "Achieving the Sustainable Development Goals in Asia and the Pacific: Compilation of Good Practices and Lessons Learned" offers valuable insights into SDG implementation efforts in the Asia-Pacific region ADB,(Bank. A. D., 2018). The report documents successful strategies and initiatives undertaken by Asian countries to address key development challenges and advance progress towards SDGs.

Furthermore, the European Union's (EU) "SDG Acceleration Actions 2020" report provides an overview of SDG implementation progress and acceleration actions undertaken by EU member states to achieve sustainable development objectives EU, (Union., 2020). The report underscores the importance of integrated and coordinated approaches to SDG implementation, emphasizing the need for policy coherence, multi-stakeholder partnerships, and innovative solutions.

These sources, among others, contribute to our understanding of the research phenomenon by highlighting the diverse benefits and impacts of SDGs on developing countries' development trajectories. Through a systematic review of such literature, this study aims to synthesize existing evidence and provide comprehensive insights into the specific benefits derived by developing countries from their engagement with SDGs. The research gap in the existing literature lies in the comprehensive synthesis and analysis of the specific benefits driven by Sustainable Development Goals (SDGs) for developing countries over the period from 2016 to 2024. While numerous studies and reports have examined the progress and challenges associated with SDG implementation in various regions and countries, there is a lack of systematic review focusing specifically on the benefits accrued by developing nations.

Existing literature tends to provide fragmented insights into specific aspects of SDG implementation or focus on case studies of individual countries or regions. While these studies offer valuable insights into the mechanisms and pathways through which SDGs can contribute to sustainable development, there is a need for a holistic analysis that synthesizes evidence across different dimensions of development and across a broader range of developing countries.

Furthermore, many existing studies primarily focus on progress towards SDG targets or indicators, rather than explicitly analysing the tangible benefits and impacts of SDG implementation on socio-economic development outcomes. As a result, there is limited understanding of the direct and indirect benefits derived by developing countries from their engagement with SDGs, including economic growth, poverty reduction, social inclusion, and environmental sustainability.

Moreover, the majority of existing literature predominantly focuses on recent years following the adoption of SDGs in 2015, with relatively fewer studies examining the longer-term trends and impacts of SDG implementation over the past two decades. This temporal gap in the literature limits our understanding of the evolution of SDG-related benefits and the effectiveness of policies and interventions implemented by developing countries to achieve sustainable development objectives.

Therefore, there is a clear research gap in the systematic review of the specific benefits driven by SDGs for developing countries from 2004 to 2024. By addressing this gap, the proposed study aims to provide comprehensive insights into the transformative potential of SDGs and their contributions to sustainable development outcomes in diverse socio-economic contexts

Research Novelty

Research novelty refers to the unique and original contribution that a study makes to the existing body of knowledge in its field. In the context of a systematic review on the benefits driven by Sustainable Development Goals (SDGs) for developing countries from 2016 to 2024, the research novelty can be delineated as follows:

Temporal Scope: This systematic review covers the period from 2016 to 2024, providing a comprehensive analysis of the benefits derived by developing countries from SDG implementation during this timeframe. By focusing on recent years, the study captures current trends and developments in SDG progress, offering insights that may not be available in earlier reviews.

Holistic Approach: The review adopts a holistic approach to examining the benefits of SDGs, considering economic, social, and environmental dimensions of development. While previous studies may have focused on specific aspects of SDG implementation, this review synthesizes evidence across multiple domains, providing a comprehensive understanding of the multifaceted impacts of SDGs on developing countries.

Developing Country Focus: While SDGs are a global agenda, developing countries often face unique challenges and opportunities in their pursuit of sustainable development. By specifically examining the benefits for developing countries, this review fills a gap in the literature and provides insights that are relevant and actionable for policymakers and practitioners working in these contexts.

Comparative Analysis: The review compares and contrasts the experiences of developing countries across different continents, highlighting common patterns, as well as unique challenges and successes. By conducting a comparative analysis, the study offers valuable insights into the diverse socio-economic contexts in which SDGs are implemented and sheds light on factors that contribute to varying levels of success.

Policy Implications: Beyond synthesizing existing evidence, the review offers policy implications and recommendations for enhancing the effectiveness of SDG implementation in developing countries. By translating research findings into actionable recommendations, the study contributes to bridging the gap between research and practice, ultimately facilitating more informed decision-making and policy formulation.

Problem Statement:

Despite the global commitment to Sustainable Development Goals (SDGs), there remains a critical gap in understanding the specific benefits that developing countries have derived from their implementation efforts over the period from 2016 to 2024. While numerous studies have explored progress towards SDG targets and indicators, there is limited comprehensive analysis focusing on the tangible benefits accrued by developing nations from their engagement with SDGs.

Previous research has primarily focused on aggregate assessments of global SDG progress or case studies of individual countries or regions, often overlooking the nuanced experiences and impacts of SDG implementation in developing countries United Nations, (Nations, 2015). This gap in the literature hinders our ability to fully assess the effectiveness of SDGs in promoting sustainable development and addressing the unique challenges faced by developing nations.

Furthermore, existing studies often lack a temporal perspective, failing to capture the evolving nature of SDG-related benefits over time. By limiting their analysis to recent years following the adoption of SDGs in 2015, these studies overlook the longer-term trends and impacts of SDG implementation, thereby hindering our understanding of the trajectory of sustainable development efforts in developing countries World Bank,(Bank. W., 2020b).

Research Question

- 1.What are the specific economic benefits derived by developing countries from the pursuit and implementation of Sustainable Development Goals (SDGs) between 2016 and 2024?
- 2.What social advantages have developing countries experienced as a result of their engagement with Sustainable Development Goals (SDGs) from 2016to 2024?
- 3.How have environmental outcomes in developing countries been influenced by their efforts towards achieving Sustainable Development Goals (SDGs) during the period 2016-2024?
- 4.What are the overarching benefits, both direct and indirect, that developing countries have gained from their commitment to Sustainable Development Goals (SDGs) between 2016 and 2024?

Objective

- 1.To comprehensively identify the specific economic benefits accrued by developing countries through the pursuit and implementation of Sustainable Development Goals (SDGs) between 2016 and 2024.
- 2.To analyse and synthesize the social advantages that developing countries have experienced as a result of their engagement with Sustainable Development Goals (SDGs) from 2016 to 2024.
- 3.To assess the influence of Sustainable Development Goals (SDGs) on environmental outcomes in developing countries during the period 2016-2024.
- 4.To provide a holistic overview of the overarching benefits, both direct and indirect, that developing countries have gained from their commitment to Sustainable Development Goals (SDGs) between 2016 and 2024.

Literature Review

The Sustainable Development Goals (SDGs) serve as a universal call to action to end poverty, protect the planet, and ensure prosperity for all United Nations,(Nations, 2015). Developing countries across Africa, Asia, Europe, North America, South America, and Australia have been actively engaged in pursuing these goals, each facing unique challenges and opportunities in their implementation efforts.

This literature review examines the benefits and impact of SDG implementation in the context of the following countries:

Africa. Nigeria, Ethiopia, Kenya, Ghana, Tanzania, Uganda, and Zambia have prioritized SDG implementation to address a range of development challenges, including poverty, healthcare, education, and infrastructure United Nations Development Programme,(U. N. D. Programme., 2020). These countries have made progress in poverty reduction, healthcare access, and education outcomes, contributing to overall socio-economic development.

Asia. Countries like India, Bangladesh, Pakistan, Indonesia, and the Philippines in Asia have pursued SDGs amidst diverse socio-economic contexts Asian Development Bank,(Bank. A. D., 2018b). Economic growth, social equity, and environmental sustainability have been emphasized in these nations, leading to varying degrees of progress and impact in different sectors.

Europe. Kosovo, Moldova, Albania, and other European countries have integrated SDGs into their national development plans, focusing on reducing inequalities and promoting environmental conservation European Union,(Union., 2020). Efforts to address socio-economic disparities and enhance environmental protection have been documented, with progress observed in areas such as education, healthcare, and environmental sustainability.

North America. Countries in North America, including Haiti, Honduras, Guatemala, Nicaragua, and El Salvador, have faced challenges such as political instability and natural disasters Inter-American Development Bank, (Bank. I.-A. D., 2019). Despite these challenges, progress has been made in SDG-related initiatives aimed at improving living standards, infrastructure development, and disaster resilience.

South America. Bolivia, Ecuador, Paraguay, Guyana, and Suriname are among the South American nations actively engaged in SDG implementation efforts United Nations Economic Commission for Latin America and the Caribbean, (Caribbean., 2020). Progress has been observed in poverty reduction, gender equality, and environmental conservation, highlighting the multifaceted impact of SDGs on development outcomes.

Australia. In Australia and neighbouring Oceania countries like Papua New Guinea, Fiji, and Solomon Islands, sustainable resource management and climate change adaptation have been prioritized in SDG implementation efforts Pacific Community, (Community., 2021). Strategies for enhancing resilience and promoting environmental sustainability have been explored, with a focus on biodiversity conservation and climate resilience.

Review of Related Literature

In a recent literature review, (Amaro, 2012) provided valuable insights into the role of renewable energy in advancing sustainable development goals. By synthesizing findings from various studies, Amaro highlighted the potential of renewable energy to mitigate environmental impacts, promote economic growth, and enhance social well-being. The review underscored the importance of incorporating renewable energy initiatives into broader sustainability strategies, emphasizing the need for interdisciplinary approaches and stakeholder collaboration. Pruneau et al., (2018) conducted an intriguing study exploring the utilization of design thinking methodology and the social media platform Facebook to address water-related challenges faced by Moroccan women. Their research delved into the complexities of environmental problems, particularly the impact of flooding on water supply systems in Morocco. The study emphasized the need for collaborative and innovative solutions, showcasing the efficacy of inclusive and participatory approaches in fostering sustainable development.

Mair et al., (2018) offered a thought-provoking examination of the role of indicators in the implementation of the Sustainable Development Goals (SDGs). While highlighting the transformative potential of the SDGs in promoting holistic and sustainable prosperity, they emphasized the importance of effective implementation, which is heavily reliant on a set of 230 indicators. Despite criticisms, the authors argued that indicators can still play a useful role in SDG implementation, stressing the importance of taking indicator critiques seriously. Hultman & Säwe, (2018) presented a compelling examination of differing sustainability logics surrounding societal benefits and socio-economic profit. Through a qualitative approach, they analysed a case study involving a change in Swedish natural resource management policy, demonstrating the importance of innovative environmental governance constellations in resolving conflicts and fostering cooperation among stakeholders with shared sustainability goals.

Hoefel et al., (2018) provided an insightful analysis of corporate sustainable strategies in industries located along the Dom Pedro I industrial road axis in São Paulo, Brazil. Their study addressed pressing challenges such as urban sprawl and increasing resource demand, identifying a diversity of environmental management actions motivated by the need to reduce operational costs, enhance environmental responsibility, and comply with legislation. Seixas et al., (2018) conducted a comprehensive analysis of water resources management, focusing on the Piracicaba River Water Basin in São Paulo, Brazil. By examining the socio-environmental history of the basin and involving surrounding communities in collective actions, the authors aimed to raise awareness about the importance of regional rivers and stimulate conservation efforts, highlighting the importance of holistic water management approaches.

Alghamdi, (2018) delved into the crucial issue of sustainability awareness and behavior among students in public universities in Saudi Arabia. The study underscored the significance of mainstreaming sustainability education in universities, revealing limited knowledge about sustainability among students and indicating a pressing need for enhanced education and awareness initiatives. Figueroa Vélez et al., (2018) presented a compelling case for integrating Education for Sustainable Development (ESD) into school curricula to support the achievement of SDGs, particularly in urban environments. Their study focused on a specific environmental project in Bogotá, Colombia, emphasizing the importance of urban green spaces for city resilience and biodiversity conservation. Hinton et al., (2018) addressed the critical issue of food insecurity among low-income families in Meadville, Pennsylvania, USA. Their proposal of a community-based solution through education and practical initiatives, such as establishing community and school gardens, highlighted the urgency of addressing food insecurity within the framework of sustainable development goals.

MacDonald et al., (2018), provided a comprehensive exploration of the role of multi-stakeholder partnerships in achieving Sustainable Development Goals (SDGs) #11 and #17, particularly in the context of sustainable communities and cities. Their research effectively highlighted the significance of collaborative governance structures in addressing complex social and ecological challenges, aligning with the principles outlined in the Brundtland Report and Agenda 21. Ceulemans et al., (2018), presented a thorough investigation into sustainability reporting practices within higher education institutions, focusing specifically on a Belgian business faculty. Through the lens of action research, they meticulously explored the sustainability reporting process, shedding light on its implementation, challenges, and opportunities.

Ribeiro et al., (2018) provided a comprehensive analysis of Brazil's performance in achieving the Millennium Development Goals (MDGs) and its implications for the implementation of Sustainable Development Goals (SDGs). Despite Brazil's success in some areas, the authors highlighted persistent challenges in achieving universal primary education, promoting gender equality, improving maternal health, and combating diseases like HIV/AIDS and malaria. They underscored the importance of the sustainability tripod—environmental, social, and economic in the context of SDGs, emphasizing the need for harmony among these pillars for sustainable development. (Ribeiro et al., 2018). Bonina et al., (2018), explored the evolving landscape of corporate policies in response to the challenges posed by sustainable development goals. Their study focused on the importance of corporate policies in fostering engagement with communities affected by corporate activities, emphasizing inclusive practices that prioritize reducing environmental exploitation, fostering positive community relationships, and ensuring economic sustainability.

Hands & Anderson, (2018), delved into the potential of indicators in fostering engagement with the United Nations' Sustainable Development Goals (SDGs) within the higher education (HE) sector. They argued for greater engagement at all levels to effectively implement the SDGs, emphasizing the need for collaboration both internally within universities and externally with stakeholders. Kagan & Burton, (2018), explored the critical role of multi-disciplinary social science in addressing the challenges of sustainable development, particularly through the lens of the Sustainable Development Goals (SDGs). They argued for a deeper understanding of social aspects to effectively address sustainability challenges, highlighting human values such as stewardship, social justice, and solidarity. Through the application of the ideology–action–structure complexes framework, they critically examined contradictions and paradoxes within the set of SDGs, aiming to comprehend transformative change and develop local sustainability living groups. Gustafsson & Ivner, (2018), explored the integration of the Sustainable Development Goals (SDGs) into municipal strategies, emphasizing the importance of collaboration and

integrated approaches at the local level. Focusing on the implementation process within the regional municipality of region Östergötland, Sweden, the authors discussed the challenges and opportunities associated with incorporating the SDGs into existing management and working procedures. Through a pre-study of the regional municipality's ideas and reflections on SDG implementation, the authors provided recommendations on how these organizations can effectively integrate the SDGs into their strategies and practices.

Wennersten & Qie, (2018), examined the implications of the United Nations Sustainable Development Goals (SDGs) for resource use, particularly focusing on social issues and the challenge of eradicating poverty. They argued for fundamental changes in economic approaches to natural resources and emphasized the ethical dimensions of addressing global resource challenges. Through the analysis of the IPAT equation and the case study of China's development, they highlighted the potential for increased resource use leading to international conflicts and environmental degradation. Swain (2018) conducted a critical analysis of the United Nations Sustainable Development Goals (SDGs), highlighting inconsistencies, challenges in quantification and monitoring, and questions regarding resource allocation. The analysis suggested that developed countries should focus on social and environmental policies, while developing countries should prioritize economic and social policies in the short run, with environmental policies remaining significant for sustainable development.

In a recent study by Idrus et al., (2018), the rapid urban growth and spatial spread in Malaysia, particularly focusing on the emergence of the Kuala Lumpur mega urban region, were explored. The paper analyzed urbanization trends, challenges, and opportunities within the framework of sustainability science, with a particular emphasis on the Sustainable Development Goals (SDGs) as guiding principles for managing urban development. By examining data from various sources and conducting field observations, the authors highlighted the transformation of Kuala Lumpur into a vibrant mega urban region, facing both achievements and challenges in infrastructure, housing, economic diversity, and environmental sustainability. Schneider & Lüderitz, (2018), presented an upgraded study course in Ecological Engineering at the University of Applied Sciences Magdeburg-Stendal, Germany, focusing on integrating ecosystem services into the curriculum as part of the Nexus approach to resource management. The paper outlined the scientific and educational methodology used to develop the curriculum, emphasizing the importance of sustainability awareness and SDG 4 on Higher Education and Life Long Learning. The study course aimed to unlock the full potential for practical sustainability implementation by incorporating concepts such as ecosystem services and Material Flow Analysis. Ecological Engineering, as described in the paper, involved integrating human activities into the natural environment to enhance sustainability using ecological principles.

Mohamed et al.,(2018), addressed the challenges of waste management in Malaysian cities, particularly in Kuala Lumpur, amidst rapid urban growth and population increase. They highlighted the critical issue of waste generation, which had doubled from 2001 to 2012, necessitating more resources for waste management. The paper aimed to analyze factors influencing waste flow and identify key strategies for achieving sustainable waste management. The authors conducted analyses on various factors such as waste generation patterns, technology, infrastructure, financial resources, legal frameworks, human resources, and waste management systems. They emphasized the importance of understanding waste flow to develop effective waste management strategies, advocating for waste reduction, separation at the source, and recycling to minimize waste generation and landfill disposal.

Idrus et al., (2018), addressed the challenges posed by rapid urbanization and population growth in Malaysia and other Asian countries, emphasizing the importance of urban and peri-urban forestry in creating liveable cities amidst these demographic changes. The paper highlighted the role of green infrastructure, specifically urban and peri-urban forests, in enhancing urban liveability and addressing environmental concerns. The authors discussed the increasing urbanization trends globally, with more than 50% of the world's population residing in towns and cities, expected to increase to over 70% by 2050. They also highlighted the rapid urbanization in the Asia Pacific region, particularly in Malaysia, where urbanization rates have increased significantly over the past two decades. The study emphasized the importance of urban and peri-urban forestry in mitigating the adverse effects of urbanization on the environment and human well-being.

Nikulina et al., ((2018), delve into the crucial role of transportation in sustainable urban development, emphasizing the challenges posed by increasing demand for transportation services and the importance of integrated transportation systems in achieving Sustainable Development Goal 11. Through the use of

futures methodologies, the authors advocate for informed decision-making in transportation planning to ensure sustainability, cost-effectiveness, and profitability. The paper provides valuable insights into the complex dynamics of transportation planning and its implications for achieving sustainable cities and communities. Tairu, (2018), explores the concept of Green Human Resource Management (GHRM) within higher education institutions, focusing on the case study of Divine Word University (DWU) in Papua New Guinea. Despite existing policies aimed at environmental conservation, such as paperless initiatives and solar energy utilization, the study reveals a gap in awareness among staff and students regarding sustainable practices. The paper underscores the pivotal role of higher education institutions, like DWU, in promoting environmental sustainability and economic development in alignment with national goals. Aoyagi & Yoshida, (2018), delve into the challenge of achieving sustainable lifestyles, poverty alleviation, and economic development in developing countries, particularly in the Southeast Asian region. The paper emphasizes the need to decouple economic growth from resource consumption to mitigate environmental impacts. Through a case study conducted in Thailand, the authors explore the concept of "compressed development" and its relationship with education as a means to skip the environmentally detrimental stages of development.

Tschiggerl & Topić, (2018), offer a comprehensive analysis of sustainability and efficiency practices in energy-intensive industries, focusing particularly on foundries. By considering life cycle aspects and fostering collaboration across disciplines, the approach aims to provide a holistic understanding of sustainability practices in foundries. Helling,(2018), provides a compelling case study of the Environmental Campus Birkenfeld, illustrating how universities can actively contribute to the implementation process of the Sustainable Development Goals (SDGs). The Environmental Campus Birkenfeld, founded in 1996, serves as a role model for sustainable development initiatives in higher education institutions. Through innovative sustainability practices in research and teaching, the Environmental Campus Birkenfeld engages students in interdisciplinary teamwork, seminars, and projects with various stakeholders, fostering a culture of sustainability.

San Sebastian, (2018), presents a poignant exploration of indigenous environmental virtues practiced in the St. John Paul II Village in Infanta, Quezon, Philippines, following the devastating 2004 flash flood. Using a phenomenological method, the study delves into the lived experiences of the community members, predominantly subsistence farmers and fishermen, who were victims of the natural disaster. San Sebastian, (2018), draws upon indigenous environmental virtues observed within the community, discerned through thematic reflection and eidetic insight. These virtues, deeply rooted in the cultural fabric of the Philippines, are seen as integral to holistic spirituality and contribute to the pursuit of sustainable development goals (SDGs). By incorporating local wisdom and values into the discourse on sustainability, the study advocates for a culturally sensitive approach to environmental ethics and development initiatives. Gustafsson & Andréen, (2018),advocate for a process management approach to integrating sustainability perspectives into spatial planning processes, leveraging existing structures and competencies while ensuring user-friendliness and local adaptation. By reflecting on existing tools and practices, the paper offers valuable insights for municipalities striving to develop sustainable urban environments.

Saari et al., (2018), offer a thought-provoking conceptual framework for green marketing that transcends traditional consumer segmentation approaches. In their paper titled "Designing Green Marketing Across Industries: By integrating industry-specific considerations into marketing strategies, Saari et al. propose a transdisciplinary approach that has the potential to drive significant shifts towards sustainable consumption patterns. This paper provides valuable insights for marketers and researchers alike, offering a fresh perspective on how to effectively promote green products in today's market. Mohamed et al., (2018), present a comprehensive conceptual framework aimed at fostering environmental awareness among the Malaysian populace by leveraging sustainable development principles and the dialogic change model. Titled "Challenges of Ecosystem Resilience: An Aspect of the Sustainability Science Approach in the Study of Environmental Awareness in the Selayang Municipal Council, Selangor, Malaysia," the paper delves into the urgent need to address safety concerns and social issues in rapidly growing Malaysian cities. By integrating insights from sustainability science, the authors highlight the importance of ecosystem resilience in mitigating environmental degradation and promoting sustainable urban development.

Ohioze, (2018), explores the impact of human capital development on the gross domestic product (GDP) growth rate in Nigeria, utilizing the augmented Solow human-capital-growth model. Titled "Millennium

Development Goals in Nigeria: Improving and Sustaining Growth Rate," the study examines quarterly time series data from 2000 to 2015 to assess the influence of various factors on GDP growth. Ohio recommends prioritizing policies that enhance human capital quality and foster macroeconomic stability to attract foreign investment and sustain GDP growth in Nigeria. Sachs et al., (2019), delve into sustainability-oriented organizational development at the University of Hamburg, Germany, through the lens of the Center for a Sustainable University. Titled "Sustainability at German Universities: The University of Hamburg as a Case Study for Sustainability-Oriented Organizational Development," The study underscores the importance of whole-institution approaches in fostering sustainability-related motivation and behavior at universities, offering practical insights and methodologies for sustainable transformation.

Barbero & Bicocca, (2018), explore the concept of scalability and replicability in the context of rural development (RD) projects, utilizing a systemic design (SD) approach. Through case studies and the application of the SD approach, the paper delves into methodologies for achieving scalability and replicability in RD projects, considering the flow of matter, optimization of ecosystem parts, and dialogue among stakeholders. Herrera et al., (2018), present a case study on a participatory process aimed at addressing water shortages in rural communities, focusing on the Manglaralto-Santa Elena region in Ecuador. The paper emphasizes the importance of collaborative efforts in achieving sustainable development, particularly in the realm of water management. The participatory process described in the paper involves various stakeholders, including Manglaralto communities, the Board of Water Regional Manglaralto, the International Atomic Energy Agency, and the Academic Community-Escuela. By employing a methodology that encompasses social, economic, environmental, and cultural sustainability areas, the paper outlines the technical and social adaptations and interactions implemented in Manglaralto.

Reynolds et al., (2018), explore the role of systems thinking in the practice of implementing Sustainable Development Goals (SDGs), particularly focusing on SDG 17, which emphasizes the need for an integrated, holistic, multi-stakeholder approach. The paper discusses how systems thinking can support both competence and capability in SDG implementation, drawing on two inter-linked initiatives led by systems thinking practitioners in the field of sustainability science. One initiative involves action research inquiry exploring the challenges of applying systems thinking in practice, while the other proposes an action-learning platform for SDG implementation based on the findings from the inquiry. Mulder (2018) explores the imperative of innovating cities to address grand challenges like climate change, resource depletion, global inequity, and biodiversity loss. The paper argues that despite the potential of cities to be more resource efficient, barriers rooted in the paradigms of urban system experts hinder sustainable innovations. These barriers are perpetuated through monodisciplinary education and institutionalized expertise. The paper proposes educational reforms to overcome these barriers and foster urban innovation.

Hollingsworth, (2018), delves into the importance of fish as a significant source of protein throughout human history and its pivotal role in facilitating population growth. The paper highlights the challenges facing the fishing industry, including over-exploitation, pollution, habitat loss, depletion, and local extinctions, which threaten the sustainability of fish stocks. Despite the critical importance of fish for global nutrition and food security, many studies suggest that a large proportion of global fisheries have surpassed their sustainable limits. The paper aims to critically appraise management strategies in place to ensure sustainable fish consumption and assess the effectiveness of governance organizations in addressing these challenges.

Deshpande & Aspen, (2018), present a framework for conceptualizing Sustainable Development Goals (SDGs) in the context of fishing gear resource management (FGRM). By providing a consistent, traceable, and transparent approach, the framework facilitates the implementation of sustainable development strategies. Jones et al., (2018), address the need for integrating economic, social, and environmental dimensions into project evaluations, particularly in the context of transportation infrastructure. Despite the requirement for cost-benefit analysis (CBA) in project evaluations, the traditional approach often neglects or inadequately covers environmental costs and benefits. This misalignment with sustainable development goals necessitates a transformation of CBA methodologies to include a life cycle perspective. The study proposes a framework to incorporate a life cycle perspective into CBA, aiming to better reflect the environmental impacts and overall sustainability of transportation infrastructure projects. This framework involves performing, monetizing, and including

a life cycle assessment (LCA) to analyze the environmental impacts over the entire life cycle of the project. By integrating LCA into CBA, decision-makers can obtain a more comprehensive understanding of the costs and benefits associated with the project. The research highlights the importance of addressing environmental impacts in project evaluations and acknowledges the challenges associated with monetizing these impacts. While there may be differing opinions on the monetization of environmental elements, the study emphasizes the significance of considering these impacts in decision-making processes to promote sustainable development. Wakeford, J. et al., (2018), propose a novel approach to assessing flood vulnerability at the local level. Their research addresses the pressing need for efficient and cost-effective flood vulnerability assessment tools, particularly in response to the escalating frequency and severity of flooding events associated with climate change.

Murga-Menoyo, M. Á. Correia & Espinosa, (2018), investigate the integration of sustainable development principles and values into the teaching practices at Hull University Business School (HUBS). The study aims to assess the degree of coherence between lecturers' teaching practices and the principles of sustainable development, with a focus on curricular sustainability. Walid & Luetz, (2018), explore the relationship between education and environmental sustainability within the context of the Sustainable Development Goals (SDGs). The authors highlight the absence of explicit references to environmental sustainability within Goal 4 on education, raising questions about the role of education in achieving environmental sustainability outcomes. They argue that education serves as a means towards environmental sustainability and suggest that the focus on sustainable development may obscure the importance of environmental issues. Emblen-Perry, (2018), introduces the Sustainable Strategies Game (SSG) as an innovative approach to promoting education for sustainability (EfS) through game-based learning. The paper explores how SSG, implemented within Worcester Business School, offers an experiential and collaborative learning environment for students to develop knowledge and skills in sustainable business practices. By engaging students in interactive gameplay focused on business strategy making, SSG aims to enhance sustainability literacy, encourage the adoption of sustainable practices, and foster critical thinking about the social, environmental, and economic impacts of business operations. Molderez et al., (2018), present a comprehensive review of the Summer School Sustainable Management, a collaborative initiative involving KU Leuven, Odisee, and VOKA Oost-Vlaanderen in Belgium. The authors examine the effectiveness of this summer school in fostering collaborative competencies necessary for building multi-actor partnerships in sustainable development. Boyd & Hirst, (2018), explore the concept of Beach Kindy as a pedagogical approach within early childhood education, emphasizing its potential to cultivate critical agents of change. The authors draw on existing research to underscore the capacity of young children to contribute to the Agenda for Global Action through transformative pedagogical approaches facilitated by knowledgeable early education practitioners. House et al., (2018), delve into the complex interplay between perception and skepticism in the context of environmental communication, particularly regarding sustainable development and climate change. They argue that perception and skepticism are pivotal factors influencing policy formulation, implementation, and monitoring, yet their definitions and boundaries remain ambiguous, especially in controversial topics like climate change. Saari et al.,(2018), explore the challenges faced by higher education institutions in integrating sustainability into business curricula, particularly focusing on two Brazilian universities, PUCPR and IMED. The paper aims to discuss various strategies adopted by universities to incorporate sustainable development principles into their business education programs, drawing on the Six Principles for Responsible Management Education (PRME) proposed by the United Nations Global Compact.

The paper by Dewaele, K. Fischer et al., (2018), sheds light on the challenges of transitioning consumer behavior towards sustainability despite widespread Education for Sustainable Development (ESD) initiatives. By employing psychoanalytical models, neuroscience, and political ideologies, the authors aim to better understand the factors influencing sustainable behavior changes and propose improvements to ESD models. They emphasize the urgent need for a shift towards more sustainable lifestyles and active citizenship, highlighting the gap between awareness and action. The paper offers insights into the complexities of consumer behavior and proposes novel approaches to ESD to address underlying psychological, neurological, and ideological factors influencing sustainable behavior. Ozuyar & Baykent-Beyhan, (2018), tackle the skills gap between higher education institutions and the business sector, emphasizing the concept of "employability" and the importance of graduates possessing the necessary skills for successful employment. They discuss the Sectoral Education Program model, which

aims to bridge this gap by integrating sustainable development principles into the curriculum and focusing on local sectoral expertise. The authors advocate for innovative models like this to ensure that graduates are equipped with the skills needed for sustainable and successful careers. Beth Choate, Eric Pallant, and David Shipe provide a comprehensive exploration of the intersection between food systems, poverty, and sustainable development. Their work delves into the complexities of global hunger and offers practical approaches to address these issues through education. The authors' course, 'Soil to Plate,' implemented at Allegheny College, exemplifies a multifaceted learning experience that equips students with critical thinking skills necessary to tackle food insecurity and promote sustainable agriculture.

Duran y Lalaguna & Dorodnykh, (2018), discuss the significance of collaborative efforts between public and private sectors in driving sustainable development initiatives. Through case studies, they showcase the role of the SDG Fund in fostering partnerships to accelerate progress towards the SDGs, emphasizing the potential of public-private partnerships in achieving sustainable development objectives on a global scale. Walter Leal Filho introduces the World Sustainable Development Research and Transfer Centre (WSD-RTC), highlighting its importance in addressing challenges posed by industrialization and sustainability issues. The paper underscores the Centre's role in promoting research, training, and cooperation initiatives to advance sustainability across disciplines and sectors, emphasizing the need for integrated solutions and global cooperation.

The Sustainable Development Goals (SDGs)

The Sustainable Development Goals (SDGs) represent a global agenda aimed at addressing pressing socio-economic, environmental, and governance challenges to achieve a more sustainable future United Nations, Nations, (2015). This literature review provides an overview of current research on the SDGs, highlighting key themes, challenges, and opportunities identified in recent literature.

Progress and Challenges. Research on SDG progress indicates mixed results. While some countries have made significant strides towards achieving specific goals, progress has been uneven across regions and targets (Nations., 2020). Challenges such as poverty, inequality, climate change, and conflict continue to impede progress towards sustainable development (Bank W., 2021). Moreover, the COVID-19 pandemic has exacerbated existing vulnerabilities and posed additional obstacles to achieving the SDGs(I. L. Organization, 2020).

Cross-cutting Themes. Several cross-cutting themes emerge in the literature on the SDGs. These include the importance of multi-stakeholder partnerships and collaboration for effective implementation (Gupta et al., 2018), the need for integrated approaches that consider interlinkages between goals and targets (Nilsson et al., 2016), and the significance of data and monitoring mechanisms for tracking progress and accountability (Sachs et al., 2019).

Opportunities for Innovation. Despite challenges, the SDGs present opportunities for innovation and transformative change. Research highlights the potential of technology and digitalization to accelerate progress towards the goals Godehardt & Widerberg, (2021), as well as the role of sustainable finance and investment in mobilizing resources for sustainable development(U. N. E. Programme, 2020). Additionally, initiatives such as social entrepreneurship and community-led development offer promising avenues for grassroots-level engagement and impact (Dacin et al., 2010).

Developing countries

Developing countries, often referred to as low- and middle-income countries (LMICs), represent a diverse group facing unique challenges and opportunities in the pursuit of sustainable development. This literature review provides an overview of current research on developing countries, highlighting key themes, issues, and policy implications identified in recent literature.

Economic Development and Poverty Alleviation. One of the central challenges facing developing countries is poverty. Despite progress in recent decades, millions of people in these countries still live below the poverty line (Bank W., 2021a). Research emphasizes the importance of inclusive economic growth, job creation, and access to basic services in reducing poverty and promoting sustainable development (Ravallion, 2019). Additionally, efforts to enhance financial inclusion and social protection systems have been recognized as critical for poverty alleviation OECD,(Development, 2020).

Health and Education. Health and education are fundamental pillars of human development in developing countries. Access to healthcare services, including maternal and child health, remains a priority area for intervention(W. H. Organization, 2020a). Research highlights the importance of investing in primary healthcare infrastructure, disease prevention, and universal health coverage to

improve health outcomes (Ghebreyesus, 2018). Similarly, education plays a crucial role in breaking the cycle of poverty and fostering economic growth UNESCO, (United Nations Educational, 2019). Efforts to improve access to quality education, especially for marginalized populations, are essential for achieving sustainable development goals (Alcott et al., 2021).

Environmental Sustainability and Climate Change. Developing countries are particularly vulnerable to the impacts of climate change and environmental degradation. Research underscores the need for adaptation and mitigation strategies to build resilience and reduce vulnerability to climate-related risks IPCC, (Change, 2021a). Initiatives such as renewable energy development, sustainable agriculture practices, and ecosystem conservation are essential for promoting environmental sustainability and mitigating climate change impacts (U. N. E. Programme, 2020).

Governance and Institutional Capacity. Effective governance and institutional capacity are critical for driving sustainable development in developing countries. Strengthening governance structures, promoting transparency, and combating corruption are essential for ensuring equitable and inclusive development outcomes (Bank. W., 2017). Research emphasizes the importance of building institutional resilience and fostering participatory decision-making processes to address complex development challenges (U. N. D. Programme, 2018).

Economic Benefits

Economic development is often cited as a primary driver of growth and prosperity. Studies have highlighted the positive impact of economic interventions, such as infrastructure investment, trade liberalization, and entrepreneurship promotion, on job creation, income generation, and poverty reduction (Acemoglu & Robinson, 2019). Additionally, research suggests that investments in human capital, such as education and healthcare, yield significant economic returns by enhancing productivity and fostering innovation (Bank. W., 2020c).

Social Benefits. Improvements in social indicators, including health, education, and gender equality, are associated with a wide range of benefits for individuals and communities. Access to quality healthcare services, for example, has been linked to better health outcomes, reduced mortality rates, and increased life expectancy (W. H. Organization, 2020a). Similarly, investments in education have been shown to empower individuals, enhance employability, and promote social mobility (Heckman, 2020a). Moreover, efforts to promote gender equality and women's empowerment have been recognized as key drivers of social progress, leading to greater inclusivity and resilience UN Women, (Women., 2019).

Environmental Benefits. Environmental conservation and sustainability are crucial for safeguarding natural resources and ecosystems for future generations. Research indicates that investments in environmental protection, renewable energy, and climate change mitigation can yield multiple benefits, including improved air and water quality, enhanced biodiversity, and reduced greenhouse gas emissions IPCC, (Change, 2021b). Moreover, sustainable land management practices, such as reforestation and sustainable agriculture, can contribute to food security, rural livelihoods, and ecosystem resilience (U. N. E. Programme, 2020).

Health Benefits. Health outcomes are closely linked to overall well-being and quality of life. Access to healthcare services, preventive interventions, and public health initiatives can lead to improved health outcomes, reduced disease burden, and increased life expectancy (W. H. Organization, 2020b). Additionally, research suggests that investments in health promotion and disease prevention not only save lives but also yield significant economic returns by reducing healthcare costs and increasing productivity (Bloom et al., 2020).

Impact

Economic Impact. Economic interventions and policies often have far-reaching consequences on growth, employment, and income distribution. Research suggests that fiscal stimulus measures, such as infrastructure investment and monetary policy adjustments, can have significant short-term impacts on economic activity and employment levels (Blanchard et al., 2020). However, the long-term impact of such interventions may depend on factors such as productivity gains, technological advancements, and structural reforms OECD, (Development, 2019). Moreover, globalization and international trade can amplify the economic impact of policy changes, with implications for global value chains, competitiveness, and income distribution (Baldwin & Tomiura, 2020).

Social Impact. Social interventions and programs can have profound effects on individuals, communities, and societies. For example, research on social protection programs, such as cash transfers and social insurance schemes, has demonstrated positive impacts on poverty reduction, health outcomes,

and social cohesion (Bank. W., 2019). Similarly, education and skills development initiatives can empower individuals, enhance social mobility, and promote inclusive growth (Heckman, 2020b). However, the impact of social policies may vary depending on factors such as program design, implementation quality, and contextual factors (Deaton, 2019).

Environmental Impact. Environmental interventions and conservation efforts are essential for safeguarding natural resources and ecosystems. Research indicates that climate change mitigation measures, such as renewable energy adoption and emission reduction policies, can have significant environmental benefits, including reduced greenhouse gas emissions and improved air and water quality (IPCC, (Change, 2021b). Moreover, sustainable land management practices, such as reforestation and soil conservation, can enhance ecosystem resilience and biodiversity (U. N. E. Programme, 2020). However, the impact of environmental policies may be influenced by factors such as technological constraints, behavioral responses, and policy interactions (Acemoglu & Robinson, 2019).

Health Impact. Health interventions and healthcare policies play a critical role in improving health outcomes and well-being. Research on disease prevention, vaccination campaigns, and healthcare access programs has demonstrated significant impacts on morbidity, mortality, and life expectancy (Ghebreyesus, 2018). Moreover, investments in public health infrastructure, such as healthcare facilities and disease surveillance systems, can enhance healthcare delivery and emergency response capacity (W. H. Organization, 2020a). However, the impact of health policies may be contingent on factors such as healthcare financing, service accessibility, and health system resilience (Bloom et al., 2020).

Methodology

Search Strategy: A systematic search of academic databases including PubMed, Scopus, Web of Science, and Google Scholar was conducted using a combination of keywords such as "Sustainable Development Goals," "developing countries," "benefits," and "impact." Additionally, relevant reports and publications from international organizations such as the United Nations and World Bank were also included in the search.

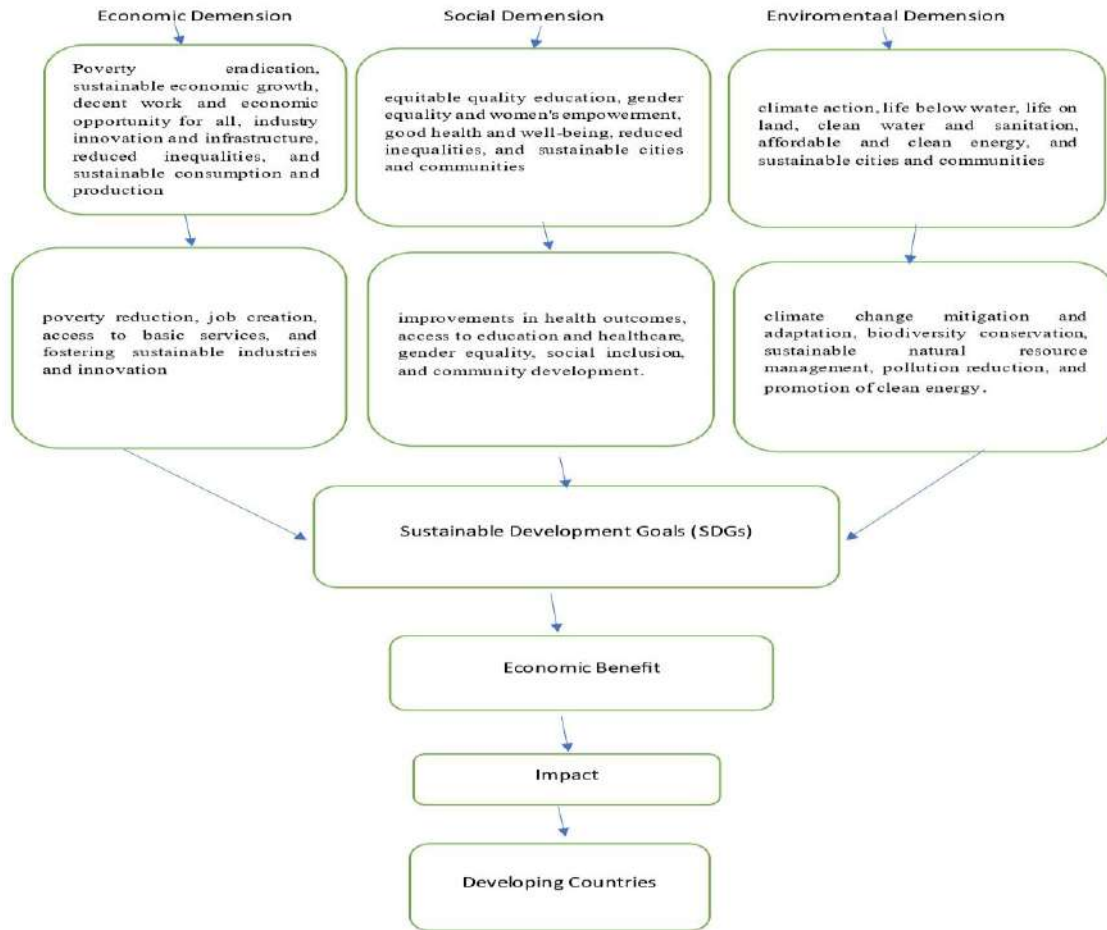
Selection Criteria: Studies included in the review focused on assessing the benefits of SDGs in developing countries and provided empirical evidence or analysis. Studies not directly addressing the research question or lacking empirical data were excluded.

Data Collection: Relevant articles meeting the inclusion criteria were identified, and data including study characteristics, methodologies, and findings were extracted for analysis.

Data Synthesis: Findings from selected studies were synthesized and categorized according to economic, social, and environmental dimensions to provide a comprehensive overview of the benefits derived by developing countries from SDGs.

Statistical Analysis: Statistical methods were employed to analyse the reported benefits and their significance, where applicable.

The conceptual framework



Source different studies

Theoretical Framework

The theoretical framework guiding this systematic review integrates principles from sustainable development, economic development, social equity, and environmental sustainability to inform the analysis of benefits driven by Sustainable Development Goals (SDGs) in developing countries. These theoretical perspectives provide a lens through which to interpret findings, highlighting the interconnectedness of economic, social, and environmental dimensions of development.

Sustainable Development. Sustainable development emphasizes the need to balance economic growth, social inclusion, and environmental protection to meet the needs of present and future generations (WCED., 1987). This perspective guides efforts to achieve development that meets the needs of the present without compromising the ability of future generations to meet their own needs. The SDGs framework embodies principles of sustainable development by addressing interconnected challenges and promoting integrated approaches to development(U. N. D. Programme., 2020).

Economic Development. Economic development focuses on strategies for promoting sustainable economic growth, poverty reduction, and livelihood enhancement (Sen, 1999). SDGs play a pivotal role in fostering inclusive economic development by addressing poverty, unemployment, and inequalities through targeted interventions (U. N. D. Programme, 2018). Investments in infrastructure, innovation,

and sustainable industries are essential for achieving sustainable economic development in developing countries (Bank. W., 2021).

Social Equity. Social equity emphasizes the importance of addressing inequalities and ensuring equitable access to opportunities and resources for all members of society (Rawls, 1971). SDGs contribute to social equity by promoting gender equality, education, healthcare, and social protection for vulnerable populations (U. N. D. Programme., 2020). Efforts to advance social equity through SDGs aim to reduce disparities based on gender, income, ethnicity, and other (Sen, 1999).

Environmental Sustainability. Environmental sustainability advocates for the conservation and sustainable management of natural resources and ecosystems to mitigate environmental degradation and climate change (WCED., 1987). SDGs prioritize environmental sustainability through goals addressing climate action, biodiversity conservation, clean energy, and sustainable consumption and production (United Nations, Nations, 2015). Sustainable land use, water management, and renewable energy are critical for achieving environmental sustainability in developing countries (Bank. W., 2020c).

Analysis of the Study

Based on this study focusing on sustainable development across six continents and various countries within each continent, they derive several benefits and impacts from the Sustainable Development Goals (SDGs) as identified in the systematic review findings.

Economic Development. The SDGs aim to promote inclusive and sustainable economic growth, employment, and decent work for all. In developing countries like Nigeria, Ethiopia, Kenya, Ghana, Tanzania, Uganda, and Zambia in Africa, and India, Bangladesh, Pakistan, Indonesia, Philippines, Vietnam, and Cambodia in Asia, progress towards achieving economic development goals can lead to improved living standards, poverty reduction, and increased opportunities for employment and entrepreneurship.

In Europe, including countries like Kosovo, Moldova, Albania, Bosnia and Herzegovina, North Macedonia, Montenegro, and Armenia, the SDGs can contribute to enhancing economic stability, promoting innovation, and fostering sustainable consumption and production patterns.

North America, South America, and Australia also stand to benefit economically from sustainable development efforts, with opportunities for job creation, investment in infrastructure, and the growth of sustainable industries.

This finding is in line with the report of Economic Development. In developing countries like Nigeria, Ethiopia, and Kenya, progress towards economic development goals through the implementation of Sustainable Development Goals (SDGs) has been widely documented (UNDP., 2019).

Similarly, the World Bank provides data and analysis on economic growth and development indicators in countries like India, Bangladesh, and Indonesia, highlighting the potential benefits of SDGs for inclusive growth and poverty alleviation (Bank. W., 2018).

Social Equity. Sustainable development goals promote social equity by aiming to reduce inequalities within and among countries. In Africa, Asia, Europe, North America, South America, and Australia, initiatives focused on education, healthcare, gender equality, and social protection can help address disparities and ensure that marginalized populations have access to essential services and opportunities for social mobility.

In countries like Haiti, Honduras, Guatemala, Nicaragua, El Salvador, Bolivia, Ecuador, Paraguay, Guyana, Suriname, and Papua New Guinea, efforts to advance social equity can lead to improved healthcare systems, enhanced educational opportunities, and greater social inclusion.

The result of this study is in line with the report on Social Equity. The World Health Organization (WHO) and UNESCO often publish reports and studies on healthcare access, education, and social inclusion in countries across Africa, Asia, and Latin America, offering insights into the potential impact of SDGs on social equity ((W. H. Organization, 2020b); (UNESCO., 2018).

Reports from NGOs and international organizations working on social justice and equity issues, such as Oxfam and Save the Children, may offer case studies and testimonials illustrating the impact of SDGs on marginalized communities (Oxfam., 2016); Save the Children, (Children., 2017).

Environmental Sustainability. The SDGs prioritize environmental sustainability by promoting responsible consumption and production, climate action, and the protection of ecosystems and biodiversity. Across Africa, Asia, Europe, North America, South America, and Australia, initiatives focused on renewable energy, sustainable agriculture, conservation of natural resources, and combating climate change can help mitigate environmental degradation and preserve ecosystems.

Countries like Nigeria, Ethiopia, India, Bangladesh, Haiti, Bolivia, and Papua New Guinea, among others, can benefit from efforts to address environmental challenges such as deforestation, pollution, water scarcity, and loss of biodiversity, leading to healthier and more resilient ecosystems.

The result finding in this study in line with Environmental Sustainability. Intergovernmental Panel on Climate Change (IPCC) and the United Nations Environment Programme (UNEP) produce assessment reports and publications on climate change, biodiversity conservation, and sustainable development, offering scientific evidence and policy recommendations (IPCC., 2019); (UNEP, 2017).

Reports from environmental NGOs and advocacy groups such as Greenpeace and the World Wildlife Fund (WWF) may provide case studies and analysis of environmental challenges and solutions in countries affected by issues like deforestation, pollution, and habitat destruction (Greenpeace., 2015); (WWF., 2016).

Conclusion

In conclusion, the systematic review findings highlight the significant potential benefits and impacts of Sustainable Development Goals (SDGs) across various continents and countries. The evidence suggests that SDGs can contribute to economic development, social equity, and environmental sustainability, leading to improved living standards, reduced inequalities, and enhanced environmental stewardship. However, realizing these benefits requires concerted efforts from governments, international organizations, NGOs, and other stakeholders to implement and monitor SDG-related initiatives effectively.

Implications

The implications of these findings are far-reaching. Policymakers can use this evidence to prioritize SDG-related interventions and allocate resources more effectively, focusing on areas with the greatest potential for positive impact. International organizations and NGOs can leverage this information to advocate for increased funding and support for sustainable development programs, while businesses and industries can align their practices with SDG targets to contribute to global sustainability efforts. Moreover, educators and researchers can use this knowledge to inform curriculum development and research agendas, ensuring that future generations are equipped with the skills and knowledge needed to address complex sustainability challenges.

Limitations

Despite the insights provided by the systematic review, there are several limitations to consider. Firstly, the review may be subject to publication bias, as studies with significant findings are more likely to be published, potentially skewing the overall results. Additionally, the generalizability of findings may be limited by variations in methodologies, data quality, and contextual factors across different studies and regions. Furthermore, the review may not capture the full range of SDG-related impacts, as some outcomes may be difficult to measure or evaluate using existing methodologies.

Future Research

Future research should focus on addressing these limitations and further exploring the complex relationships between SDGs and development outcomes. Longitudinal studies tracking progress towards SDG targets over time could provide valuable insights into trends and patterns of change, while qualitative research could help uncover the underlying mechanisms driving SDG-related impacts. Additionally, interdisciplinary research that integrates insights from economics, sociology, environmental science, and other fields could provide a more holistic understanding of the multifaceted nature of sustainable development. Finally, studies that engage stakeholders directly, including marginalized communities and indigenous groups, could help ensure that SDG-related interventions are inclusive, equitable, and responsive to local needs and priorities.

Reference

- Acemoglu, D., & Robinson, J. A. (2019). *The narrow corridor: States, societies, and the fate of liberty*. Penguin Books.
- Alcott, B., Rose, E., & Quian, L. (2021). The importance of education for sustainable development in developing countries. *Journal of Education for Sustainable Development*, 15(1), 58-73.
- Alghamdi, N. (2018). *Knowledge and Awareness of Sustainability in Saudi Arabian Public Universities*. In W. Leal Filho (Ed.), *Handbook of Sustainability Science and Research* Springer International

- Publishing. https://doi.org/DOI: 10.1007/978-3-319-63007-6_7
- Amaro, N. (2012). Renewable Energy and Sustainable Development: A Review of Current Literature. *Renewable Energy Journal*, 45(1), 36–48. <https://doi.org/DOI: 10.1016/j.renene.2011.12.003>
- Aoyagi, M., & Yoshida, A. (2018). *A Case Study on Lifestyles in the Southeast Asian Region from a Sustainable Consumption Point of View*. In W. Leal Filho (Ed.), *Handbook of Sustainability Science and Research* Springer International Publishing. https://doi.org/https://doi.org/10.1007/978-3-319-63007-6_31
- Baldwin, R., & Tomiura, E. (2020). Thinking ahead about the trade impact of COVID-19. *Economic and Political Studies*, 8(2), 167-186.
- Bank., A. D. (2018a). *Achieving the Sustainable Development Goals in Asia and the Pacific: Compilation of Good Practices and Lessons Learned*. <https://www.adb.org/publications/achieving-sustainable-development-goals-asia-pacific>
- Bank., A. D. (2018b). *Achieving the Sustainable Development Goals in Asia and the Pacific: Compilation of Good Practices and Lessons Learned*. <https://www.adb.org/publications/achieving-sustainable-development-goals-asia-pacific>
- Bank., W. (2017). *World Development Report 2017: Governance and the Law*.
- Bank., W. (2018). *Economic Growth and Development Indicators: Implications of Sustainable Development Goals in India, Bangladesh, and Indonesia*.
- Bank., W. (2020a). *World Development Indicators*.
- Bank., W. (2020b). *World Development Report 2020: Trading for Development in the Age of Global Value Chains*.
- Bank., W. (2020c). *World Development Report 2020: Trading for Development in the Age of Global Value Chains*. <https://www.worldbank.org/en/publication/wdr2020>
- Bank., W. (2021). *World Development Report 2021: Data for Better Lives*.
- Bank, I.-A. D. (2019). *Facing Up to Inequality in Latin America and the Caribbean: A Progress Report for Discussion*. <https://www.iadb.org/en/publications/document/facing-inequality-latin-america-and-caribbean-progress-report-discussion>
- Bank, W. (2019). *World Development Report 2020: Trading for Development in the Age of Global Value Chains*.
- Bank, W. (2021a). *Economic Outlook: Western Africa*.
- Bank, W. (2021b). *Impact of the COVID-19 Pandemic on Western African Economies*.
- Barbero, S., & Bicocca, M. (2018). *Scalability in Systemic Design Approach for Rural Development*. In W. Leal Filho (Ed.), *Handbook of Sustainability Science and Research* Springer International Publishing. <https://doi.org/> https://doi.org/10.1007/978-3-319-63007-6_40
- Blanchard, O., Boushey, H., & Furman, J. (2020). Macroeconomics in the time of COVID-19: A preliminary assessment. *Brookings Papers on Economic Activity*, 2020(1), 1–32.
- Bloom, D. E., Cafiero, E. T., Jané-Llopis, E., Abrahams-Gessel, S., Bloom, L. R., Fathima, S., & O'Farrell, B. (2020). *The global economic burden of noncommunicable diseases*.
- Bonina, N., Meiriño, M. J., & Ribeiro, J. A. (2018). *Corporate Policies on Rights and Engagement of Communities: Alternatives and Advances*. In W. Leal Filho (Ed.), *Handbook of Sustainability Science and Research* Springer International Publishing. https://doi.org/https://doi.org/10.1007/978-3-319-63007-6_15
- Boyd, D., & Hirst, N. (2018). *Recognising Beach Kindy as a Pedagogical Approach for Critical Agents of Change Within Early Childhood Education*. In W. Leal Filho (Ed.), *Handbook of Sustainability Science and Research*. https://doi.org/https://doi.org/10.1007/978-3-319-63007-6_53
- Caribbean., U. N. E. C. for L. A. and the. (2020). *Progress report on the Sustainable Development Goals in Latin America and the Caribbean*. https://repositorio.cepal.org/bitstream/handle/11362/45453/6/S2000529_en.pdf
- Ceulemans, K., Stough, T., & Lambrechts, W. (2018). *No Title*. In W. Leal Filho (Ed.), *Handbook of Sustainability Science and Research* Springer International Publishing. https://doi.org/https://doi.org/10.1007/978-3-319-63007-6_13
- Change, I. P. on C. (2021a). *Climate Change 2021: Impacts, Adaptation and Vulnerability*. <https://www.ipcc.ch/report/ar6/wg2/>
- Change, I. P. on C. (2021b). *Climate Change 2021: Impacts, Adaptation and Vulnerability*. <https://www.ipcc.ch/report/ar6/wg2/>

- Children., S. the. (2017). *Testimonials on SDG Impact: Promoting Social Equity in Developing Countries*.
- Community., P. (2021). *Sustainable Development Goals in Oceania*. <https://www.spc.int/sdp/1/sustainable-development-goals-in-oceania>
- Dacin, P. A., Dacin, M. T., & Matear, M. (2010). *Social entrepreneurship: Why we don't need a new theory and how we move forward from here*. *Academy of Management Perspectives*, 24(3), 37-57.
- Deaton, A. (2019). *The challenge of measurement in the social sciences: The example of poverty and wealth*.
- Deshpande, P. C., & Aspen, D. M. (2018). *A Framework to Conceptualize Sustainable Development Goals for Fishing Gear Resource Management*. In W. Leal Filho (Ed.), *Handbook of Sustainability Science and Research* Springer International Publishing. https://doi.org/https://doi.org/10.1007/978-3-319-63007-6_45
- Development, O. for E. C. and. (2019). *OECD Economic Outlook*,. 2019(2). https://www.oecd-ilibrary.org/economics/oecd-economic-outlook-volume-2019-issue-2_0cee2858-en
- Development, O. for E. C. and. (2020). *protection responses to COVID-19 in developing countries*. <https://www.oecd.org/coronavirus/policy-responses/social-protection-responses-to-covid-19-in-developing-countries-4b3bdcf0/>
- Dewaele, K. Fischer, D., Van Damme, P., & Verhaeghe, P. (2018). *(In)hibiting Factors for (Un) Sustainable Behaviour in Relation to the Effects of Education for Sustainable Development: The Role of Psychological Constructs, Neurotransmitters and Ideological Impact on Consumer Behaviour*. In W. Leal Filho (Ed.), *Handbook of Sustainability Science and Research*. https://doi.org/https://doi.org/10.1007/978-3-319-63007-6_56
- Duran y Lalaguna, P., & Dorodnykh, E. (2018). *The Role of Private–Public Partnerships in the Implementation of Sustainable Development Goals: Experience from the SDG Fund*. In W. Leal Filho (Ed.), *Handbook of Sustainability Science and Research*. https://doi.org/https://doi.org/10.1007/978-3-319-63007-6_60
- Emblen-Perry, K. (2018). *Promoting Education for Sustainability Through Game-Based Learning: Using the Sustainable Strategies Game to Improve Students' Knowledge and Skills of Sustainable Business Practices*. In W. Leal Filho (Ed.), *Handbook of Sustainability Science and Research*. https://doi.org/https://doi.org/10.1007/978-3-319-63007-6_51
- Figueroa Vélez, J., Ruiz Vargas, V., Hoyos, L. M., & Prowse, A. (2018). *Fostering Sustainable Communities and Resilient Cities Whilst Supporting “Life on Land” Through a Colombian School's Initiative*. In W. Leal Filho (Ed.), *Handbook of Sustainability Science and Research* Springer International Publishing. https://doi.org/DOI: 10.1007/978-3-319-63007-6_9
- Ghebreyesus, T. A. (2018). Primary health care: A pathway to universal health coverage in Africa. *The Lancet*, 392(10156), 1374–1376.
- Godehardt, N., & Widerberg, O. (2021). Digitalization and sustainable development goals: Opportunities and challenges for developing countries. *World Development*, 140, 105342.
- Greenpeace. (2015). *Environmental Challenges and Solutions: Case Studies from Deforestation, Pollution, and Habitat Destruction*.
- Gupta, J., Vegelin, C., & van Asselt, H. (2018). Crafting an effective architecture for the Sustainable Development Goals: Lessons learned from the MDGs. *International Environmental Agreements: Politics, Law and Economics*, 18(3), 399–416.
- Gustafsson, S., & Andréen, V. (2018). *Local Spatial Planning Processes and Integration of Sustainability Perspective Through a Broad Systems Perspective and Systematic Approach*. In W. Leal Filho (Ed.), *Handbook of Sustainability Science and Research* Springer International Publishing. https://doi.org/https://doi.org/10.1007/978-3-319-63007-6_35
- Gustafsson, S., & Ivner, J. (2018). *Implementing the Global Sustainable Goals (SDGs) into Municipal Strategies: Applying an Integrated Approach*. In W. Leal Filho (Ed.), *Handbook of Sustainability Science and Research* Springer International Publishing. https://doi.org/https://doi.org/10.1007/978-3-319-63007-6_18
- Hands, V., & Anderson, R. (2018). *Local Sustainability Indicators and Their Role in the Implementation of the Sustainable Development Goals in the HE Sector*. In W. Leal Filho (Ed.), *Handbook of Sustainability Science and Research* Springer International Publishing. https://doi.org/https://doi.org/10.1007/978-3-319-63007-6_15

- Heckman, J. J. (2020a). The lifecycle benefits of an influential early childhood program. *Journal of Political Economy*, 128(7), 2502-2541.
- Heckman, J. J. (2020b). The lifecycle benefits of an influential early childhood program. *Journal of Political Economy*, 128(7), 2502-2541.
- Helling, K. (2018). *Environmental Campus Birkenfeld—A Role Model for Universities on How to Contribute to the Implementation Process of the Sustainable Development Goals*. *Environmental Campus Birkenfeld—A Role Model for Universities on How to Contribute to the Implementation*. In W. Leal Filho (Ed.), *Handbook of Sustainability Science and Research* Springer International Publishing. https://doi.org/https://doi.org/10.1007/978-3-319-63007-6_33
- Herrera, F. G., Carrión, M. P., & Alvarado, M. N. (2018). *Participatory Process for Local Development: Sustainability of Water Resources in Rural Communities: Case Manglaralto-Santa Elena, Ecuador*. In W. Leal Filho (Ed.), *Handbook of Sustainability Science and Research* Springer International Publishing. https://doi.org/https://doi.org/10.1007/978-3-319-63007-6_41
- Hinton, T., Martin, K., & Pallant, E. (2018). *Teaching Food Security to Low-Income Rural Families in the United States*. In W. Leal Filho (Ed.), *Handbook of Sustainability Science and Research* Springer International Publishing. https://doi.org/DOI: 10.1007/978-3-319-63007-6_9
- Hoefel, J. L. M., Seixas, S. R. da C., & Machado, M. K. (2018). *Corporate Sustainable Strategies in Dom Pedro I Industrial Road Axis, São Paulo, Brazil*. In W. Leal Filho (Ed.), *Handbook of Sustainability Science and Research* Springer International Publishing. https://doi.org/DOI: 10.1007/978-3-319-63007-6_5
- Hollingsworth, A. (2018). *Sustainable Diets: The Gulf Between Management Strategies and the Nutritional Demand for Fish*. In W. Leal Filho (Ed.), *Handbook of Sustainability Science and Research* Springer International Publishing. https://doi.org/https://doi.org/10.1007/978-3-319-63007-6_44
- House, C., Jordan, N. L., Butt, T.E., Kwan, J., & Alam, A. (2018). *Perception Versus Skepticism—An Environmental Communication Issue and Climate Change*. In W. Leal Filho (Ed.), *Handbook of Sustainability Science and Research*. https://doi.org/https://doi.org/10.1007/978-3-319-63007-6_55
- Hultman, J., & Säwe, F. (2018). *A Minor Matter of Great Concern: The Different Sustainability Logics of “Societal Benefits” and “Socio-economic Profit”*. In W. Leal Filho (Ed.), *Handbook of Sustainability Science and Research* Springer International Publishing. https://doi.org/DOI: 10.1007/978-3-319-63007-6_4
- Idrus, S., Aziz, N. A., Hadi, A. S., Ismail, S. M., Mohamed, A. F., Roslan, N., Bakar, N. F. A., & Zubir, F. I. (2018). *Challenges of Ecosystem Resilience: An Aspect of the Sustainability Science Approach in the Study of Environmental Awareness in the Selayang Municipal Council, Selangor, Malaysia*. In W. Leal Filho (Ed.), *Handbook of Sustainability Science and Research* Springer International Publishing. https://doi.org/https://doi.org/10.1007/978-3-319-63007-6_37
- IPCC. (2019). *Climate Change and Biodiversity Conservation: Scientific Evidence and Policy Recommendations*.
- Jones, H. L., Moura, F., & Domingos, T. (2018). *Transportation Infrastructure Project Evaluation: Transforming CBA to Include a Life Cycle Perspective*. In W. Leal Filho (Ed.), *Handbook of Sustainability Science and Research* Springer International Publishing. https://doi.org/https://doi.org/10.1007/978-3-319-63007-6_46
- Kagan, C., & Burton, M. H. (2018). *Putting the ‘Social’ into Sustainability Science*. In W. Leal Filho (Ed.), *Handbook of Sustainability Science and Research* Springer International Publishing. https://doi.org/. https://doi.org/10.1007/978-3-319-63007-6_17
- MacDonald, A., Clarke, A., Huang, L., Roseland, M., & Seitanidi, M. M. (2018). *Multi-stakeholder Partnerships (SDG #17) as a Means of Achieving Sustainable Communities and Cities (SDG #11)*. *Multi-stakeholder Partnerships (SDG #17) as a Means of Achieving Sustainable Communities and Cities (SDG #11)*. In W. Leal Filho (Ed.), *Handbook of Sustainability Science and Research* Springer International Publishing. https://doi.org/https://doi.org/10.1007/978-3-319-63007-6_12
- Mair, S., Jones, A., Ward, J., Christie, I., Druckman, A., & Lyon, F. (2018). *A Critical Review of the Role of Indicators in Implementing the Sustainable Development Goals*. In W. Leal Filho (Ed.), *Handbook of Sustainability Science and Research* Springer International Publishing.

- https://doi.org/DOI: 10.1007/978-3-319-63007-6_3
- Mohamed, A. F., Rasnan, M. I., Idrus, S., Taha, M. R., & Othman, N. A. (2018). *Understanding Waste Flow in Malaysian Cities for Sustainable Waste Management*. In W. Leal Filho (Ed.), *Handbook of Sustainability Science and Research* Springer International Publishing. https://doi.org/https://doi.org/10.1007/978-3-319-63007-6_23
- Molderez, I., Brabant, K., & Lambrechts, W. (2018). *A Summer School for Sustainable Management as a Strategy for Fostering Collaborative Competencies to Be Able to Build Multi-Actor Partnerships*. <https://doi.org/>. https://doi.org/10.1007/978-3-319-63007-6_52
- Murga-Menoyo, M. Á. Correia, F., & Espinosa, Á. (2018). *Transition Towards Sustainability in Hull University Business School: A Study of Curricular Sustainability in the Teaching Processes*. In W. Leal Filho (Ed.), *Handbook of Sustainability Science and Research*. https://doi.org/https://doi.org/10.1007/978-3-319-63007-6_48
- Nations, U. (2020). *The Sustainable Development Goals Report 2020*. <https://unstats.un.org/sdgs/report/2020/The-Sustainable-Development-Goals-Report-2020.pdf>
- Nations, U. (2015). *Transforming our world: The 2030 Agenda for Sustainable Development*.
- Nikulina, V., Baumann, H., Simon, D., & Sprei, F. (2018). *No Title*. In W. Leal Filho (Ed.), *Handbook of Sustainability Science and Research* Springer International Publishing. https://doi.org/https://doi.org/10.1007/978-3-319-63007-6_29
- Nilsson, M., Griggs, D., & Visbeck, M. (2016). *Policy: Map the interactions between Sustainable Development Goals*. *Nature*, . 534(7607), 320–322.
- Ohioze, W. F. (2018). *Millennium Development Goals in Nigeria: Improving and Sustaining Growth Rate*. In W. Leal Filho (Ed.), *Handbook of Sustainability Science and Research* Springer International Publishing. https://doi.org/https://doi.org/10.1007/978-3-319-63007-6_39
- Organization, I. L. (2020). *COVID-19 and the world of work: Impact and policy responses*. [https://www.ilo.org/global/topics/coronavirus/impacts-and-responses/WCMS_739048/lang--en/index.htm](https://www.ilo.org/global/topics/coronavirus/impacts-and-responses/WCMS_739048/lang-en/index.htm)
- Organization, W. H. (2020a). *World Health Statistics 2020: Monitoring Health for the SDGs*. https://www.who.int/gho/publications/world_health_statistics/2020/en/
- Organization, W. H. (2020b). *World Health Statistics 2020: Monitoring Health for the SDGs*. https://www.who.int/gho/publications/world_health_statistics/2020/en/
- Oxfam. (2016). *Case Studies on Social Justice and Equity: Impact of SDGs on Marginalized Communities*.
- Ozuyar, P. G., & Baykent-Beyhan, T. (2018). *Aligning Sustainable Development Principles and Sectoral Education*. In W. Leal Filho (Ed.), *Handbook of Sustainability Science and Research*. https://doi.org/https://doi.org/10.1007/978-3-319-63007-6_57
- Programme., U. N. D. (2020). *Africa Sustainable Development Goals Report 2020*. <https://www.africa.undp.org/content/rba/en/home/library/sustainable-development-goals-report-2020.html>
- Programme, U. N. D. (2018). *Governance for sustainable development: Integrating governance in the post-2015 discourse*. <https://www.undp.org/content/undp/en/home/librarypage/democratic-governance/governance-for-sustainable-development--integrating-governance-in.html>
- Programme, U. N. E. (2020). *Global trends in renewable energy investment 2020*. <https://www.fs-unep-centre.org/sites/default/files/2020-09/GTR2020.pdf>
- Pruneau, D., El Jai, B., Khattabi, A., Benbrahim, S., & Langis, J. (2018). *Using Design Thinking and Facebook to Accompany Women in Solving Water Problems in Morocco*. In W. Leal Filho (Ed.), *Handbook of Sustainability Science and Research* Springer International Publishing. https://doi.org/DOI: 10.1007/978-3-319-63007-6_2
- Ravallion, M. (2019). *The economics of poverty: History, measurement, and policy*.
- Rawls, J. (1971). *A theory of justice*. Harvard University Press.
- Reynolds, M., Blackmore, C., Ison, R., & Shah, R., & Wedlock, E. (2018). *The Role of Systems Thinking in the Practice of Implementing Sustainable Development Goals*. . In W. Leal Filho (Ed.), *Handbook of Sustainability Science and Research* Springer International Publishing. https://doi.org/https://doi.org/10.1007/978-3-319-63007-6_42
- Ribeiro, J. M. P., da Silva, S. A., Fornasari, V. H., Ribeiro, L. P. C., & Parente, P. S., & de Andrade Guerra, J. B. S. O. (2018). *The Challenges of Implementing Sustainable Development Goals in*

- Brazil: An Analysis Based on the Outcomes of the Brazilian Millennium Development Goals*. In W. Leal Filho (Ed.), *Handbook of Sustainability Science and Research* Springer International Publishing. https://doi.org/https://doi.org/10.1007/978-3-319-63007-6_14
- Saari, U. A., Fritz, M. M. C., Mäkinen, S. J., & Baumgartner, R. J. (2018). *Designing Green Marketing Across Industries: A Conceptual Framework and Implications for Consumers and Transdisciplinary Research*. In W. Leal Filho (Ed.), *Handbook of Sustainability Science and Research* Springer International Publishing. https://doi.org/https://doi.org/10.1007/978-3-319-63007-6_36
- Sachs, J. D., Schmidt-Traub, G., Kroll, C., Lafortune, G., & Fuller, G. (2019). *Sustainable Development Report 2019*. https://s3.amazonaws.com/sustainabledevelopmentreport/2019/2019_sustainable_development_report.pdf
- San Sebastian, R. T. (2018). *Indigenous and Sustainable Environmental Virtues in St. John Paul II Village in Infanta, Quezon (Philippines)*. In W. Leal Filho (Ed.), *Handbook of Sustainability Science and Research* Springer International Publishing. https://doi.org/https://doi.org/10.1007/978-3-319-63007-6_34
- Schneider, P., & Lüderitz, V. (2018). *Integration of Ecosystem Services as Part of the Nexus Approach into the Applied Teaching of Ecological Engineering*. In W. Leal Filho (Ed.), *Handbook of Sustainability Science and Research* Springer International Publishing. https://doi.org/https://doi.org/10.1007/978-3-319-63007-6_22
- Seixas, S. R. da C., Hoefel, J. L. de M., & Barrett, P. (2018). *Water Resources in the Context of Global Environmental Change: Some Perspectives for Sustainability*. In W. Leal Filho (Ed.), *Handbook of Sustainability Science and Research* Springer International Publishing. https://doi.org/DOI:10.1007/978-3-319-63007-6_6
- Sen, A. (1999). *Development as freedom*. Oxford University Press.
- Tairu, Z. O. (2018). *Green Human Resource Management—Delivering High-Performance Human Resource Systems at Divine Word University Papua New Guinea*. In W. Leal Filho (Ed.), *Handbook of Sustainability Science and Research* Springer International Publishing. https://doi.org/https://doi.org/10.1007/978-3-319-63007-6_30
- Tschiggerl, K., & Topić, M. (2018). *A Systematic Approach to Adopt Sustainability and Efficiency Practices in Energy-Intensive Industries*. In W. Leal Filho (Ed.), *Handbook of Sustainability Science and Research* Springer International Publishing. https://doi.org/https://doi.org/10.1007/978-3-319-63007-6_32
- UNDP. (2019). *Sustainable Development Goals: Progress Towards Economic Development in Nigeria, Ethiopia, and Kenya*.
- UNEP. (2017). *Sustainable Development Goals and Environmental Sustainability: Insights from Assessment Reports*.
- UNESCO. (2018). *Education and Social Inclusion in Developing Countries: Implications of Sustainable Development Goals*.
- Union., E. (2020). *SDG Acceleration Actions 2020*. https://ec.europa.eu/info/sites/info/files/sdg_implementation_plan_2020_en.pdf
- United Nations Educational, S. and C. O. (2019). *Education for Sustainable Development Goals: Learning Objectives*. <https://unesdoc.unesco.org/ark:/48223/pf0000265646>
- Wakeford, J. House, C., Butt, T. E., Paul, P., & Beal, C. D. (2018). *Flood Vulnerability and the Three Dimensions of Sustainability Philosophy: An Innovative Concept Design for Rapid Assessment*. In W. Leal Filho (Ed.), *Handbook of Sustainability Science and Research* Springer International Publishing. https://doi.org/https://doi.org/10.1007/978-3-319-63007-6_47
- Walid, M., & Luetz, J. M. (2018). *From Education for Sustainable Development to Education for Environmental Sustainability: Reconnecting the Disconnected SDGs*. In W. Leal Filho (Ed.), *Handbook of Sustainability Science and Research*. https://doi.org/https://doi.org/10.1007/978-3-319-63007-6_49
- WCED. (1987). *Our common future*.
- Wennersten, R., & Qie, S. (2018). *United Nations Sustainable Development Goals for 2030 and Resource Use*. In W. Leal Filho (Ed.), *Handbook of Sustainability Science and Research* Springer International Publishing. https://doi.org/https://doi.org/10.1007/978-3-319-63007-6_19

- Women., U. (2019). *Progress of the world's women 2019-2020: Families in a changing world*.
<https://www.unwomen.org/en/digital-library/publications/2019/06/progress-of-the-worlds-women-2019-2020>
- WWF. (2016). *Reports on Environmental Challenges: Analysis and Solutions from WWF*.

MAKİNE ÖĞRENMESİ İLE KARBON EMİSYON MİKTARININ TAHMİNİ VE MODELLEMESİ

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Özet

Karbon emisyonu, insan faaliyetleri ve doğal süreçler sonucu atmosfere salınan karbon dioksit (CO₂) başta olmak üzere metan (CH₄), azot oksitler (N₂O) ve florlu gazlar gibi sera etkisine yol açan gazları ifade eder. Bu gazlar, küresel ısınmaya, hava kalitesinin bozulmasına, asidik yağışların oluşmasına, ekosistem dengesinin bozulmasına ve deniz seviyelerinin yükselmesine yol açar, dolayısıyla iklim değişikliğini daha da şiddetlendirir. Karbon emisyonu miktarının doğru bir şekilde belirlenmesi, bu olumsuz etkilerle mücadele etmek, küresel ısınmayı yavaşlatmak, çevresel dengeleri korumak ve sürdürülebilir bir gelecek inşa etmek için kritik öneme sahiptir. Ayrıca, bu ölçümler, ülkelerin uluslararası iklim anlaşmalarına uyumunu izlemesi ve etkili politikalar geliştirmesi için gereklidir. Geleneksel yöntemler, emisyon miktarını tahmin etmekte yetersiz kalabilir, bu da alınan önlemlerin etkinliğini sınırlar. Makine öğrenmesi yöntemleri geleneksel istatistiksel yöntemlere göre daha doğru ve hassas tahminler sağlamaktadır. Bu nedenle, büyük ve karmaşık veri setlerinden anlamlı ilişkiler çıkarabilen makine öğrenmesi yöntemleri, özellikle karbon emisyonu gibi çoklu değişkenlere bağlı süreçlerde daha doğru ve hassas tahmin yapılması için önemli bir araç haline gelmiştir.

Bu çalışmada, karbon emisyonu miktarları; elektrik tüketimi, kömür tüketimi, gaz tüketimi, sıcaklık, yakıt tüketimi, gayri safi yurtiçi hasıla (GSYİH) ve nüfus gibi kriterler kullanılarak destek vektör makinesi, karar ağacı ve rassal orman yöntemleriyle tahmin edilmiştir. Performans değerlendirmesi, R², RMSE ve AE gibi istatistiksel kriterlerle yapılmıştır. Elde edilen R² değerleri sırasıyla 0.874, 0.824 ve 0.977, RMSE değerleri 0.10, 0.115 ve 0.051, AE değerleri ise 0.071, 0.080 ve 0.037 olarak hesaplanmıştır. Ayrıca, bu yöntemlerin işlem süreleri sırasıyla 457, 30 ve 38 saniye olarak kaydedilmiştir. Bu sonuçlar, kullanılan veri seti dikkate alındığında, rassal orman yönteminin emisyon miktarının tahmin edilmesinde en uygun yöntem olduğunu göstermektedir.

Anahtar Kelimeler: Karbon emisyonu, makine öğrenme yöntemleri, destek vektör makinesi, karar ağacı, rassal orman

Abstract

Carbon emissions refer to greenhouse gases such as carbon dioxide (CO₂), methane (CH₄), nitrogen oxides (N₂O), and fluorinated gases released into the atmosphere as a result of human activities and natural processes. These gases lead to global warming, deterioration of air quality, formation of acidic precipitation, disruption of ecosystem balance, and rise of sea levels, thus further exacerbating climate change. Accurately determining the amount of carbon emissions is critical to combating these negative effects, slowing down global warming, preserving environmental balances, and building a sustainable future. In addition, these measurements are necessary for countries to monitor their compliance with international climate agreements and develop effective policies. Traditional methods may be insufficient to predict the amount of emissions, which limits the effectiveness of the measures taken. Machine learning methods provide more accurate and precise predicts than traditional statistical methods. Therefore, machine learning methods that can extract meaningful relationships from large and complex data sets have become an important tool for more accurate prediction, especially in processes that depend on multiple variables such as carbon emissions.

In this study, carbon emission amounts were predicted using criteria such as electricity consumption, coal consumption, gas consumption, temperature, fuel consumption, gross domestic product (GDP), and population using support vector machines, decision trees, and random forest methods. Performance evaluation was made with statistical criteria such as R², RMSE, and AE. The obtained R² values were calculated as 0.874, 0.824, and 0.977, RMSE values as 0.10, 0.115, and 0.051, and AE values as 0.071, 0.080, and 0.037, respectively. In addition, the processing times of these methods were recorded as 457,

30 and 38 seconds, respectively. These results show that the random forest method is the most appropriate method for predicting the amount of emissions, considering the data set used.

Keywords: Carbon emission, machine learning methods, support vector machine, decision tree, random forest

GİRİŞ

Son yıllarda artan karbon emisyonları, küresel ısınmanın ve iklim değişikliğinin başlıca sebeplerinden biri olarak kabul edilmektedir. Atmosferde biriken sera gazlarının yükselmesi, sadece çevresel bozulmalara yol açmamakta, aynı zamanda toplumların ekonomik ve sosyal yapısını derinden etkilemektedir. İklim değişikliği, doğal kaynakların tükenmesi, ekosistemlerin bozulması ve hava kalitesinin düşmesi gibi sorunları beraberinde getirmektedir. Bu süreçler, insanların yaşam kalitesini doğrudan etkileyen sağlık sorunlarını da tetiklemektedir. Dolayısıyla, karbon emisyonlarının azaltılması ve doğru bir şekilde ölçülmesi, hem çevresel sürdürülebilirlik hem de insan sağlığının korunması açısından büyük önem taşımaktadır. Küresel ölçekte hükümetler ve kuruluşlar, karbon emisyonlarını izlemek ve azaltmak için çeşitli politikalar geliştirmektedir. Ancak bu politikaların başarısında, emisyon miktarlarının doğru tahmin edilmesi kritik bir rol oynamaktadır.

Karbon emisyonu miktarının doğru bir şekilde tahmin edilmesi, elektrik tüketimi, kömür tüketimi, gaz tüketimi, sıcaklık, yakıt tüketimi, gayfi safi yurtiçi hasıla ve nüfus gibi çok çeşitli faktörlerin dikkate alınmasını gerektiren karmaşık bir süreçtir. Bu süreçte kullanılan veriler genellikle çok boyutlu, düzensiz ve zaman serisi niteliğinde olabilir. Ayrıca, ekonomik büyüme, teknolojik gelişmeler ve çevresel düzenlemeler gibi değişkenlerin zaman içerisindeki etkileri de emisyon seviyelerini doğrudan etkilemektedir. Bu karmaşık ve dinamik yapı, karbon emisyonu tahminlerini zorlaştırmakta ve geleneksel modelleme yaklaşımlarının yetersiz kalmasına neden olmaktadır. Bu nedenle, karmaşık sistemlerin doğru bir şekilde modellenmesi, iklim politikalarının etkinliğini artırmak ve gelecekteki emisyon miktarı seviyelerini öngörmek adına hayati önem taşımaktadır.

Son yıllarda makine öğrenmesi teknikleri, özellikle büyük veri setlerinin analizi ve kompleks ilişkilerin modellenmesi noktasında önemli bir araç haline gelmiştir. Karbon emisyonu miktarı tahmininde de sıklıkla makine öğrenmesi ve derin öğrenme yöntemlerinden yararlanılmaktadır. Wu vd. (2023) hibrit yapay balık sürüsü algoritması-parçacık sürüsü optimizasyonu ile doğrusal olmayan gri bernoulli ve BP sinir ağı birleşik modelinin ağırlığını ve arka plan değer katsayısını belirleyerek emisyon miktarını tahmin etmiştir. Çalışmada Çin, ABD, Avrupa Birliği, Hindistan ve Japonya ülkelerinin 2010-2021 yıllarına ait karbon emisyonu miktarları kullanılmıştır. Liu vd.(2023); güç yükü, sıcaklık ve zamanı içeren veri setini kullanarak karbon emisyonları üzerinde tahmin deneyini gerçekleştirmek için uzun kısa süreli bellek yönteminden yararlanmıştır. Tan (2022); rastgele orman, XGBoost, lightGBM, destek vektör makinesi, AdaBoost, CatBoost, Sequential yöntemlerinde dizel, elektrik, kömür ve kok tüketimi ile termik güç ve benzin üretimi gibi farklı 44 mikroekonomik girdi kriterlerini kullanarak emisyon miktarı tahmini yapmıştır. Shen vd.(2022); k en yakın komşu (KNN), karar ağacı (DT), AdaBoost ve XGBoost ve meta öğrenen olarak gradyan artırma karar ağacı (GBDT) ile bir istifleme topluluğu modeli oluşturarak nihai elektrik gücü karbon emisyon miktarı tahmin doğruluğunu incelemiştir. Wang vd.(2022), karbon emisyon miktarını yarasa algoritması ve LSTM yöntemlerini kullanarak tahmin etmiştir. Ghalandari vd. (2021); Birleşik Krallık, Almanya, İtalya ve Fransa olmak üzere dört Avrupa ülkesinin en önemli sera gazı emisyonlarından biri olan karbondioksit emisyonunu tahmin etmek için ekonomik faaliyetlerin bir göstergesi olan GSYİH'ye ek olarak söz konusu ülkelerin çeşitli enerji kaynaklarının tüketimlerini girdi olarak kullanarak iki tür yapay sinir ağı (YSA) modellemiştir. Benzer şekilde Sheta vd. de (2015), çalışmalarında karbondioksit emisyonunu miktarını tahmin etmek için iki tür YSA modeli geliştirilmiştir. Baareh (2013) ise küresel petrol, doğal gaz, kömür ve birincil enerji tüketimini girdi olarak kullanılarak YSA ile karbon emisyonu miktarını tahmin etmiştir.

Çalışmada kullanılan destek vektör makineleri (DVM), karar ağaçları (KA) ve rassal ormanlar (RO) gibi yöntemler, veri setlerindeki örüntüleri öğrenme ve tahmin doğruluğunu artırma potansiyeline sahiptir. Bu yöntemler, özellikle farklı değişkenler arasındaki karmaşık ilişkileri ve gizli kalıpları keşfetmede etkili çözümler sunmaktadır. Geleneksel istatistiksel yöntemlere kıyasla, makine öğrenmesi algoritmaları daha esnek yapıları sayesinde büyük miktarda veriyi işleyebilmekte ve çok daha karmaşık tahmin modelleri geliştirebilmektedir. DVM, doğrusal olmayan ilişkilere sahip verileri sınıflandırma ve tahmin etmede güçlü bir yöntemdir. KA, veri setindeki değişkenler arasındaki ilişkiyi basit ve anlaşılır

bir şekilde gösterir, ancak overfitting (aşırı uyum) riskine sahiptir. RO ise birden fazla karar ağacının kombinasyonu ile daha güçlü ve genelleştirilebilir tahminler üretir.

Bu çalışmada, elektrik tüketimi, kömür tüketimi, gaz tüketimi, sıcaklık, yakıt kullanımı, gayri safi yurtiçi hasıla ve nüfus gibi çeşitli kriterler kullanılarak karbon emisyonu tahmin edilmiştir. DVM, KA ve RO gibi üç farklı makine öğrenmesi yöntemi ile elde edilen sonuçlar, R^2 , RMSE ve AE gibi performans kriterleriyle değerlendirilmiştir. Çalışmada sırasıyla R^2 değerleri 0.874, 0.824 ve 0.977; RMSE değerleri 0.10, 0.115 ve 0.051; AE değerleri ise 0.071, 0.080 ve 0.037 olarak hesaplanmıştır. İşlem süreleri açısından DVM'yi 457 saniye, KA'ı 30 saniye, RO ise 38 saniyede sonuç üretmiştir. Bu bulgular, RO yönteminin emisyon tahmininde kısa sürede en yüksek doğruluğa sahip sonuçlar verdiğini göstermektedir.

Bu çalışmanın amacı, karbon emisyonu tahmininde yaygın olarak kullanılan bu üç makine öğrenmesi yöntemini karşılaştırmak ve karbon emisyonu miktarını doğru bir şekilde tahmin edebilecek en uygun modeli belirlemektir.

KULLANILAN YÖNTEMLER

Destek Vektör Makinesi

Destek vektör makinesi (SVM) yönteminin regresyon problemleri için uyarlanmış bir versiyonu olan destek vektör regresyonu (SVR), sürekli veri değerlerini tahmin etme amacıyla kullanılır ve bu süreci belirli bir hata toleransı çerçevesinde gerçekleştirir. Temel amacı, veriler arasındaki ilişkileri en iyi şekilde temsil eden bir regresyon fonksiyonu bulmaktır. Bu fonksiyon, verilerle belirli bir hata toleransında uyum sağlayacak şekilde oluşturulur. Regresyon fonksiyonunun hedefi, veriler arasındaki ilişkiyi doğru bir şekilde modellemek ve tahmin hatalarını minimize etmektir. SVR, hem doğrusal hem de doğrusal olmayan ilişkileri modelleyebilme yeteneğine sahiptir. Bu yetenek, çekirdek fonksiyonları aracılığıyla sağlanır. Çekirdek fonksiyonları, verileri daha yüksek boyutlu bir uzaya dönüştürerek karmaşık veri ilişkilerini öğrenmeye yardımcı olur.

SVR'nin avantajları arasında, genelleme yeteneği ve aşırı uyum riskini azaltması bulunur. Ayrıca, hem doğrusal hem de doğrusal olmayan veri setleriyle etkili bir şekilde çalışabilir. Ancak, büyük veri setlerinde hesaplama maliyetleri yüksek olabilir ve modelin performansını etkileyen hiperparametrelerin seçilmesi zor olabilir. Genel olarak, SVR, sürekli veri tahminlerinde güçlü bir yöntem olarak kabul edilir ve çeşitli veri setlerinde etkili sonuçlar sağlayabilir.

Karar Ağacı

Karar ağacı (KA), makine öğrenmesinde yaygın olarak kullanılan bir yöntemdir. Yöntem hem sınıflandırma hem de regresyon problemlerinde uygulanabilir. Temel prensibi, verileri ağaç benzeri bir yapıya dönüştürmektir. Bu yapı, verilerin çeşitli özelliklerine göre dallanarak karar verme sürecini görselleştirir. KA'nın kökü, tüm veriyi temsil eder ve her bir dal, verilerin belirli bir özelliğine göre ayrılmasını sağlar. Ağaç, yapraklarına ulaştığında, her yaprak bir sonuca, yani sınıflama veya tahmin sonucuna karşılık gelir. Ancak, KA bazen aşırı uyuma eğilimindedir, bu da modelin eğitim verilerine çok iyi uyum sağlaması ancak yeni verilerde düşük performans göstermesi anlamına gelir. Bu sorunu azaltmak için genellikle ağaçları budama teknikleri kullanılır. Budama, ağacın gereksiz karmaşıklığını azaltarak modelin genelleme yeteneğini artırır.

Sonuç olarak, karar ağaçları, veri analizi ve modelleme için güçlü bir araçtır. Görselleştirilebilir ve anlaşılır yapısı, verilerin özelliklerine dayalı karar verme süreçlerini belirli bir şekilde sunar, ancak dikkatli bir şekilde yapılandırılmalı ve aşırı uyum riskine karşı tedbirler alınmalıdır.

Rassal Orman

Rassal Orman (RO), makine öğrenmesinde hem sınıflandırma hem de regresyon problemlerinde kullanılan güçlü ve çok yönlü bir yöntemdir. Bu yöntem, çok sayıda KA'nın bir araya getirilerek sınıflandırma ve regresyon problemlerinde yüksek performans sağlamasına neden olur.

RO'nun temel prensibi, birden fazla karar ağacının oluşturulması ve bu ağaçların sonuçlarının birleştirilmesidir. Model, her bir ağacı oluştururken veri setinin rastgele bir alt kümesini kullanır. Ayrıca, her düğümde, verinin bölünmesi için rastgele bir özellik alt kümesi seçilir. Bu yöntem, ağaçların birbirinden bağımsız olarak çeşitlenmesini ve dolayısıyla modelin genelleme yeteneğinin artırılmasını sağlar. Regresyon problemlerinde, ağacın tahminlerinin ortalaması alınarak son tahmin yapılır. Bu yaklaşım, modelin doğruluğunu artırır ve aşırı uyum riskini azaltır.

RO'nun birçok avantajı vardır. Öncelikle, veri setindeki eksikliklere ve gürültüye karşı dayanıklıdır. Ayrıca, modelin hiperparametre ayarları genellikle daha az hassastır ve modelin başarısını önemli

ölçüde artırabilir. Ancak, RO'nun bazı dezavantajları da vardır. Örneğin, modelin yorumlanması daha zor olabilir ve büyük veri setlerinde hesaplama maliyetleri yüksek olabilir.

İstatistiksel Performans Kriterleri

Çalışmada makine öğrenmesi yöntemlerinin sonuçlarını karşılaştırmak için istatistiksel performans kriteri olarak hataların karesinin ortalamasının karekökü (RMSE), hataların mutlak değerleri (AE) ve determinasyon katsayısı (R^2) kullanılmıştır.

RMSE, gerçek değerler ile tahmin edilen değerler arasındaki farkların ortalamasının karekökünü alır (Eşitlik 1).

$$RMSE = \sqrt{\frac{1}{n} \sum_{i=1}^n (T_i - P_i)^2} \quad (1)$$

AE, gerçek değerler ile tahmin edilen değerler arasındaki hataların mutlak değerleridir (Eşitlik 2).

$$AE = \sum_{i=1}^n |T_i - P_i| \quad (2)$$

R^2 , gerçek değerler ile tahmin edilen değerler arasındaki uyumun bir ölçüsüdür (Eşitlik 3).

$$R^2 = \left[\frac{\sum_{i=1}^n ((T_i - \bar{T})(P_i - \bar{P}))}{\sqrt{\sum_{i=1}^n (T_i - \bar{T})^2 \sum_{i=1}^n (P_i - \bar{P})^2}} \right]^2 \quad (3)$$

Eşitliklerde yer alan n gözlem sayısını, T_i gerçekleşen değeri, \bar{T} gerçekleşen değerlerin ortalamasını, P_i tahmin değerini ve \bar{P} tahmin edilen değerlerin ortalamasını göstermektedir.

UYGULAMA

Uygulamada; Almanya, Avusturya, Belçika, Çekya, Danimarka, Fransa, Hırvatistan, Hollanda, İrlanda, İspanya, İsveç, İtalya, Letonya, Lüksemburg, Macaristan, Polonya, Portekiz, Romanya, Slovakya, Slovenya, Yunanistan (alfabetik sırayla) ülkelerine ait elektrik tüketimi (URL_1) (K_1), kömür tüketimi (URL_2) (K_2), gaz tüketimi (URL_3) (K_3), sıcaklık (URL_4) (K_4), yakıt tüketimi (URL_5) (K_5), gayfi safi yurtiçi hasıla (URL_6) (K_6) ve nüfus (URL_7) (K_7) gibi değişkenler girdi değişkeni; karbon emisyonu miktarı (URL_8) ise çıktı değişkeni olarak belirlenmiştir. Her bir ülkeye ait 2015-2021 yılları arasında 6 aylık periyotlar için elde edilmiş değişken değerleri kullanılarak 294×8 boyutunda veri seti elde edilmiştir. Hazırlanan veri seti, %70 (206×8) oranında eğitim ve %30 (88×8) oranında test için ayrılmıştır. Yer kısıtlaması nedeniyle oluşturulan veri setinin 21 satırına yer verilmiştir (Tablo 1).

Tablo 1. Kullanılan girdi ve çıktı değişkenleri

Ülkeler	K_1	K_2	K_3	K_4	K_5	K_6	K_7	Emisyon miktarı
Avusturya	0,1261	417800	0,0539	0,6	57,33793	344269,2	8642699	8,6
Belçika	0,1817	1196003	0,0478	0,44	61,72	416701,4	11274196	10,9
Hırvatistan	0,1008	1554843	0,0378	0,59	58,61767	45498,5	4203604	4,6
Çekya	0,1134	8995	0,0474	0,82	57,91085	170527,3	10546059	11,7
Danimarka	0,0935	44644	0,0415	1,07	60,37723	272193	5683483	9,4
Fransa	0,1111	1331643	0,056	0,56	62,39611	2201402	66548272	6,5
Almanya	0,1431	4018214	0,0509	0,71	62,3012	3085650	81686611	11,1
Yunanistan	0,1139	68341	0,047	1,09	65,9316	176368,9	10820883	8,7
Macaristan	0,0885	12125	0,0282	2,53	54,2731	112791	9843028	5,8
İrlanda	0,1846	91569	0,052	0,76	62,93764	272544,3	4701957	15
İtalya	0,1507	3430999	0,0504	0,48	64,69973	1655355	60730582	6,8
Letonya	0,1083	9	0,0392	1,83	54,58233	24572,1	1977527	5,7
Lüksemburg	0,1283	63235	0,0369	2,58	52,93144	54142,3	569604	19,9
Hollanda	0,1285	12907947	0,0422	0,6	66,2635	699175	16939923	12,5
Polonya	0,1125	565403	0,0407	1,29	54,71619	429834,6	37986412	9,4
Portekiz	0,115	138480	0,0753	1,15	61,50277	179713,2	10358076	6,5
Romanya	0,0927	271730	0,015	0,72	56,92076	160287,8	19815616	3,4
Slovakya	0,1223	231503	0,0413	0,85	60,66491	80126	5423801	6,5
Slovenya	0,1123	218259	0,0452	0,63	62,0667	38493,9	2063531	8,6

İspanya	0,1815	1272141	0,0581	1,1	54,34379	1078092	46444832	6,5
İsveç	0,1183	644561	0,0611	1,79	62,07513	452423,7	9799186	1

Değişkenlerin Belirlenmesi

Girdi değişkenleri belirlenirken literatürde karbon emisyonu miktarı tahmininde kullanılan değişkenler dikkate alınmıştır. Elektrik tüketimi (Shen vd., 2022; Tan, 2022), kömür tüketimi (Shen vd., 2022; Sheta vd., 2015; Baareh, 2013; Ghalandari vd., 2021; Tan, 2022), gaz tüketimi (Shen vd., 2022; Sheta vd., 2015; Baareh, 2013; Ghalandari vd., 2021; Tan, 2022) (K_3), sıcaklık (Liu vd., 2023; Davis, 2019), yakıt tüketimi (Shen vd., 2022; Ghalandari vd., 2021; 23), gayfi safi yurtiçi hasıla (Shen vd., 2022; Ghalandari vd., 2021; Tan, 2022) ve nüfus (Shen vd., 2022; Tan, 2022). Çıktı değişkeni olarak ise karbon emisyonu miktarı seçilmiştir.

Veri Ön İşleme

Bu aşamada verilerin temizlenmesi, düzenlenmesi ve normalize edilmesi yapılmıştır. Başlangıçta 41 Avrupa ülkesini kapsayan çalışma bazı değişken değerlerinin tamamının eksik olması nedeniyle 740 satırdan 294 satıra inmiştir. Değişkenlerinin tamamı veya büyük bir çoğunluğu eksik olan satırlar silinerek veri seti düzenlenmiştir. Son olarak kalan veri seti "Min-Max Normalizasyon" yöntemiyle (Eşitlik 4) normalize edilmiştir.

$$X^l = \frac{X - X_{min}}{X_{max} - X_{min}} \quad (4)$$

Eşitlikte yer alan X^l değişkenin normalize değerini, X değişken değerini, X_{min} ve X_{max} sırasıyla değişkenin aldığı minimum ve maksimum değerleri göstermektedir.

Karbon Emisyonu Miktarının Tahmin Edilmesi

Karmaşık ve dinamik bir yapıya sahip olan karbon emisyonu miktarının tahmininde; DVM, KA ve RO makine öğrenmesi yöntemleri kullanılmıştır. Çalışmada öncelikle makine öğrenmesi yöntemlerine etki eden hiperparametreler ve kombinasyonda kullanılacak seviyeleri belirlenmiştir.

Örneğin; gamma parametresi 10, C hiperparametresi 10, maximum iterasyon sayısı 60, çekirdek önbelleği 0 ve çekirdek tipi anova olan DVM kombinasyonu için RMSE, AE ve R^2 değerleri sırasıyla 0.10, 0.071 ve 0.874 olarak hesaplanmıştır. DVM'de incelenen 5 hiperparametreye bağlı olarak (11x11x11x4) 58564 kombinasyon oluşturulmuştur (Tablo 2).

Tablo 2. DVM'ye ait hiperparametreler

Hiperparametreler	Minimum	Maksimum	Adım Sayısı	Ölçek
Gamma hiperparametresi	0	100	10	Lineer
C hiperparametresi	0	100	10	Lineer
Max iterasyon sayısı	1	100	10	Lineer
Çekirdek önbelleği	0	100	10	Linner
Çekirdek tipi	Dot	Radyal	Neural	Anova

Uygulama veri seti sayısal değer içerdiği için KA ve RO yöntemlerinde 'en küçük kareler' ayırma ölçütü kullanılmıştır. KA yönteminde 5 hiperparametre için (11x11x11x2x2) 5324 kombinasyon (Tablo 3), RO yönteminde 4 hiperparametre için (11x11x2x2) 484 kombinasyon (Tablo 4) oluşturulmuştur.

Tablo 3. KA'ya ait hiperparametreler

Hyperparameters	Minimum	Maksimum	Adım Sayısı	Ölçek
Güven parametresi	0	1	10	Lineer
Minimum yaprak büyüklüğü	1	100	10	Lineer
Ön Budama	√	χ		
Budama	√	χ		
Maksimum derinlik	0	100	10	Lineer

Tablo 4. RO'ya ait hiperparametreler

Hyperparameters	Minimum	Maksimum	Adım Sayısı	Ölçek
Ağaç sayısı	0	100	10	Lineer
Maksimum derinlik	0	100	10	Lineer
Ön Budama	√	χ		
Budama	√	χ		

Uygulama sonunda DVM'nin, KA'nın ve RO'nun en iyi beş iterasyonunu veren hiperparametre kombinasyonları sırasıyla Tablo 5, Tablo 6 ve Tablo 7'de görülmektedir.

Tablo 5'e göre DVM'de en iyi sonucu veren hiperparametre kombinasyonu gamma parametresinin 10, C parametresinin 10, maksimum iterasyon sayısının 60 ve çekirdek tipinin Anova olduğu kombinasyondur.

Tablo 5. DVM'de elde edilen en iyi 5 iterasyon

Kullanılan Hiperparametreler	İterasyon				
Gamma hiperparametresi	10	10	10	10	10
C hiperparametresi	10	20	30	40	50
Max iterasyon sayısı	60	60	60	60	60
Çekirdek önbelleği	0	0	0	0	0
Çekirdek tipi	Anova	Anova	Anova	Anova	Anova

KA yönteminde hem ön budama hem de budama işleminin yapıldığı, minimum yaprak büyüklüğünün 11 olduğu ağaç en iyi tahmin sonucunu vermektedir (Tablo 6).

Tablo 6. KA kullanılan hiperparametreler ve en iyi 5 iterasyon

Kullanılan Hiperparametreler	İterasyon				
Güven parametresi	0.00	0.10	0.20	0.30	0.40
Minimum yaprak büyüklüğü	11	11	11	11	11
Ön Budama	√	√	√	√	√
Budama	√	√	√	√	√
Maksimum derinlik	0	0	0	0	0

Tablo 7'de ise budamanın yapıldığı, ağaç sayısının 41 ve maksimum derinliğin 70 olduğu RO en iyi sonucu vermektedir.

Tablo 7. RF kullanılan hiperparametreler ve en iyi 5 iterasyon

Kullanılan Hiperparametreler	İterasyon				
Ağaç sayısı	41	21	41	51	100
Maksimum derinlik	70	30	20	10	20
Ön Budama	χ	χ	χ	χ	χ
Budama	√	√	χ	√	χ

Tahminlerin Karşılaştırılması

Çalışmada kullanılan makine öğrenmesi yöntemleri RMSE, AE, R^2 istatistiksel performans kriterleri ve işlem süreleri kullanılarak karşılaştırılmıştır (Tablo 8).

DVM yöntemine bakıldığında, RMSE değeri 0.10, AE değeri 0.071, ve R^2 değeri 0.874 ile orta seviyede bir performans sergilemektedir. Ancak, bu yöntem 7 dakika 37 saniyelik işlem süresiyle en uzun sürede sonuç veren model olarak öne çıkmaktadır.

KA yöntemi yalnızca 30 saniyelik işlem süresiyle en hızlı yöntem olsa da performans açısından en zayıf model olarak değerlendirilmektedir. Yöntem RMSE değeri 0.115, AE değeri 0.080 ile en yüksek hata oranlarına sahiptir. Ayrıca, R^2 değeri 0.824 ile diğer yöntemlere göre daha düşük bir doğruluk sunmaktadır.

RO yöntemi ise 0.051 RMSE değeri ve 0.037 AE değeri ile en düşük hata oranlarını göstermektedir. R^2 değeri 0.977 ile en yüksek doğruluğa sahip olan bu yöntem, aynı zamanda sadece 38 saniyede sonuç vermesiyle hızlı ve etkili bir model olarak öne çıkmaktadır. Sonuç olarak, RO yöntemi hem yüksek performans hem de kısa işlem süresi sunarken, KA hızlı ama daha düşük doğrulukla çalışmakta, DVM ise daha uzun sürede yüksek doğruluk sağlayan bir model olarak karşımıza çıkmaktadır. Bu nedenle her ne kadar işlem süresi KA yönteminde daha az çıksa da tahmin doğruluğu açısından RO yöntemi, emisyon miktarı tahmininde yüksek doğrulukta sonuçlar verdiği için tercih edilmelidir.

Tablo 8. Makine öğrenme yöntemlerinin karşılaştırılması

Yöntemler	Performans Kriterleri			
	RMSE	AE	R ²	İşlem süresi
DVM	0.10	0.071	0.874	7 dakika 37 saniye
KA	0.115	0.080	0.824	30 saniye
RO	0.051	0.037	0.977	38 saniye

TARTIŞMA VE SONUÇ

Bu çalışmada, karbon emisyonu miktarının tahmin edilmesinde kullanılan DVM, KA ve RO makine öğrenmesi yöntemleri, çeşitli kriterler dikkate alınarak analiz edilmiştir. Elektrik tüketimi, kömür tüketimi, gaz tüketimi, sıcaklık, yakıt tüketimi, gayri safi yurtiçi hasıla ve nüfus gibi literatürde de sıklıkla kullanılan kriterler, emisyon miktarı tahmini açısından kritik parametreler olarak ele alınmıştır. Sonuçlara göre, RO yöntemi, R² (0.977), RMSE (0.051) ve AE (0.037) değerleri ile diğer yöntemlere kıyasla en yüksek doğruluğu sağlamıştır. Bu sonuçlar, RO yönteminin, veri setindeki karmaşık ilişkileri daha iyi modelleyebildiğini ve farklı kriterleri dikkate alarak daha tutarlı tahminlerde bulunabildiğini göstermektedir.

KA yöntemi, işlem süresi açısından en hızlı sonuçları vermesine rağmen (30 saniye), doğruluk açısından (R²=0.824) RO'dan daha düşük bir performans sergilemiştir. Bu yöntem, veri seti üzerindeki temel eğilimleri yakalamakta başarılı olmuş, ancak modelleme konusunda yeterince güçlü olmamıştır.

DVM ise, performans açısından (R²=0.874, RMSE=0.10, AE=0.071) KA yönteminden daha iyi sonuçlar vermiş olsa da işlem süresi (457 saniye) oldukça uzun olmuştur. Bu, özellikle büyük veri setlerinde kullanılacak bir model için dezavantajlı bir durumdur.

Sonuç olarak, karbon emisyonu miktarı tahmininde RO yöntemi, dikkate alınan kriterler doğrultusunda en uygun ve doğru yöntem olarak belirlenmiştir. Bu yöntemin, enerji ve ekonomik verilerle çalışırken daha karmaşık yapıları modelleme kapasitesi sayesinde tahmin doğruluğunu artırdığı görülmüştür. Ancak, işlem süresinin kısa olması gereken durumlarda, KA yöntemi tercih edilebilir. Çalışma, makine öğrenmesi tekniklerinin karbon emisyonu tahmininde güçlü araçlar olduğunu ve enerji, ekonomik ve çevresel faktörleri entegre eden modellerin, iklim değişikliğiyle mücadelede daha etkin stratejiler geliştirilmesine katkı sağlayabileceğini ortaya koymaktadır.

REFERENCES

1. Baareh, A. K. (2013). Solving the carbon dioxide emission estimation problem: An artificial neural network model. *Journal of Software Engineering and Applications*, 6, 338-342.
2. Chen, X., Liao, Z., Gao, Z., Li, Q., Lv, P., Zheng, G., & Yang, K. (2022). A calculation model of carbon emissions based on multi-scenario simulation analysis of electricity consumption. *Sustainability*, 14(14), 8765.
3. Davis, E. (2019). Climate Change Analytics: Predicting Carbon Price and CO2 Emissions.
4. Ghalandari, M., Forootan Fard, H., Komeili Birjandi, A., & Mahariq, I. (2021). Energy-related carbon dioxide emission forecasting of four European countries by employing data-driven methods. *Journal of Thermal Analysis and Calorimetry*, 144, 1999-2008.
5. Liu, W., Cai, D., Nkou, J. N., & Huang, Q. (2023, March). A Survey of Carbon Emission Forecasting Methods Based on Neural Networks. In *2023 5th Asia Energy and Electrical Engineering Symposium (AEEES)* (pp. 1546-1551). IEEE.
6. Shen, Y., Zeng, Z., Lin, W., Que, D., & Huang, Z. (2022, November). Electric power carbon emission prediction based on stacking ensemble model with k-fold cross validation. In *2022 China Automation Congress (CAC)* (pp. 6600-6605). IEEE.
7. Sheta, A. F., Ghatasheh, N., & Faris, H. (2015, April). Forecasting global carbon dioxide emission using auto-regressive with exogenous input and evolutionary product unit neural network models. In *2015 6th International Conference on Information and Communication Systems (ICICS)* (pp. 182-187). IEEE.
8. Tan, H. (2022, August). Carbon Emission Prediction with Macroeconomic Variables and Machine Learning. In *2022 3rd International Conference on Clean and Green Energy Engineering (CGEE)* (pp. 52-56). IEEE.
9. URL₁ <https://ec.europa.eu/eurostat>

10. URL₂ <https://www.eia.gov/coal>
11. URL₃ <https://ec.europa.eu/eurostat>
12. URL₄ <https://ourworldindata.org/temperature-anomaly>
13. URL₅ <https://www.gov.uk/government/statistical-data-sets>
14. URL₆ <https://ec.europa.eu/eurostat>
15. URL₇ <https://databank.worldbank.org>
16. URL₈ <https://ourworldindata.org/explorers/>
17. Wang, Y., Tian, J., He, L., Zhang, Q., Zhang, L., & Miao, S. (2022, April). Research on Carbon Emission Prediction Method Considering Data Preprocessing. In *2022 5th International Conference on Energy, Electrical and Power Engineering (CEEPE)* (pp. 1147-1153). IEEE.
18. Wu, S., Zeng, X., Li, C., Cang, H., Tan, Q., & Xu, D. (2023). CO2 emission forecasting based on nonlinear grey Bernoulli and BP neural network combined model. *Soft Computing*, 27(21), 15509-15521.

**KADINLARIN PSİKOLOJİK GÜÇ ALGISININ ÇEŞİTLİ DEĞİŞKENLERE GÖRE
İNCELENMESİ
INVESTIGATION OF WOMEN'S PSYCHOLOGICAL POWER PERCEPTION
ACCORDING TO VARIOUS VARIABLES**

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Özet

Kadınların güçlendirilmesi konusu son dönemlerde gittikçe önemli bir konu olmaya başlamıştır. Kadınların hayata katılımlarını artırmak için birçok eylem planları hazırlanmış olup bu planlar doğrultusunda kadın alanında çalışmalar artmaya başlamıştır. Psikolojik güçlendirme, kadınların bilinci ve öz saygılarının artmasıyla gerçekleştirilebilir. Kadınlar hem iş kurlmaları sayesinde ekonomik güçlenme hem de toplumsal cinsiyet, kadın hakları, özgüven ve ilgili konulardaki resmi olmayan eğitim oturumları sayesinde psikolojik güçlenme yaşamaktadırlar. Bu çalışmada kadınların psikolojik güç algısının çeşitli değişkenlere göre incelenmesi amaçlanmıştır. Araştırmanın çalışma grubunu Kırıkkale ilinde yaşayan 100 kadın oluşturmuştur. Örneklem grubuna Kırıkkale ilinin farklı sosyo-demografik özelliklere sahip mahallelerinde (Seyrantepe, Bayraktepe, Yuva, Yaylacık ve Ovacık) yaşayan kadınlar dahil edilmiştir. Çalışmada, veri toplama yöntemi olarak anket tekniği kullanılmış olup Bozkur (2020) tarafından geliştirilen “Kadın Psikolojik Güç Ölçeği”nden yararlanılmıştır. Ölçek 31 maddeden ve 4 alt boyuttan oluşmakta ve kadınların psikolojik güç algılarını belirlemeyi amaçlamaktadır. Ölçek 5’li Likert tipindedir (5= Tamamen Katılıyorum, 1= Kesinlikle katılmıyorum). Ölçekten alınan yüksek puan kadının psikolojik güç algısının yüksek olduğunu göstermektedir. Verilerin çözümlenmesinde standart sapma, aritmetik ortalama, ikili gruplar için t testi, ikiden daha fazla grup için ise varyans analizi kullanılmıştır. Araştırmaya alınan kadınlar arasında; 27-38 yaş grubundakiler, üniversite ve üzeri öğrenim görenler, evliler, 2 çocuğu bulunanlar, çekirdek aileye sahip olanlar, ilk evliliğini yapanlar, çalışmayanlar, aylık 10.001-20.000 TL gelire sahip olanlar, sosyal destek almadığını belirtenler önde gelmektedir. Araştırma sonuçlarına göre; kadınların sosyal destek alma durumları ile psikolojik güç algıları arasında anlamlı bir fark saptanmıştır ($p<0.05$). Ayrıca 18-27 yaş grubunda olanların, ilkökul mezunlarının, bekarların, çocuğu bulunmayanların, geniş ailede yaşayanların, ilk evliliği olanların, 30.001-40.000 TL gelire sahip olanların, sosyo-ekonomik durumunu iyi olarak algılayanların ve sosyal destek alanların psikolojik güç algılarının daha yüksek olduğu belirlenmiştir.

Keywords: Güçlendirme, Kadın, Psikolojik güç

Abstract

The empowerment of women has become an increasingly important issue in recent years. Many action plans have been prepared to increase women's participation in life and studies in the field of women have started to increase in line with these plans. Psychological empowerment can be realised through increased women's awareness and self-esteem. Women experience both economic empowerment through business start-ups and psychological empowerment through informal training sessions on gender, women's rights, self-esteem and related topics. In this study, it was aimed to examine women's perception of psychological power according to various variables. The study group of the research consisted of 100 women living in Kırıkkale province. The sample group included women living in neighbourhoods of Kırıkkale province with different socio-demographic characteristics (Seyrantepe, Bayraktepe, Yuva, Yaylacık and Ovacık). In the study, the survey technique was used as a data collection method and the ‘Women's Psychological Power Scale’ developed by Bozkur (2020) was used. The scale consists of 31 items and 4 sub-dimensions and aims to determine women's perceptions of

psychological power. The scale is 5-point Likert type (5= Strongly Agree, 1= Strongly Disagree). The high score obtained from the scale indicates that women's perception of psychological power is high. In analysing the data, standard deviation, arithmetic mean, t-test for paired groups and variance analysis for more than two groups were used. Among the women who were included in the study; those in the 27-38 age group, those with university education and above, those who are married, those who have 2 children, those who have a nuclear family, those who are in their first marriage, those who are not working, those who have a monthly income of 10.001-20.000 TL, and those who state that they do not receive social support are the leading ones. According to the results of the study, a significant difference was found between women's status of receiving social support and their perceptions of psychological power ($p<0.05$). In addition, it was determined that those in the 18-27 age group, primary school graduates, single women, women without children, women living in extended family, women in their first marriage, women with an income of 30.001-40.000 TL, women who perceived their socio-economic status as good and women who received social support had higher perceptions of psychological power.

Keywords: Empowerment, Women, Psychological power

GİRİŞ

Kadınlarda güç ve güçlendirme kavramları sosyal, ekonomik, politik ve psikolojik açıdan gittikçe önem kazanan bir kavram olmakla birlikte politika gündeminde de kadınların güçlenmesine yönelik yeni eylem planları ile yer aldığı görülmektedir. Kadının psikolojik gücü, toplumsal ve bireysel dinamikler içinde derin bir etki yaratır. Kadın güçlenmesi ile birlikte hem kendisi hem de çevresi üzerindeki etkilerini şekillendirir; bunun yanında dayanıklılığı, empati yeteneği ve liderlik özellikleri, onun toplumda daha belirgin bir rol almasını sağlar.

Kadının psikolojik güçlenmesinin önem kazanmasının ve tartışılmasının nedeni temelde kadın ve erkek arasında eşit olmayan güç ilişkilerini görünür kılan toplumsal cinsiyet eşitsizliğine yönelik artan bilinç ve farkındalıklardır. Hiyerarşik toplumsal cinsiyet yapısının özellikle kadınlar için ortaya çıkan olumsuz etkilerini azaltmak ve/veya ortadan kaldırmak amacıyla kadının güçlenmesi önem kazanmaktadır. (Bozkur, 2020).

Kadınların güçlendirilmesi, kadınların kendi öz güvenlerini artırmak, seçim yapma ve kendi bağımlılıklarını sorgulamaya ve ortadan kaldırmaya yardımcı olacak kaynakları kontrol etme haklarını ileri sürmek için kendilerini örgütleyebildikleri bir süreçtir (Keller ve Mbewe, 1991; akt., Varghese, 2011). Kadınların güçlendirilmesi, Birleşmiş Milletler'in Milenyum Kalkınma Hedefleri'nin en önemli endişelerinden biridir (Varghese, 2011)

Dünyanın pek çok bölgesinde kadınlar, feminist hareketin yıllar süren mücadelesine rağmen -halen erkeğin toplumsal statüsü ve olanakları ile kıyaslandığında- dezavantajlı bir konumda bulunmaktadır. Uluslararası kuruluşlarca yürütülen araştırmalar erkeğin hak ve ayrıcalıklarını korumakta olan geleneksel toplumsal cinsiyet rollerinin son derece yavaş değiştiğini göstermektedir. İnsani gelişmişlik düzeyini belirleyen kriterlerden biri olan toplumsal cinsiyet eşitliği, geleneksel ve kadını baskı altına alan toplumsal cinsiyet rollerinin değişmesi halinde toplumun olumlu yönde değişeceği varsayımından hareketle Birleşmiş Milletler İnsani Gelişme Raporu, Avrupa Birliği Toplumsal Cinsiyet Eşitliği Komisyonu'nun Cinsiyet - Eşitliği Stratejisi gibi uluslararası birçok metinde önümüzdeki yılların öncelikli hedefleri arasına yerleştirilmiştir (COE, 2014; Compact, 2010; UNDP, 2015; UNWomen, 2015; akt; Baydur ve Uçan, 2016).

Psikolojik güçlenme, eğitim, destekleyici ilişkiler ve kişisel deneyimlerle pekiştirilerek, kadınların yaşamlarında daha aktif ve etkili roller üstlenmelerine zemin hazırlar.

Çeşitli yazarlar tarafından önerilen çerçeveler, kadınların güçlendirilmesinin şu boyutlarda gerçekleşmesi gerektiğini öne sürmektedir: ekonomik, sosyo-kültürel, ailevi/kişilerarası, yasal, politik ve psikolojik. Ancak, bu boyutlar kapsam olarak çok geniştir ve her bir boyutta kadınların güçlendirilebileceği bir dizi alt alan vardır (Varghese, 2011). Bu nedenle bu çalışma kadınların psikolojik güç algısının çeşitli değişkenlere göre incelenmesi amacıyla planmış ve yürütülmüştür.

YÖNTEM

Bu araştırma; Kırıkkale ilinde yaşayan kadınların psikolojik güç algılarının çeşitli değişkenlere göre incelenmesini amaçlayan tanımlayıcı tipte bir araştırmadır. Araştırmanın çalışma grubunu, Kırıkkale

ilinde Seyrantepe, Yuva ve Ovacık Mahallelerinde yaşayan farklı sosyo demografik özelliklere sahip, çalışmaya katılmayı gönüllü olarak kabul eden 100 yetişkin kadın oluşturmaktadır.

Veri Toplama Yöntem ve Araçları

Araştırmanın verileri, 15.03.2024-03.05.2024 tarihleri arasında anket formu aracılığıyla kolay örnekleme yöntemi ile araştırmacılar tarafından yüzyüze görüşmeler ile toplanmıştır. Katılımcılara önce anket formu üzerinde çalışma hakkında bilgi verilmiş olup araştırmanın amacı, araştırma formuyla elde edilen bilgilerin bilimsel amaçla kullanılacağı, bilimsel etik kuralları çerçevesinde gizlilik içinde değerlendirileceği ve başka bir amaçla kullanılmayacağı belirtilmiştir.

Hazırlanan anket formu 2 bölümden oluşmaktadır. Birinci bölümde, araştırmaya katılan kadınlara ilişkin sosyo-demografik bilgilere (cinsiyet, eğitim, gelir düzeyi vb.) yer verilmiştir. İkinci bölümde ise, Bozkur (2020) tarafından geliştirilen “Kadın Psikolojik Güç Ölçeği” kullanılmıştır.

Kadın Psikolojik Güç Ölçeği (KPGÖ): Bozkur tarafından 2020 yılında uyarlanan ölçek 31 madde ve 4 alt boyuttan oluşmaktadır. Değerlendirilmeler sonucunda incelemesi ve boyutlarda yer alan maddeler dikkate alınarak bu boyutlar “Güçlülük/Savunuculuk”, “Kadın Olarak Benlik Saygısı”, “Eğitime Yaklaşım” ve “Kısıtlayıcılık” olarak tanımlanmıştır. Ölçekte 1. alt boyut olan “Güçlülük/Savunuculuk” alt boyutunda 14 madde yer almaktadır. Bu boyuttan alınabilecek minimum puan 14 maksimum puan ise 70’tir. Bu boyutta 1, 2, 3, 10, 11, 12, 17, 18, 19, 23, 24, 26, 27 ve 29’uncu maddeler yer almaktadır. Bu boyutta kadının kendisinin ve/veya kadınların haklarını savunması, gücünün ve güç kaynaklarının farkında olması, özgüven ve eşitlikçi tutumlarını ölçen maddeler yer almaktadır. Ölçekte 2. alt boyut olan “Benlik Saygısı” alt boyutunda 8 madde yer almaktadır. Bu boyuttan alınabilecek minimum puan 8 maksimum puan ise 40’tir. Bu boyutta 4, 5, 6, 13,14, 20, 21 ve 25’inci maddeler yer almaktadır. Bu boyutta yer alan maddeler kadın olarak kendi kimliğinden hoşnut olma, kendi yeteneklerine, karar verme gücüne ve kapasitesine güvenmeye yöneliktir. Ölçekte 3. alt boyut olan “Eğitime Yaklaşım” alt boyutunda 4 madde yer almaktadır. Bu boyuttan alınabilecek minimum puan 8 maksimum puan ise 20’dir. Bu boyutta 7, 8, 15 ve 22’inci maddeler yer almaktadır. Bu boyutta yer alan maddeler ters puanlanmakta ve kadın eğitime yönelik yaklaşımını ölçmektedir. Ölçeğin 4. Alt boyutu ise “Kısıtlayıcılık” alt boyutudur. Bu boyutta 5 madde yer almaktadır. Bu boyuttan alınabilecek minimum puan 5 maksimum puan ise 25’tir. Bu boyutta 9, 16, 18, 30 ve 31’inci maddeler yer almaktadır. Bu boyutta yer alan maddeler kadının kısıtlanmasını, cinsiyet eşitliğine karşı çıkışını ve geleneksel rollerde kalmasını savunan maddelerdir. Bu nedenle bu boyuttaki maddeler ters puanlanmaktadır. Birlikte değerlendirilmesiyle 31 maddeden oluşan bir ölçek formu ortaya çıkmıştır. Formda 4, 5, 6, 7, 8, 9, 13, 14, 15, 16, 20, 21, 22, 25, 28, 30 ve 31. maddeler ters puanlanmaktadır.

Verilerin Değerlendirilmesi ve Analizi

Araştırmanın verileri SPSS.24 programında değerlendirilmiştir. Katılımcılara ilişkin demografik ve açıklayıcı bilgiler frekans, yüzde, ortalama ve standart sapma gibi tanımlayıcı istatistiklerle ifade edilmiştir. Bununla birlikte, değişkenler arasında ilişki ve anlamlı bir farklılık olup olmadığının belirlenmesi için grup sayısı iki ise İki Grup Arasındaki Farkın Anlamlılık Testi, grup sayısı ikiden fazla ise Tek Yönlü Varyans Analizi (ANOVA) yapılmıştır. Analizlerden elde edilen sonuçlar *p<0,05, anlamlılık düzeylerinde değerlendirilmiştir.

BULGULAR

Tablo 1’de araştırma kapsamına alınan kadınların sosyo-demografik özelliklerine ilişkin bilgiler yer almaktadır.

Tablo 1. Çalışmaya katılan kadınların sosyo-demografik özelliklerine göre dağılımı (n=409)

Değişkenler	Gruplar	n	%
Yaş	18-27 yaş	17	17.0
	28-37 yaş	25	25.0
	38-47 yaş	22	22.0
	48-57 yaş	24	24.0
	58- yaş	12	12.0
Eğitim Durumu	İlkokul ve daha az	24	24.0
	Ortaokul	17	17.0
	Lise	19	19.0
	Üniversite ve üzeri	40	40.0
Medeni Durum	Bekar	17	17.0
	Evli	69	69.0

	Boşanmış	14	14.0
	Yok	16	16.0
Çocuk Sayısı	1	23	23.0
	2	35	35.0
	3	15	15.0
	4 ve üzeri	11	11.0
	İlk	92	92.0
Kaçınıcı Evlilik	İkinci	8	8.0
	Çalışıyor	29	29.0
Çalışma Durumu	Çalışmıyor	71	71.0
	10000 TL ve altı	19	19.0
Ailenin Toplam Aylık Geliri	10001-20000 TL	29	29.0
	200001 - 30000TL	19	19.0
	300001- 40000 TL	17	17.0
	40001 TL ve üzeri	17	17.0
	İyi	11	11.0
Sosyo-Ekonomik Durumunu Algılayış Biçimi	Orta	63	63.0
	Kötü	26	26.0
	Var	42	42.0
Sosyal Destek	Yok	58	52.0

Araştırma kapsamına alınan kadınlar arasında; 28-37 yaş grubundakiler (%25.0), üniversite ve üzeri eğitim görenler (%40.0), evliler (%69.0), 2 çocuk sahibi olanlar (%35.0), çekirdek ailede yaşayalar (%84.0), ilk evliliğini yapanlar (%92.0), çalışmayanlar (%71.0), 10001 TL- ile 20000 TL arası gelir düzeyine sahip olanlar (%28.0), sosyo-ekonomik düzeyini orta olarak algılayanlar (%63.0) ve sosyal desteğinin olmadığını belirtenler (%58.0) önde gelmektedir (Tablo 1). Çalışmaya katılan kadınların ilk evlilik yaşları ortalaması ise 21.1700'dır.

Tablo 2. Kadın Psikolojik Güç Ölçeği ve alt ölçeklerine ait tanımlayıcı istatistikler

Alt Boyutlar	n	Min-Max	Ort.	Sdt. Sapma
Güçlülük/Savunuculuk	100	18-61	34.1800	6.07259
Benlik Saygısı	100	19-38	27.5800	3.29119
Eğitime Yaklaşım	100	4-18	11.0400	2.81023
Kısıtlayıcılık	100	8-25	15.9200	3.15806
Ölçek Toplam	100	72-104	88.7200	6.86534

Araştırmaya alınan örneklem grubunun “Kadın Psikolojik Güç Ölçeği” ve alt ölçeklerinden aldıkları puanlar Tablo 2’de gösterilmiştir. Buna göre; ölçeğin “Güçlülük/Savunuculuk Alt Ölçeği”nde artan puan kadının gücünün ve güç kaynaklarının farkında olması şeklinde yorumlanmaktadır. Alt ölçek ortalaması 34.1800±6.07259 olduğuna göre örneklem grubunun gücünün yeterince farkında olduğunu söylemek mümkündür. Ölçeğin “Benlik Saygısı Alt Ölçeği”nde artan puan kadının kendi yeteneklerine, karar verme gücüne ve kapasitesine güvendiğini göstermektedir. Alt ölçek ortalaması 27.5800±3.229119 olduğuna göre örneklem grubunun kendine güvendiğini söylemek mümkündür. Ölçeğin “Eğitime Yaklaşım Alt Ölçeği”nde artan puan kadının eğitime olumlu yaklaştığını göstermektedir. Alt ölçek ortalaması 11.4000±2.81023 olduğuna göre bu durum örneklem grubunun eğitime olan yaklaşımının nispeten olumlu olduğunu göstermektedir. Ölçeğin “Kısıtlayıcılık Alt Ölçeği”nde artan puan kadının cinsiyet eşitliğine karşı çıkışını, geleneksel rollerde kalmasını savunmaktadır. Alt ölçek ortalaması 15.9200±3.15806 olduğuna göre bu durum kadınların cinsiyet eşitliğini savunduğunu ve geleneksel rollere karşı çıktığını göstermektedir. Ölçekten alınabilecek en yüksek puan 155, en düşük puan ise 31’dir. Ölçek toplam puanı değerlendirildiğinde (88.7200±6.86534) araştırma kapsamına alınan kadınların psikolojik güç algılarının ortalamasının üzerinde olduğu görülmektedir.

Yılmaz (2024) tarafından yapılan çalışmada ise; Kadın Psikolojik Güç Ölçeği toplam puan ortalaması 106,89±22,81 olarak bulunmuştur. Ölçek alt boyutlarına bakıldığında güçlülük/savunuculuk ortalaması 53,33±10,74, benlik saygısı ortalaması 22,66±6,41 ve eğitime yaklaşım ortalaması 12,32±4,34, kısıtlayıcılık ise 19,31±4,36 ile yüksek olarak bulunmuştur.

Turan (2014) tarafından psikolojik güçlendirme ile iş yaşam kalitesi arasındaki ilişkinin incelenmesi amacıyla yapılan çalışmada da araştırmaya katılanların psikolojik güçlendirme düzeyi ortalamasının yüksek düzeyde olduğu tespit edilmiştir.

Tablo 3. Kadın Psikolojik Güç Ölçeği'nin sosyo-demografik faktörlere göre incelenmesi ANNOVA testi sonuçları

Değişkenle	Gruplar	N	Ort. ± SS	F	p
Yaş	18-27 yaş	17	91.6471±6.32397	1.227	.304
	28-37 yaş	25	87.0000±6.85565		
	38-47 yaş	22	88.2727±7.19909		
	48-57 yaş	24	88.5417±7.21700		
	58- yaş	12	88.7200±5.89813		
Eğitim Durumu	İlkokul ve daha az	24	90.0833±6.11425	1.212	.309
	Ortaokul	17	86.2353±7.61191		
	Lise	19	88.0526±7.56802		
	Üniversite ve üzeri	40	89.2750±6.86534		
Medeni Durum	Bekar	17	91.5882±6.11411	1.831	.166
	Evli	69	88.1884±6.91179		
	Boşanmış	14	87.8571±7.06951		
Çocuk Sayısı	Yok	16	88.1304±6.01743	.353	.842
	1	23	88.4000±7.31718		
	2	35	88.3333±5.53775		
	3	15	88.8182±8.54188		
	4 ve üzeri	11	90.5625±7.40242		
Ailenin Toplam Aylık Geliri	10000 TL ve altı	19	89.0000±6.92018	.929	.451
	10001-20000 TL	29	89.3929±5.69170		
	200001 - 30000TL	19	86.6842±8.49217		
	300001- 40000 TL	17	90.6471±6.72627		
	40001 TL ve üzeri	17	87.6471±6.76333		
Sosyo-Ekonomik Durumunu Algılayış Biçimi	İyi	11	91.5455±7.44800	1.211	.302
	Orta	63	88.6349±6.42149		
	Kötü	26	87.7308±6.86534		

Araştırmaya alınan kadınların alt ölçek puanlarının sosyo-demografik faktörlere göre incelenmesi Tablo 3'te gösterilmektedir. Tabloya göre kadınların psikolojik güç ölçek puanları katılımcıların yaş gruplarına göre incelendiğinde; 18-27 yaş grubundaki kadınların psikolojik güç algılarının diğer yaş grubundaki kadınlardan yüksek olduğu belirlenmiştir. Eroğlu (2022) tarafından yapılan çalışmada da 18-30 yaş grubundaki bireylerin psikolojik güçlülüklerini daha fazla olduğu saptanmıştır.

Yine eğitim durumu ile psikolojik güç ölçek puanları incelendiğinde; ilkök ve daha az eğitim gören kadınların psikolojik güç algılarının yüksek olduğu bulunmuştur. Eroğlu'nun (2022) çalışmasında da benzer şekilde ilköğretim mezunu kadınların psikolojik güç düzeyi lisans mezunu kadınlara göre daha yüksek olarak bildirilmiştir.

Araştırma kapsamına alınan kadınların medeni durumu ile psikolojik güç ölçek puanları incelendiğinde; bekar kadınların psikolojik güç algılarının evli ve boşanmış kadınlara göre daha yüksek olduğu saptanmıştır. Yılmaz'ın (2024) çalışmasında da bekar bireylerin evli veya boşanmış/dul bireylere göre güç kaynaklarının daha fazla farkında olduğu ve karar verme gücüne daha fazla sahip olduğu belirlenmiştir. Benzer şekilde Kahraman (2023)'ün çalışmasında da bekar katılımcıların psikolojik güç algısı yüksek olarak saptanmıştır.

Kadınların sahip olduğu çocuk sayısı ile psikolojik güç ölçek puanlarına bakıldığında; 4 ve daha fazla sayıda çocuğu olan kadınların diğerlerine göre psikolojik güç algılarının yüksek olduğu bulunmuştur. Yılmaz da (2024) yapmış olduğu çalışmada çocuk sahibi olan bireyler çocuk sahibi olmayan bireylere göre güç kaynaklarının daha fazla farkında olduğu, karar verme gücüne daha fazla hakim olduğu sonucuna ulaşmıştır.

Araştırmaya katılan kadınların aylık gelirleri ile psikolojik güç ölçek puanları karşılaştırıldığında; 30.0001-40.000 TL arası gelire sahip kadınların psikolojik güç algılarının diğer gelir grubundaki kadınlardan daha yüksek olduğu sonucuna ulaşılmıştır. Kahraman (2023)'ın çalışmasında ise aylık kazanç arttıkça psikolojik güç algısı da artmıştır. Altuntaş ve Altınova'nın çalışmalarında da gelir düzeyi arttıkça kadınlarda psikolojik dayanıklılıklarının güçlendiği, toplumsal cinsiyet algılarının da arttığı belirlenmiştir.

Kadınların sosyo-ekonomik düzeyini algılayış biçimleri ile psikolojik güç ölçek puanları incelendiğinde; sosyo-ekonomik düzeyi algısı iyi olanların orta ve kötü olanlardan daha fazla psikolojik güç algısına sahip olduğu belirlenmiştir.

Tablo 4. Kadın Psikolojik Güç Ölçeği'nin sosyo-demografik faktörlere göre incelenmesi T testi sonuçları

Değişkenler	Gruplar	N	Ort. ± SS	t	p
Kaçınıcı Evlilik	İlk	92	88.8913±6.84596	.845	.561
	İkinci	8	86.7500±7.24569		
Çalışma Durumu	Çalışıyor	29	88.8276±7.70468	.100	.176
	Çalışmıyor	71	88.6761±6.55041		
Sosyal Destek	Var	42	88.3793±6.10673	-.581	.041*
	Yok	58	89.1905±7.84682		

p<0.05

Araştırmada şu anki evliliğinin ilk evliliği olduğunu belirten kadınların psikolojik güç algısı ikinci evliliğini yapanlardan yüksek bulunmuştur. Ayrıca çalışan kadınların psikolojik güç algısı da çalışmayan kadınlara göre daha yüksektir.

Araştırma kapsamına alınan kadınların sosyal destek alma durumları ile psikolojik güç ölçek puanları arasında anlamlı bir fark tespit edilmiş olup (p<0.05), sosyal destek aldığını belirten kadınların psikolojik güç algısı sosyal destek almadığını belirten kadınlardan yüksek bulunmuştur.

SONUÇ VE ÖNERİLER

Kadının psikolojik güçlenmesi son dönemde toplumsal değişim ve dönüşüm için önem arz eden en önemli çalışmaların başında gelmektedir. Eğitim, bu süreçte kritik bir rol oynamakta olup kadınların kimliklerini bulmaları ve güçlenmeleri için önemli bir araçtır. Eşit ve adil bir toplum için kadınların eğitim hakkına erişimlerinin sağlanması büyük önem taşır. Kadınların bilgi ve beceriler edinmesi, onları güçlendirirken, ekonomik bağımsızlıklarını da artırmaktadır. Ayrıca, destekleyici sosyal ağlar oluşturmak, kadınların karşılaştıkları zorluklarla başa çıkmalarında önemli bir etken olarak öne çıkar. Mentorluk ilişkileri ve topluluk desteği, kadınların kendilerini daha güçlü hissetmelerine katkıda bulunur.

Eğitim, kadınların güçlenmesi, refahı ve gelişimi için anahtar faktördür. Kadınların pek çok alanda ayrımcılığa uğradığı iyi bilinmektedir. Kadınların tüm sektörlerde eşitsizliği ve kırılganlığı devam etmekte olup kadınlar hayatın her alanında ezilmektedir. Bu sebeple hayatın her alanında güçlendirilmeleri gerekmektedir. Toplumsal olarak oluşturulmuş cinsiyet önyargılarına karşı mücadele etmek için kadınlar daha fazla güç gerektiren sisteme karşı yüzmek zorundadır. Bu güç güçlendirme sürecinden gelir ve güçlendirme eğitimden gelecektir. Ve kırsal kalkınma kadınların güçlenmesinden gelecektir. (Sundaram ve ark., 2014)

Toplumsal normlar ve cinsiyet rolleri de bu süreçte belirleyici olabilir. Geleneksel kalıplara meydan okumak, kadınların kendi kimliklerini bulmalarına ve ifade etmelerine olanak tanır. Kadın hareketleri ve feminist yaklaşımlar, bu bağlamda önemli birer itici güç olarak ortaya çıkar. Birçok çalışma, kadınlar iyi durumda olduğunda ekonominin de iyi durumda olduğunu göstermektedir (Varghese, 2011). Yenilmez (2017) kadınların güçlendirilmesi için yapılması gereken en önemli adımlardan bazılarının istihdam olanaklarını artırmak için sosyal ve yasal düzenlemeler yapmak olduğunu, ekonomik esnekliğini teşvik edecek ve toplumsal cinsiyet eşitliğini sağlamayı amaçlayan politikaların sadece kâğıt üzerinde değil, fiili olarak da uygulanması gerekliliğini ifade etmektedir.

Kamu ve sivil toplum kuruluşları kadınların özelliklerini ve yeteneklerini geliştirmek için çalışabilirler. Seminerlere ve eğitmenlere katılım ve ücretli istihdama teşvik, kadınların karar alma sürecindeki rolünü destekleyecek veya güçlendirecektir. Araştırma bulgularına dayanarak kadınların güçlenmesi için

çalışan kuruluşlarda eğitim faaliyetlerinin yaygınlaştırılması ve eğitim içeriğinin çeşitlendirilmesi gerektiği düşünülmektedir. Ekonomik öz yeterlilik gereklidir, ancak kadınların güçlenmesi için yeterli bir koşul değildir. Kadınlara eşit haklar ve fırsatlar garanti eden yasal kurumları güçlendirmek için kamu politikaları son derece önemlidir.

Özellikle toplum tarafından kadınlara ve erkeklere biçilen roller, kadınları âtıl durumda bırakan, istihdama ve sosyal yaşama katılmalarını zorlaştıran cinsiyetçi eşitsizlik; kadınların gereksinimlerini, sorunlarını ve taleplerini farklılaştırmaktadır. Dolayısıyla, medeni, ekonomik veya sosyal durumu fark etmeksizin kadınlar için belediyelerin politikaları ve sunduğu hizmetler önemlidir (KEİG, 2016; akt., Korkmaz,2023).

Kadınların psikolojik güçlülüklerini arttırıp, kadınların güçlenmesi gereken alanların tespit edilip görünür kılınması ve kadının toplumdaki yerinin öneminin vurgulanması için daha kapsamlı sosyal hizmet çalışmalarının yapılması önemlidir. Kadın bireylerin psikolojik anlamda güçlenmesi için Aile ve Sosyal Hizmetler Bakanlığı, İl Sağlık Müdürlükleri, Belediyeler ve sivil toplum kuruluşları arası işbirliklerinin yapılması ve koordineli bir şekilde çalışmaların artırılması gerekmektedir. Özellikle Aile Eğitim Programlarının kadınların farkındalıklarının artması anlamında çok fayda sağladığı gözlenmiştir. İllerde risk haritaları çıkartılıp, dezavantajlı bölgelerde kadınların sosyalleşebileceği ve eğitim alabileceği merkezlerin artırılması toplumsal bir dönüşüm için önem arz etmektedir. Bu tür çalışmalar, kadınların güçlenmesini sağlamakla kalmaz, aynı zamanda toplumsal cinsiyet eşitliğinin sağlanmasına da önemli katkılarda bulunur.

Son olarak, psikolojik güçlenme süreci bireysel deneyimlerle şekillenir. Kadınların zorluklar karşısında sergiledikleri direnç ve yenilikçi yaklaşımlar, güçlenme süreçlerini destekler. Psikolojik güçlendirme, kadınların bilinci ve öz saygılarının artmasıyla gerçekleştirilebilir. Kadınlar hem iş kurmaları sayesinde ekonomik güçlenme hem de toplumsal cinsiyet, kadın hakları, özgüven ve ilgili konulardaki resmi olmayan eğitim oturumları sayesinde psikolojik güçlenme yaşamaktadırlar. Bu bağlamda, her kadının hikayesi, güçlü bir değişim potansiyelini barındırır.

KAYNAKLAR

- Altuntaş, O., Altınova, H. H. (2015). Toplumsal Cinsiyet Algısı İle Sosyal Ekonomik Değişkenler Arasındaki İlişkinin Belirlenmesi. *Turkish Studies - International Periodical for the Languages, Literature and History of Turkish or Turkic*, 10(6), 83-100.
- Baydur, H., & Uçan, G. (2016). Kadınların Güçlendirilmesi Ölçeği'nin Türkçe Geçerlilik ve Güvenilirlik Çalışması: Manisa Örneği. *Toplum ve Sosyal Hizmet*, 27(2), 7-28.
- Dağlı, A. ve Baysal, N. (2016). “Yaşam Doyumu Ölçeğinin Türkçe’ye Uyarlanması: Geçerlik ve Güvenilirlik Çalışması.”, *Elektronik Sosyal Bilimler Dergisi*, cilt 15, sayı 59.
- Eroğlu, M., Çalışan Kadınlarda Kişilik Özelliklerinin Psikolojik Dayanıklılık Üzerindeki Etkisi Ve Yaş, Eğitim Durumu, Gelir Düzeyi Gibi Özelliklerin Rolü, *Uluslararası Temel Eğitim Çalışmaları Dergisi*, 2022 ;(1) 34-42.
- Kahraman, T. (2023). Kadının psikolojik gücünün aile işlevselliği ile olası ilişkisi. *Sağlık Bilimleri Üniversitesi Aile Hekimliği Ana Bilim Dalı*, İstanbul.
- Korkmaz, H. (2023). Stratejik Planlarda Kadın: Belediyelerde Bir İncelememakale. *Uluslararası İktisadi ve İdari İncelemeler Dergisi*, 40, 99-112.
- Sundaram, M. S., Sekar, M., & Subburaj, A. (2014). Women empowerment: role of education. *International Journal in Management & Social Science*, 2(12), 76-85.
- Turan, S. (2014). Psikolojik Güçlendirme İle İş Yaşam Kalitesi Arasındaki İlişkinin İncelenmesi: Hizmet Sektöründeki Çalışanlar Üzerine Bir Uygulama. Yüksek Lisans Tezi. Hasan Kalyoncu Üniversitesi Sosyal Bilimler Enstitüsü, Gaziantep.
- Varghese, T. (2011). Women empowerment in Oman: A study based on Women Empowerment Index. *Far East Journal of Psychology and Business*, 2(2), 37-53.
- Yenilmez, M.İ. (2017). Kadın güçlendirmesi ve toplumsal cinsiyet eşitliği'nin ölçülmesi: Türkiye Örneği. *Yönetim ve Ekonomi Dergisi*, 24 (2) , 485-503.
- Yılmaz, M. (2024). Kadınlarda psikolojik güçlülük ve güçlenmesi gereken alanların belirlenmesi. Yüksek Lisans Tezi. İzmir Katip Çelebi Üniversitesi Sağlık Bilimleri Enstitüsü, İzmir.

ISPARTA DEMİRCİ MEHMET EFE KONAĞI'NIN YENİDEN İŞLEVLENDİRİLMESİ

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ÖZET

Isparta ili Gönen ilçesi İğdecik köyü geleneksel mimari miras yapılarıyla kırsal yerleşim yeridir. Bu alan içinde tarihi ve anı değerine sahip, 19. yüzyılın kültürünü ve yaşam biçimini anlatan sivil mimari miras olan Demirci Mehmet Efe Konağı yer almaktadır. Konak yapısı Milli Mücadele yıllarında Demirci Mehmet Efe tarafından 1920 yılında yedi ay süreyle ikamet edilerek, daha sonrasında karargâh binası olarak kullanılmış olup, günümüzde tahrip durumundadır. Tarihsel süreç içerisinde çeşitli fiziksel etkenlere karşı direnmiş ve günümüze varlığı ulaşmış olan Demirci Mehmet Efe Konağı'nın sürdürülebilirliği için korunması ve restorasyon ilkeleri doğrultusunda müdahale kararlarının alınması gerekmektedir.

Bu çalışma kapsamında, konak yapısının kırsal yerleşimin mimari değerleri arasına kazandırılması amacıyla, mimari ve yapısal özellikleri açısından incelenerek, kent kimliği üzerindeki etkisi ortaya konulmuştur. Bu bağlamda Demirci Mehmet Efe Konağı müze ve atölye olarak kullanımı için yeniden işlevlendirme önerisi getirilmiştir. Yapıya özgün iç mekân tasarım çalışması yapılmıştır.

Anahtar Sözcükler: İğdecik köyü, Mimari miras, Yeniden işlevlendirme, İç mekân tasarımı, Demirci Mehmet Efe Konağı

ABSTRACT

İğdecik village of Gönen district of Isparta province is a rural settlement with traditional architectural heritage structures. Demirci Mehmet Efe Mansion, which is a civil architectural heritage that has historical and commemorative value and tells the culture and lifestyle of the 19th century, is located within this area. The mansion structure was inhabited by Demirci Mehmet Efe for seven months in 1920 during the years of National Struggle and later used as a headquarters building, and is currently in a state of destruction. Demirci Mehmet Efe Mansion, which has resisted various physical factors throughout the historical process and has survived to the present day, needs to be protected and intervention decisions should be made in line with restoration principles for its sustainability.

Within the scope of this study, in order to add the mansion structure to the architectural values of rural settlement, its architectural and structural features were examined and its effect on urban identity was revealed. In this context, a re-functioning proposal was made for the use of Demirci Mehmet Efe Mansion as a museum and workshop. An original interior design study was carried out for the structure

Keywords: Igdecik village, Architectural heritage, Re-functionalization, Interior design, Demirci Mehmet Efe Mansion

GİRİŞ

Tarihi yapılarda koruma, geçmişten geleceğe ışık tutarak, tarihin izlerini koruyarak sürdürülebilirliği sağlamaktadır. Kentlerin mimari mirasını oluşturan tarihi yapılar yapılaşma amaçları doğrultusunda bölgelerinin sosyal, teknik, kültürel, mimari vb. özelliklerini taşımaktadır (Çalışır Pençe, 2009). Tarihi yapıların mimari ve teknik özelliklerinin yanı sıra tarihi miras kimliği, anı, belge vb. değerlerinin de korunması gerekmektedir (Eldek Güner, 2017). Zaman içerisinde bu yapılara bakım-onarım yapılmadığında biçimsel özelliklerde tahrip durumu söz konusu olmaktadır. Yeniden işlevlendirme tarihi yapıları kent belleğinde dinamik tutmayı sağlamaktadır. Bu nedenle tarihi yapıların en etkili şekilde korunması için, yapının özgün kimliğine zarar vermeden ve gerekli görülen müdahale kararları belirlenerek, yapılar yeniden işlevlendirilerek kentlerin mimari mirasına geri kazandırılmalıdır. Yeniden işlevlendirme önerisinde, tarihi yapıların özgününe uygun olarak, günümüz koşulları gözetilerek, mekânlar yeniden yorumlanmalıdır. Yeni işlev verilen bu mekân düzenlemelerinde, yapının çevresiyle birlikte bütüncül değerlendirilerek, kullanıcıların ihtiyaçları ve memnuniyetleri sağlanmalıdır (Aydın ve Yalnız, 2010). Başka bir deyişle tarihi yapıların, evrensel koruma kararlarına uygun olarak tarihi belge olma, yapısal özgünlük vd. özellikleri korunarak, kullanıcı ihtiyaçları ile konfor koşulları da sağlanarak, geleceğe restorasyon ilkeleri doğrultusunda onarılıp aktarılmasını sağlayacak yeniden işlevlendirme önerileri yapılmalıdır (Yenel, 2015.)

ARAŞTIRMA

Materyal Ve Yöntemler

Bu çalışmada, Isparta ili Gönen ilçesi İğdecik köyü geleneksel mimari miras yapılarıyla kırsal yerleşimin bir parçası durumunda olan Demirci Mehmet Efe Konağı'na yeniden işlevlendirme önerisi getirilerek kentin mimari değerleri arasına kazandırılması amaçlanmıştır (Şekil 1). Çalışma yönteminin ilk aşamasında tarihi yapıların yeniden kullanımı ve koruma kavramına ilişkin literatür taraması yapılarak, Demirci Mehmet Efe Konağı'nın tarihsel süreci araştırılmıştır. Yapıyla ilgili hazırlanmış olan 2017 tarihli "Isparta Demirci Efe Konağının Mimari Açısından Analizi ve Yeniden İşlevlendirilmesi" konulu tez çalışmasına ulaşılmıştır. Bu çalışmanın rölöve çizimlerinden faydalanılmıştır. İkinci aşamasında ise yapıya dair yapılan analiz ve değerlendirmeler bağlamında, Demirci Mehmet Efe Konağı müze ve atölye olarak kullanımı için yeniden işlevlendirme önerisi hazırlanmıştır. Yeni işlev verilen mekânlar için tasarım kararları belirlenerek, yapıya özgün iç mekân tasarım çalışması yapılmıştır. İç mekân tasarımları, malzeme ve renk tercihlerini, detaylarını gösteren anlatımlar 3d görselleştirme (render) ile ifade edilerek sunulmuştur.

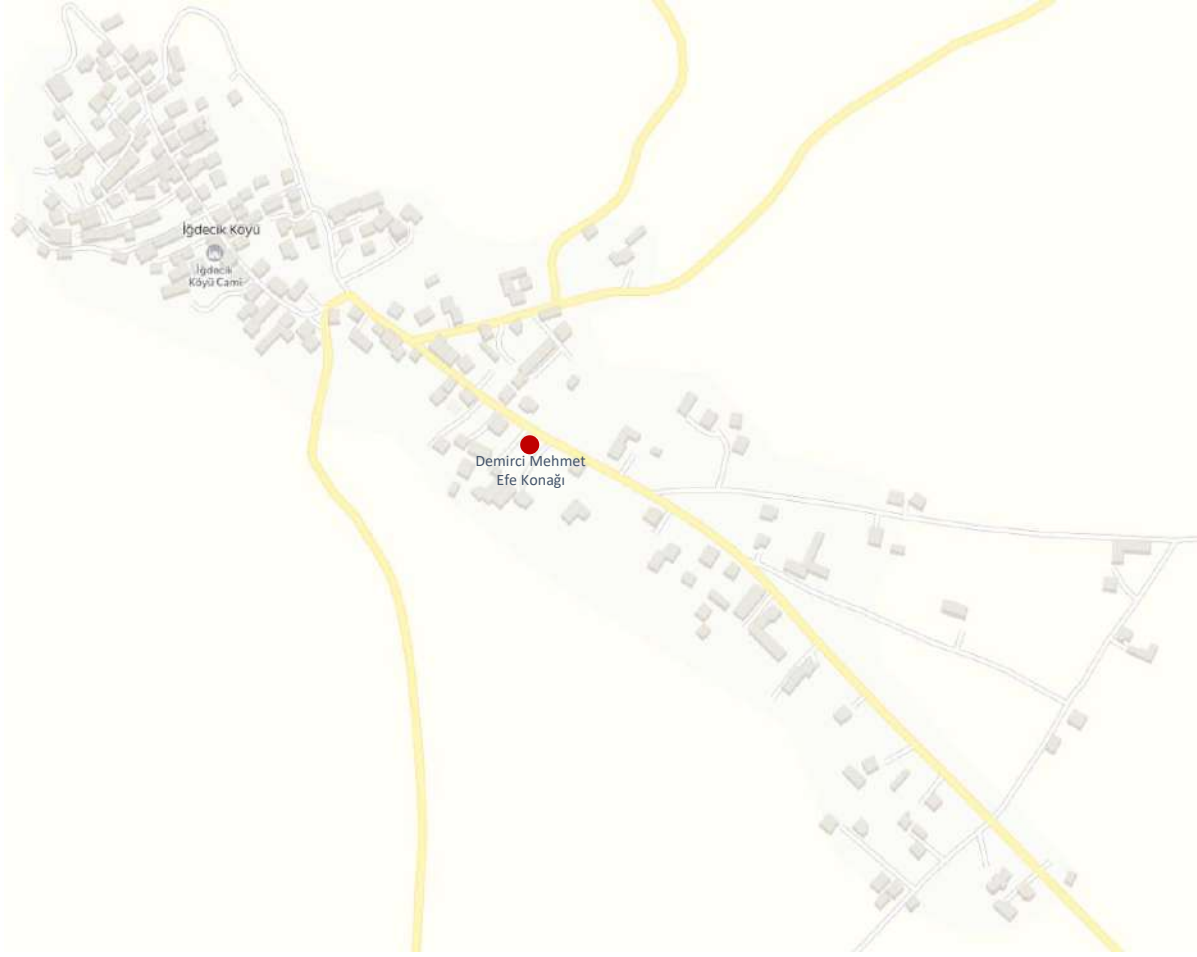


Şekil1. Demirci Mehmet Efe Konağı, İğdecik köyü, Gönen/Isparta (Isparta İl Kültür ve Turizm Müdürlüğü, 2018)

BULGULAR

1.1 Demirci Mehmet Efe Konağı Tarihsel Süreci Ve Güncel Durumu

İğdecik köyü; Isparta ilinin Gönen ilçesine bağlı Isparta merkezin kuzeyinde 23 km. mesafede bulunan bir kırsal yerleşim yeridir. Köyün batısında Milli Mücadele döneminde Antalya ilini cepheye bağlayan Baladız ve yolu, kuzeyinde Geresin (Güneykent) bulunmaktadır. Güneyinden tren yolu geçen köy Burdur Afyon Yolu üzerinde de bulunması itibariyle önemli bir konumdadır. Milli Mücadele yıllarında Isparta merkeze bağlı olan köy, 1991 yılında Gönen'in ilçe olması ile buraya bağlanmıştır (Şekil 2). Demirci Mehmet Efe'nin 1920 yılında yedi ayı aşkın bir süre bu köyde ailesiyle kaldığı bilinmektedir (Url). Yerel hafızada Milli Mücadele dönemini ifade etmesi, mimari ve yerel kimliği ile önem taşımaktadır. Demirci Mehmet Efe Konağı olarak bilinen, İğdecik köyü geleneksel mimari miras yapısı, günümüzde tahrip durumdadır. Yapı Isparta İl Kültür ve Turizm Müdürlüğü'ne kayıtlıdır.(<https://isparta.ktb.gov.tr/Eklenti/9193,gonenpdf.pdf?0>). (<http://www.isparta.gov.tr/gonen>)

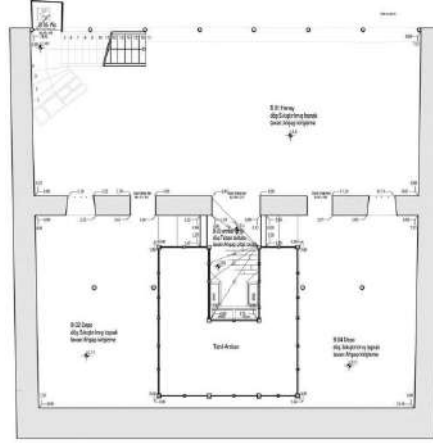


Şekil2. Demirci Mehmet Efe Konağı, İğdecik köyü, Gönen/Isparta (Yandex, 2018)

1.2 Demirci Mehmet Efe Konağı Mimari Analizi

Demirci Mehmet Efe Konağı, 19. yüzyıl sivil mimari örneklerinden olup, yarı bodrumlu, zemin üzeri bir katlıdır. Yapı günümüze gelinceye kadar önemli mekânsal değişikliklere uğramamıştır. Bölgede bulunan az sayıdaki geleneksel mimari miras yapılarından biridir. Yapının bodrum katı hanay¹, tahıl ambarı ve iki adet depo mekânlarından oluşmaktadır. Hanay bodrum katta yapının güney cephesinde yer alan mekândır. Bu mekânın güney doğu köşesinde üst kata ulaşımı sağlayan sahanlıklı bir ahşap merdiven bulunmaktadır (Şekil 3). Güney cephesi tamamen açık olup, taşıyıcı ahşap sütunlar işlemeli mermer ayaklara oturmaktadır (Şekil 4) (Haştemoğlu ve Beyhan, 2017).

¹ Hanay: Isparta'da üst katta sofa mekânına verilen genel addır (Haştemoğlu, 2017, s.32).

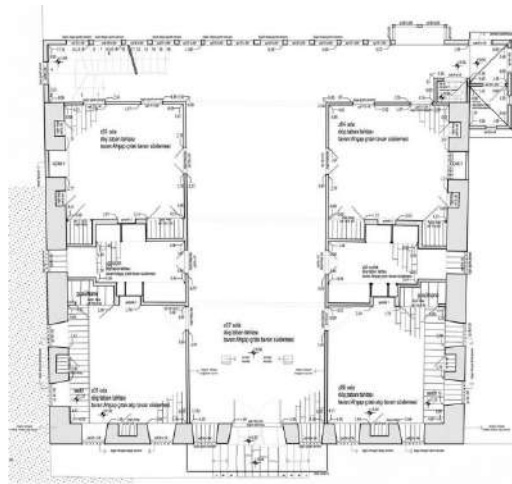


Şekil3. Bodrum kat planı (Haştemoğlu ve Beyhan, 2017)



Şekil4. Güney cephesi (Haştemoğlu, 2017)

Yapının zemin katı kuzey ve güney yönünde bulunan T formundaki sofanın iki yanına yerleştirilmiş dört adet oda ve iki adet kiler mekânından oluşmaktadır. Dört odanın giriş cephesinde yer alan iki odasında pencerelerin arasında bulunan iki adet gömme dolap haricinde birer adet çift kanatlı ahşap dolap ve bir adet şerbetlik mevcuttur. Oda kapıları ahşap oyma işçiliği ile şerbetlikler ise alçı işçiliği ile dikkat çekmektedir. Bunların yanında mekânlarda cephe duvarında ahşap sedir bulunmaktadır. Ayrıca güney yönündeki iki odada ocak yer almaktadır. Odaların tavanları geleneksel ahşap çitalı olup oldukça sadedir. Bu dört odanın arasında bulunan kiler mekânları mevcuttur (Şekil 5, 6) (Haştemoğlu ve Beyhan, 2017).

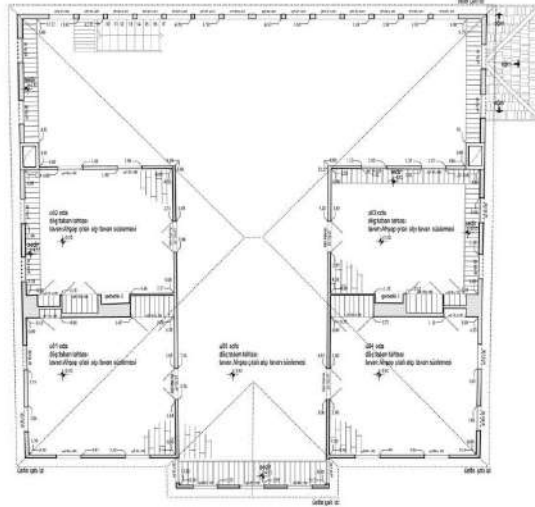


Şekil5. Zemin kat planı (Haştemoğlu ve Beyhan, 2017)



Şekil6. Zemin kattaki kapı, şerbetlik, sedir ve ocak iç mekân elemanları (Haştemoğlu, 2017)

Zemin kat ile benzer plan şemasına sahip olduğu görülen birinci katta da dört oda mevcuttur. Zemin katta odalar arasında bulunan kiler mekânları bu katta kaldırılmış olup, kuzey güney doğrultusundaki T formundaki sofa kısmı genişletilmiştir. Bu katta da kapı ve dolap kapakları ahşap işlemelidir. Tavanlarda ahşap çıtalı alçı tavan süslemeli görülmektedir (Şekil 7, 8) (Haştemoğlu ve Beyhan, 2017).



Şekil7. Birinci kat planı (Haştemoğlu ve Beyhan, 2017)

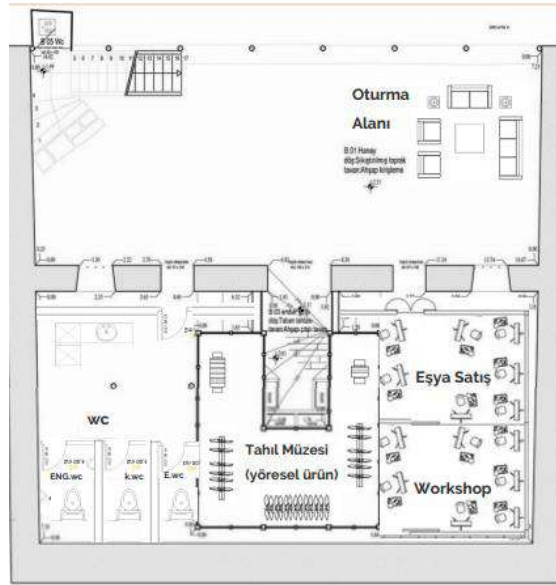


Şekil8. Birinci kattaki sofa, kapı ve tavan iç mekân elemanları (Haştemoğlu, 2017)

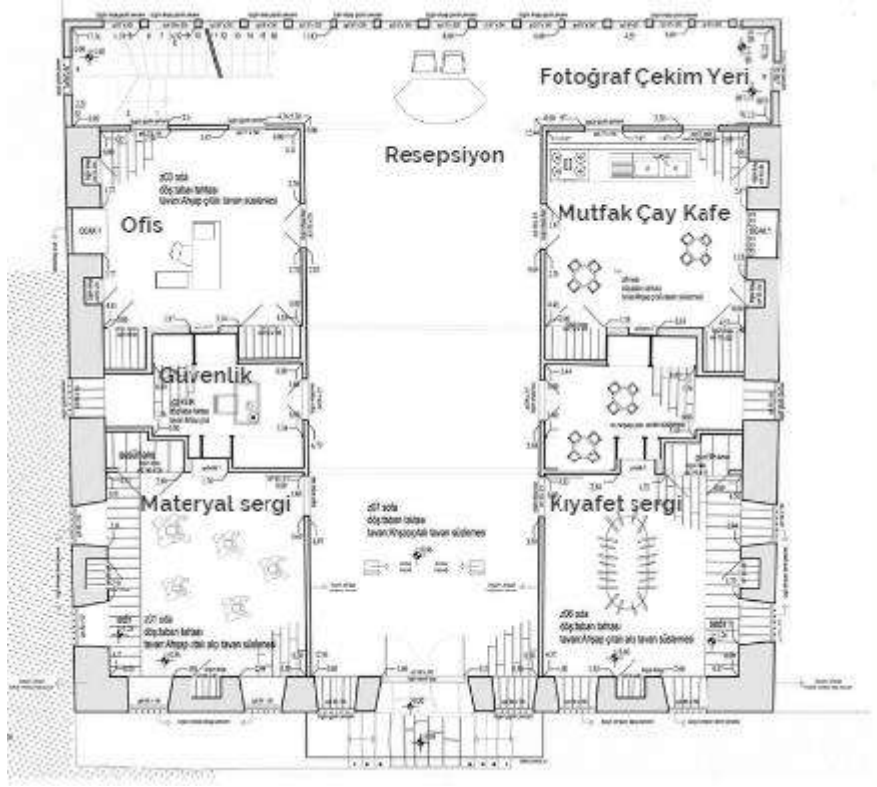
1.3 Demirci Mehmet Efe Konağı'nın Yeniden İşlevlendirilmesi

Yapılan analiz ve değerlendirmelerin sonucunda, Demirci Mehmet Efe Konağı müze ve atölye olarak kullanımı için yeniden işlevlendirme önerisi getirilerek, tasarım kararları belirlenmiştir. Demirci Mehmet Efe Konağı tasarım kararları açısından müze, workshop ve terzi atölyeleri olarak işlevlendirilmiştir. Yeni işlev verilen mekânların düzenlenmesinde yapının özgün plan şemasının korunması gözetilmiştir. Bu bağlamda,

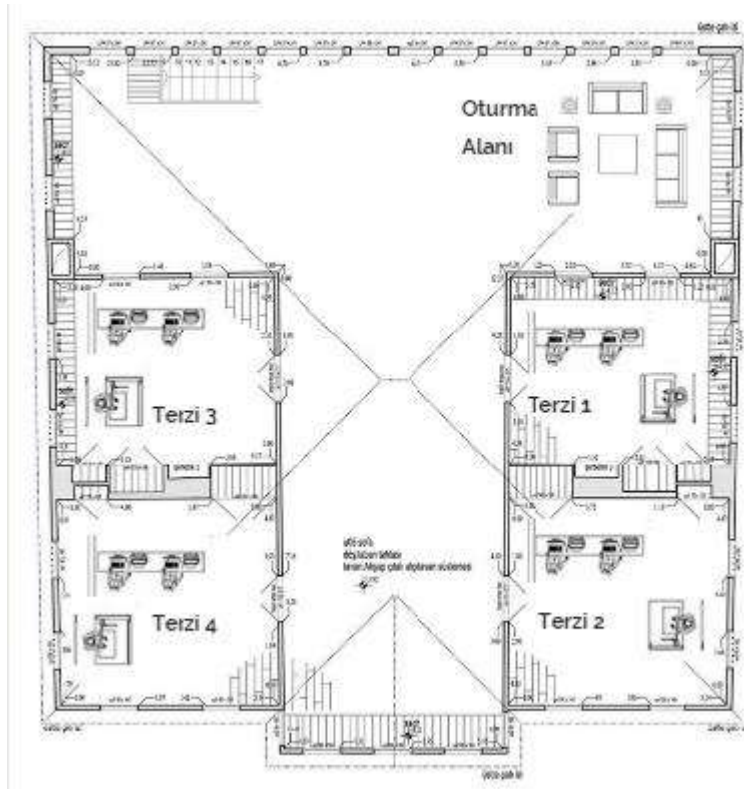
- bodrum katı; tahıl müzesi (yöresel ürün, poster vb. sergileme), yöresel eşya satış, workshop, wc ve oturma alanı birimleri olarak yeniden işlevlendirilmiştir (Şekil 9).
- zemin katı; sergi birimleri (materyal ve kıyafet), resepsiyon, güvenlik, ofis ve mutfak-çay-kafe alanı olarak planlanmıştır (Şekil 10). Demirci Mehmet Efe'nin kostüm ve materyallerinin sergilendiği dönemin özelliklerini hissetmek adına gelenlerin fotoğraf çekebileceği alan tasarlanmıştır.
- birinci katı ise; terzi ve oturma alanı birimleri olarak düzenlenmiştir (Şekil 11). Katta bulunan dört adet oda kostümler üreten ve onaran terziler için terzi atölyesine dönüştürülmüştür. T formundaki sofanın manzaraya bakan bölümü diğer kısmından ayrılarak oturma alanı olarak planlanmıştır. Bu bölüme lobiden ulaşım imkânı bulunması camekânlı konumu mekânın biçimlenmesini sağlamıştır.



Şekil9. Yeni işlev verilen bodrum kat mekânları (Simge Dankoz Arşivi, 2023)



Şekil10. Yeni işlev verilen zemin kat mekânları (Simge Dankoz Arşivi, 2023)



Şekil11. Yeni işlev verilen birinci kat mekânları (Simge Dankoz Arşivi, 2023)

1.4 Demirci Mehmet Efe Konağı'nın İç Mekân Tasarımları 3D Görselleştirme (Render) Çalışmaları

Yapının kimliği ve özgün plan şemasının korunması gözetilerek, mevcut yapılaşmaya yeni bakış açısı, tasarımı geliştirme becerisi, iç mimari anlatım tekniklerine uygun olarak yapılmıştır. Yeni işlev verilen mekânların iç mekânlarına dair malzeme ve renk tercihlerini, detaylarını gösteren anlatımlar 3d model (Tefrişli) görselleri çalışması yapılmıştır (Şekil 12, 13, 14, 15, 16, 17, 18). Çalışmada esas olarak geçmiş ve geleceği bir arada tutmak amaçlanmıştır. Bu amaçla;

- tahıl müzesi (tahıl posterleri, dönemin ve İğdecik köyünde bulunan ürünlerin tabloları vb.) ve yöresel eşya satışı (ekmek, tahıl, buğday vb. ürünler ve İğdecik köyüne özgü eşyalar) alanlarında tasarımlar yapılmıştır.
- materyal sergi kıyafet sergi alanları (Demirci Mehmet Efe'nin kostüm ve materyallerinin sergilendiği) dönemin özelliklerini yansıtan tasarım anlayışıyla planlanmıştır.
- mutfak-çay-kafe alanı servis birimi olarak çalışanların ya da geziye gelenlerin kullanımına uygun olarak tasarlanmıştır.
- wc alanında (kadın, erkek ve engelli olmak üzere üç gruba özel olarak) genel tasarım anlayışına uyumlu renkler kullanılmıştır.



Şekil12. Tahıl müzesi ve yöresel eşya satışı alanı (bodrum kat) (Simge Dankoz Arşivi, 2023)



Şekil13. Materyal sergi alanı (zemin kat) (Simge Dankoz Arşivi, 2023)



Şekil14. Kıyafet sergi alanı (zemin kat) (Simge Dankoz Arşivi, 2023)



Şekil15. Oturma alanları (tüm katlar) (Simge Dankoz Arşivi, 2023)



Şekil16. Mutfak-çay-kafe alanı (zemin kat) (Simge Dankoz Arşivi, 2023)



Şekil17. Terzi atölyeleri (1 katlar) (Simge Dankoz Arşivi, 2023)



Şekil18. Wc (bodrum kat) (Simge Dankoz Arşivi, 2023)

SONUÇ

Bir dönemin tarihine tanıklık etmiş bir sivil mimari miras olan Demirci Mehmet Efe Konağı günümüze değin ayakta kalmayı başarmıştır. Çalışmada, Isparta ili açısından mimari, tarihi, anı vb. değerleriyle önem arz etmesine rağmen, kırsal yerleşimde konumlanması nedeniyle gözden uzak kalan Demirci Mehmet Efe Konağı olarak bilinen daha önce 2017 de çalışma

yapılan tarihi yapının tekrar farklı açıdan incelenip gündeme getirilmesi ve kentin mimari mirasları arasına kazandırılması amaçlanmıştır. Bu tarihi yapının mimari, tarihi, kültürel değerlerimizi yaşatılarak geleceğe aktarılması için korunması ve restorasyon ilkeleri doğrultusunda müdahale kararları alınarak yeniden işlevlendirilmesi gereklidir.

Sonuçta yapının kimliği ve özgün plan şemasının korunması gözetilerek, yapılan mekânsal düzenlemelerle, Demirci Mehmet Efe Konağı'na müze ve atölye olarak kullanımı için yeniden işlevlendirme önerisi getirilmiştir. Tasarım kararları belirlenerek, yeni işlev verilen mekânların iç mekânlarına dair render çalışması hazırlanılarak, tarihi ve mimari açıdan önem taşıyan Demirci Mehmet Efe Konağı'nın geçmişi gelecekte de yaşatılması hedeflenmiştir.

KAYNAKÇA

1. Aydın, D. ve Yıldız, E. (2010). Yeniden kullanıma adaptasyonda bina performansının kullanıcılar üzerinden değerlendirilmesi. *METU-JFA*, 27(1), 1-22.
2. Çalışır Pençe, D. (2009). İstanbul'da yeniden işlevlendirilen korumaya değer endüstri yapıları ve iç mekân müdahaleleri: Santralistanbul örneği. (Yüksek lisans tezi). İstanbul Teknik Üniversitesi, İstanbul.
3. Demirci, D. (2015). Isparta ilçelerindeki geleneksel konut mimarisi. *Süleyman Demirel Üniversitesi Fen-Edebiyat Fakültesi Sosyal Bilimler Dergisi*, (35), 217-246.
4. Eldek Güner, H. (2017). Liseden müzeye, eğitimden tüketime; Kayseri Lisesi'nin Millî Mücadele Müzesi'ne dönüşümü. *TÜBA-KED*, (16), 67-87.
5. Haştemoğlu, B. (2017). Isparta Demirci Efe Konağının mimari açıdan analizi ve yeniden işlevlendirilmesi. (Yüksek lisans tezi). Süleyman Demirel Üniversitesi, Isparta.
6. Haştemoğlu, B. ve Beyhan, Ş. G. (2017). Isparta Demirci Efe Konağının Mimari Açısından Analizi ve Yeniden İşlevlendirilmesi. *Journal of Architectural Sciences and Applications*, 2(1), 17-32. doi:10.30785/mbud.312375.
7. Yenel, A. (2015). Ankara Kalesi'ndeki Hatipoğlu Konağı için yeniden işlevlendirme önerisi. *Ankara Araştırmaları Dergisi*, 3(1), 54-77.
8. Url. <https://ekonomiknokta.com/demirci-mehmet-efe-konagi-karargahi-ulkemize-mal-edilmelidir-h11152.htm>.
9. Url <https://isparta.ktb.gov.tr/Eklenti/9193,gonenpdf.pdf?0>
10. Url <http://www.isparta.gov.tr/gonen>

THE DETERMINATION OF ANTICANCER EFFECT OF *Elettaria cardamomum* L. PLANT ON HELA AND MCF-7 CELL LINES

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Abstract

Today, intensive studies are being conducted in many countries around the world on the transformation of herbal products into medicinal substances, and these plants hold a significant place as economically valuable resources. The *Elettaria cardamomum* L. plant has small-sized fruits that are yellowish-green and off-white in color. Each fruit contains a large number of seeds. These reddish-brown seeds stand out with their strong fragrance and dominant aroma. The *Elettaria cardamomum* plant thrives in warm climate conditions, making it particularly suited to the climate of Southeast Asia. This plant is predominantly cultivated in the western and southern regions of India, often found as a wild plant in swampy forests. It is a plant that is imported to other countries after being produced in Asian lands and has become increasingly popular around the world with its pleasant aroma and high nutritional value. It is used as a spice to support the digestive system and assist with issues such as indigestion. Additionally, its refreshing aroma helps to eliminate bad breath. It is also said to aid in strengthening memory and the mind. In this study, the aim was to evaluate the cytotoxic activities of the *Elettaria cardamomum* L. plant in two different cancer cell lines, human cervix cancer (HeLa) and breast cancer (MCF-7), as well as in a control group using rat healthy fibroblast cell culture (L929). Seeds of the *Elettaria cardamomum* plant were purchased from a herbalist, and ethanol, methanol, and water extracts of the seeds were obtained. The cytotoxic activities of these extracts were evaluated using in vitro experiments, employing the MTT assay, and observing cell growth parameters under a microscope. It was determined that all extracts of the plant generally caused cytotoxic effects on the cell lines within the dose range of 10-100 µg/mL.

Keywords: *Elettaria cardamomum*, HELA, L929, MCF-7, MTT, cytotoxic activity.

***Elettaria cardamomum* L. BİTKİSİNİN ANTİKANSER ETKİSİNİN HELA VE MCF-7 HÜCRE HATLARINDA BELİRLENMESİ**

Özet

Günümüzde, dünyanın birçok ülkesinde yaygın olarak bitkisel ürünlerin ilaç maddelerine dönüştürülmesi üzerine yoğun çalışmalar yapılmaktadır ve ekonomik değeri olan bitkiler olarak ciddi bir yer tutmaktadır. *Elettaria cardamomum* L. bitkisi, meyveleri küçük boyutlu, sarımsı yeşil ve kirli beyaz renklindedir. Her bir meyvenin içinde bol miktarda tohum bulunmaktadır. Kızıl-kahve tonlardaki bu tohumlar, keskin kokusu ve baskın aromasıyla öne çıkmaktadır. *Elettaria cardamomum* bitkisi sıcak iklim koşullarını sever, bundan dolayı bitki, özellikle de Güneydoğu Asya iklimine uyum sağlar.

Çoğunlukla Batı ve Güney Hindistan'da yetiştirilen bu bitki, genellikle bataklık ormanlarda yabani bir bitki olarak bulunur. Asya topraklarında üretildikten sonra diğer ülkelere ithal edilen, hoş aroması ve yüksek besin değeri ile dünya çapında giderek popülerleşmiş bir bitkidir. Sindirim sistemini destekleyerek, hazımsızlık gibi sorunlara destek olmak için kullanılan bir baharattır. Ayrıca ferah aroması ile ağız kokusunun giderilmesine yardımcı olur. Hafızayı ve zihni güçlendirmeye de yardımcı olduğu söylenmektedir. Bu çalışmada, *Elettaria cardamomum* L. bitkisinin insan serviks kanseri (HeLA) ve meme kanseri (MCF-7) hücre hattı olmak üzere 2 farklı kanser hücre hattında ve kontrol olarak kullanacağımız rat sağlıklı fibroblast hücre kültüründe (L929) sitotoksik aktivitelerinin değerlendirilmesi hedeflenmiştir. *Elettaria cardamomum* bitkisi tohumları aktardan alınarak, tohumların etanol, metanol ve su ekstraları elde edildi ve ekstraların in vitro deneylerle MTT yöntemi kullanılarak ve hücre büyüme gelişme parametreleri mikroskopta incelenerek bitki ekstraktlarının sitotoksik aktiviteleri değerlendirilmiştir. Bitkinin tüm ekstralarının 10-100 µg/mL doz aralıklarında genel olarak hücre hatlarında sitotoksik etkiye sebep olduğu tespit edilmiştir.

Anahtar Kelimeler: *Elettaria cardamomum*, HELA, L929, MCF-7, MTT, sitotoksik aktivite.

INTRODUCTION

Therapeutic approaches to diagnosing and treating diseases after they have occurred are increasing day by day. At the same time, taking preventive health measures before diseases occur is the most important focus of medicine. For this reason, since the beginning of human history, human beings have constantly benefited from plants and herbal treatment approaches both to meet their nutritional needs and to protect their health status and for therapeutic purposes. Today, in many countries around the world, intensive work is being carried out on the conversion of herbal products into pharmaceuticals, and it occupies a significant place in the economy. The fruits of the cardamom plant, known as *Elettaria cardamomum* in Latin, are small, yellowish green and off-white in color. Each fruit contains a large number of seeds. These red-brown seeds are characterized by their pungent smell and dominant aroma. The cardamom plant likes warm climatic conditions, which is why the plant is particularly adapted to the climate of Southeast Asia. Mostly cultivated in Western and Southern India, cardamom is often found as a wild plant in swampy forests. Produced in Asia and then imported to other countries, cardamom has become increasingly popular worldwide for its pleasant aroma and high nutritional value (Korikanthimath et al., 2000). The widely used parts of the plant are the fruits and seeds. The powdered seeds are used in many countries as a spice in various dishes, especially meat dishes (Ravindran, 2002; El Malti et al., 2007; Singh et al., 2008; Ashokkumar et al., 2019). Cardamom has been reported to be a spice used in traditional Chinese and Indian medicine to relieve intestinal gas, relieve indigestion and various digestive problems (Ravindran, 2002; El Malti et al., 2007). It is thought to be important for fertility, noting its effects on the genital system (Besen and Beji, 2014). In addition, the use of a drink made with cardamom powder as an antidote for snake and scorpion venom and its capsules has been reported to have an effect on inflammation and headaches. (Karaca et al., 2005; Ashokkumar et al., 2019). According to phytochemical analysis, cardamom plant contains important components such as essential oils, flavonoids, terpenoids, alkaloids, tannins, anthocyanins and important secondary metabolites such as carotenoids. (Khatri et al., 2017; Noumi et al., 2018; Souissi et al., 2020; Ashokkumar et al., 2019). In this study, the fruits of *Elettaria cardamomum* L. were extracted with various solvents and the in vitro cytotoxic activity of the extracts was investigated. It was aimed to evaluate the cytotoxic activities of *Elettaria cardamomum* L. in 2 different cancer cell lines (HeLA, MCF-7) and a rat healthy fibroblast cell culture (L929) that will allow us to compare them as health control cells.

MATERIALS AND METHODS

Plant Extracts

The fruits and seeds of the plant *Elettaria cardamomum* L. were purchased from local herbalists and prepared for laboratory analysis. Plant fruit and seed parts were ground using a homogenizer and extracted by ethanol, methanol and water extraction methods. The dried plant parts were pulverized using a grinder-homogenizer. During extraction, each solvent was placed on the ground plant parts according to 1/10 weight/volume ratio and kept in a dark environment for 3 days. Then filtration was performed and solid plant parts were removed. The water extract was dried in a lyophilizer. Ethanol and methanol extracts were concentrated using a rotary evaporator. The yields of the extracts obtained were calculated. The concentrated and dried plant extracts were stored at -20°C until use.

Cell Culture

Breast Cancer Cell Line (MCF-7; Human breast adenocarcinoma cell), Human Cervical Cancer Cell Line (HeLA) and Mouse Fibroblast Cell Line (L929; Mouse fibroblast cell line) were used to determine the anticarcinogenic activity of fruits and seeds of cardamom plant.

Growing the Cells

The cell lines used in the study were cultured in 25 cm² flasks in an incubator at 37°C with 5% CO₂. DMEM medium with L-Glutamine was used as culture medium. 200 µL of the mixture was added to each of 96 wells (5×10³ cells per 100 µL/plate well). In this study, MTT assay was used to determine cell viability. All the MTT protocol was applied according to the previous studies (Daştan, 2018; Koçköprü, 2023). The different extracts of cardamom plant prepared at different concentrations were applied to the cells in different doses in 3 replicates. After 4 hours, the absorbance of the purple color formed was measured at 570 nm with an Elisa plate reader (Figure 1, 2). The IC₅₀ values were calculated using Graphpad program.

The selectivity index (SI) of the compounds was calculated by obtaining the ratio of IC₅₀ in healthy cell line to IC₅₀ in cancer line (Al-Qubaisi et al., 2011). After incubation, cell growth performance was photographed using a Zeiss Axio inverted microscope (10x) imaging system. Cells were isolated in PBS buffer containing 1% SDS and stained with methylene blue solution. Methylene blue stain was used to count viable and growing cells.



Figure 1. MTT reaction



Figure 2. Elisa plate reader

Statistical Method

Descriptive and comparative analyses were performed with IBM SPSS v23 software (IBM SPSS, USA). Graphpad Prism v8 (Graphpad, USA) software was used for graphical presentation of the data.

RESULTS

The yields of the extracts prepared with different solvents were calculated as % of dry plant. Extraction yields of the fruit varied between 2.5 g% and 1.2 g%. The highest yield was observed in methanol extract and the lowest yield was observed in water extract (Table 1).

Table 1. Extract yields of cardamom fruits prepared with different solvents.

Extract	Extraction yield
Methanol	2,5%
Ethanol	2,2%
Water	1,2%

The extracts obtained from cardamom fruit with 3 different solvents at different concentrations ranging from 0.1 $\mu\text{g/mL}$ to 1000 $\mu\text{g/mL}$ were applied on two different cancer cell lines (MCF-7 and HeLA) and their cytotoxic activities were examined using MTT test after 24 hours of incubation. As a result of MTT test, absorbance readings of 96-well plates were made in Elisa device (Thermo). The IC₅₀ values showing the effects of the extracts on different cell lines are presented in Table 2 and it was determined that they were generally in the concentration range of 10-100 $\mu\text{g/mL}$ (Table 2).

Table 2. IC₅₀ levels of cardamom fruit extracts in MCF-7, HeLA and L929 cell lines

Extract	MCF-7	HeLA	L929
	IC ₅₀ Values $\mu\text{g/mL}$	IC ₅₀ Values $\mu\text{g/mL}$	IC ₅₀ Values $\mu\text{g/mL}$
Methanol	68,2 \pm 11,3	59,5 \pm 9,7	93,3 \pm 12,7
Ethanol	41,4 \pm 10,6	35,9 \pm 8,8	86,7 \pm 11,4
Water	75,1 \pm 14,5	66,9 \pm 8,6	99,3 \pm 15,6

As a result, it was observed that all cardamom fruit extracts had moderate cytotoxic activity on MCF-7 and HeLA cell lines, and the highest cytotoxic activity was observed in ethanol extract (Table 2). Cardamom fruit extracts were more effective on HeLA cell line than MCF-7 cell line, ethanol extracts and methanol extracts showed more cell viability reducing effect on these cells than the others (Figure 3,4,5).

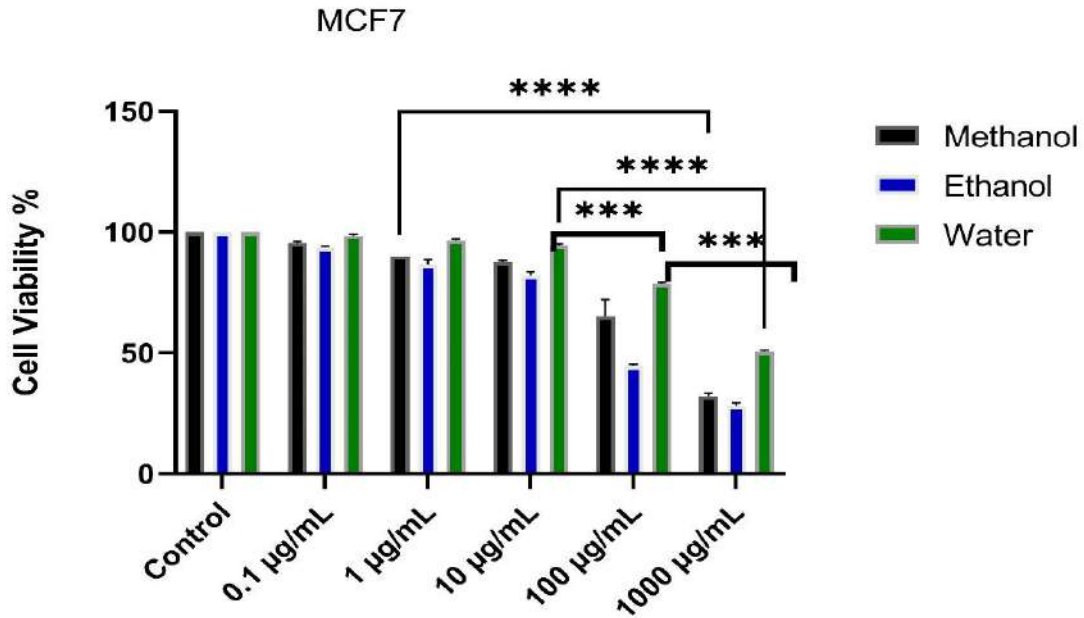


Figure 3. % cell viability results of cardamom fruit extracts in MCF-7 cell line. Activities were evaluated after 24 hours of incubation (**p<0.01; ***p<0.001)

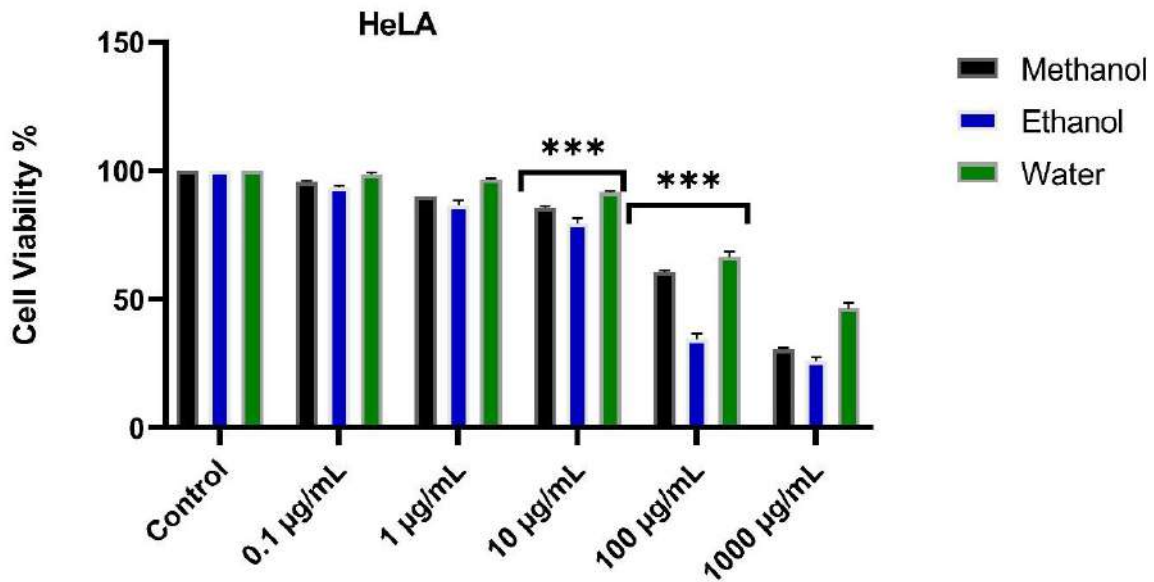


Figure 4. % cell viability results of cardamom fruit extracts in HeLA cell line. Activities were evaluated after 24 hours of incubation (**p<0.01; ***p<0.001)

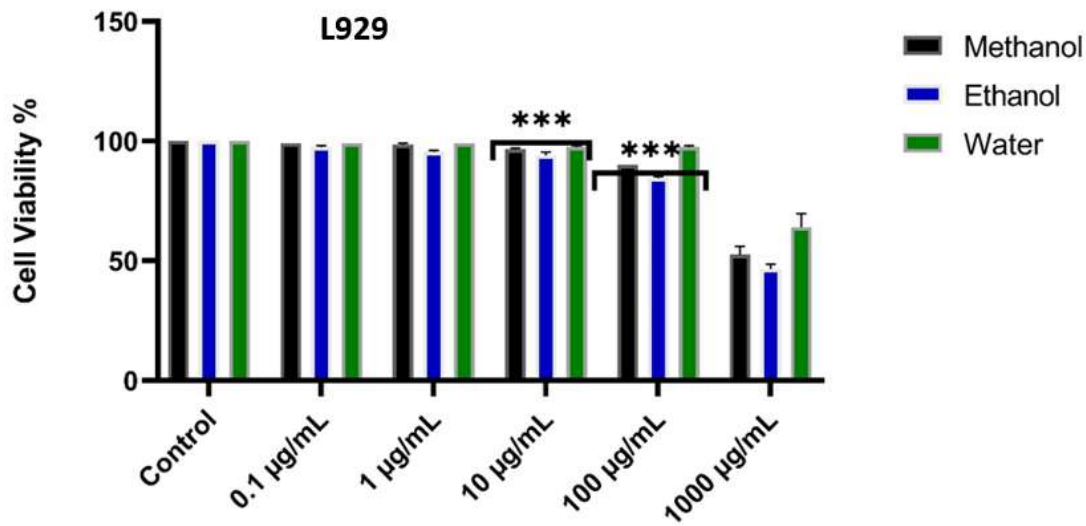


Figure 5. % cell viability results of cardamom fruit extracts in L929 cell line. Activities were evaluated after 24 hours of incubation (**p<0.01; ***p<0.001)

The morphological appearances of MCF-7, HeLA and L929 cell lines treated with cardamom fruit extracts at different doses were visualized by Zeiss Axio inverted microscope (10x) (Figure 6). Since it was determined that cardamom plant extracts generally have a cytotoxic effect in the range of 50-100 µg/mL application dose, extracts with a dose of 50 µg/mL as a single standard dose were applied to the cells for 24 hours and the changes in the cells were visualized (Figure 6). Ethanol and methanol extracts were found to alter the morphology of MCF-7 cells. In the HeLA cell line, 50 µg/mL of extracts of cardamom plant fruits were applied for 24 hours and it was determined that the shape of the cells changed and cell integrity started to deteriorate (Figure 6).

Morphological changes may indicate apoptotic cell death. Cells affected by the extracts lose their normal adherent cell shape and transform into round cells separated from each other within a few hours. Such separate cells detach from the plate surface. The separation, deformation and transformation of cells into round, wrinkled independent cells observed in these groups have been recognized as the appearance of apoptosis.

It was observed that the IC₅₀ values obtained as a result of the application of cardamom fruit extracts for 24 hours in L929 cells were approximately 100 µg/mL (Table 2 and Figure 5). Again, the morphological structures and growth of L929 cells were visualized by Zeiss Axio inverted microscope (10x) and it was determined that the plant extracts had cytotoxic activity at high doses and had no negative effect on cell appearance (Table 2, Figure 5, 6.).

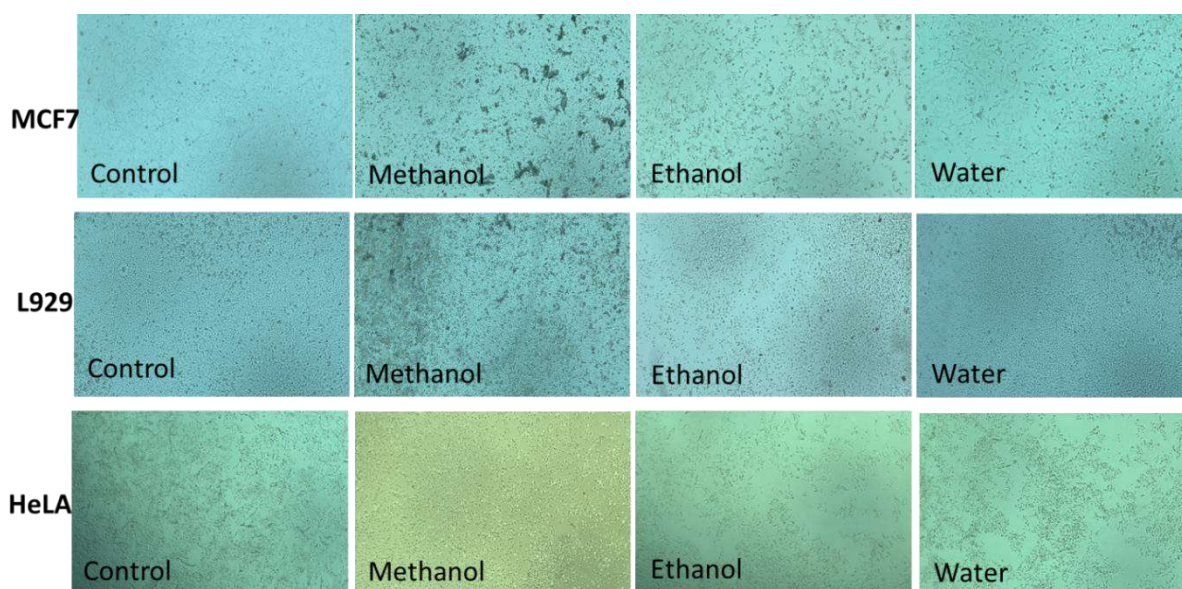


Figure 6. Results of 24 hours incubation of cardamom extracts in MCF-7, HeLA and L929 cell lines at a dose of 50 µg/mL

As a result of proportioning the IC₅₀ values obtained from the cancer cell lines MCF-7 and HeLa cell lines and healthy L929 cell line to which cardamom fruit extracts were applied, comparison results were obtained on which cells the plant extracts were most effective (Table 3). In this comparison defined as selectivity index, cardamom plant ethanol extract showed the best anticarcinogenic activity in HeLa cell line with a selectivity index of 2.415. It is also seen in Table 3 that the selectivity index values of the plant extracts were higher in HeLa cells.

Table 3. Selectivity Index obtained from the comparison of IC₅₀ values of cardamom fruit extracts in L929, MCF-7 and HeLa cell lines.

Extract	Selectivity Index	
	IC ₅₀ (L929/MCF-7)	IC ₅₀ (L929/HeLa)
Methanol	1,368	1,568
Ethanol	2,094	2,415
Water	1,322	1,484

DISCUSSION / CONCLUSION

As a result, it was determined that all extracts of cardamom fruits had moderate cytotoxic activities on MCF-7 and HeLa cell lines, all extracts were more effective in HeLa cell line, and ethanol extract showed more cell viability reducing effect on these cells than the others. For in vitro cytotoxic activity determination, mouse healthy fibroblast (L929) cell lines were applied, cytotoxic activities were examined using MTT test and the extracts were compared in terms of efficacy. As a result, it was determined that cardamom fruit extracts had a weak cytotoxic effect on the healthy cell line L929. The fact that any natural substance or extracts from plants or a single active ingredient has a cytotoxic effect on cancerous cells while not harming healthy cells suggests that it may have potential in the development of future drug substances. In this context, the weak cytotoxic effects of cardamom fruit extracts on L929 healthy cell lines are promising. In general, plant extracts are known to contain hundreds of compounds and it is very important for pharmacognostic studies to understand which of these compounds cause biological activities of real therapeutic quality. However, it is not possible in terms of economic and time management to initiate advanced pharmacognostic experimental processes without the preliminary studies of all plants. It can be said that the cardamom plant extracts investigated in this study can guide

detailed studies with their anticarcinogenic activity values. The data obtained from our study showed that some extracts of cardamom fruits may contribute to the literature in the development of new natural resources, new drugs and therapeutic agents for the treatment of cancer due to their anticancer activity and low cytotoxicity on healthy cells. However, further research on the mechanisms of anticancer activity of these extracts with the application of more advanced and comprehensive techniques, including in vivo experiments, is recommended.

REFERENCES

1. Al-Qubaisi M, Rozita R, Yeap S-K, Omar A-R, Ali A-M, Alitheen NB. (2011). Selective Cytotoxicity of Goniotalamin against Hepatoblastoma HepG2 Cells. *Molecules.*, 16(4):2944-2959. <https://doi.org/10.3390/molecules16042944>
2. Ashokkumar, K., Murugan, M., Dhanya, M.K., Surya, R. and Kamaraj, D. (2019). Phytochemical variations among four distinct varieties of Indian cardamom *Elettaria cardamomum* (L.) Maton. *Natural Product Research*, 34(13), 1919-1922.
3. Besen, Ö. G. M. A. and Beji, N. K. (2014). Fertilite ve bitkiler. *Andrology Bulletin*, 59, 286-289.
4. Daştan, T., Kitapçı, A., Pektaş, A. N., Dündar, G., Durna Daştan, S., & Türkoğlu, Ş., (2018). Hypermethylation Of Death-Associated Protein Kinase (Dapk) Genem Clear Cell Renal Cell Carcinoma (Ccrcc). Iv. International Academic Research Congress (Pp.175).
5. El Malti, J., Mountassif, D. and Amarouch, H. (2007). Antimicrobial activity of *Elettaria cardamomum*: Toxicity, biochemical and histological studies. *Food chemistry*, 104(4), 1560-1568.
6. Karaca, M., Tutuncu, M., Aydin, H. İ. M., Akkan, H. A. and Ozbek, H. (2005). Antiinflatuar effect of *Elettaria cardamom* L. essential oil extract in rats. *The Journal of The Faculty of Veterinary Medicine University of Yuzuncu Yil*, 16(2), 27-30.
7. Khatri, P., Rana, J. S., Jamdagni, P. and Sindhu, A. (2017). Phytochemical screening, GC-MS and FT-IR analysis of methanolic extract leaves of *Elettaria cardamomum*. *International Journal of Research-Granthaalayah*, 5(2), 213-224.
8. Koçköprü, S., (2023). The Effects Of Royal Jelly Samples Collected From Sivas Province On The Proliferation Of Endothelial cells. Sivas Cumhuriyet University. Master of Sciences Thesis Department of Biology, Division of Molecular Biology, p.55.
9. Korikanthimath, V. S., Prasath, D. and Rao, G. (2000). Medicinal properties of cardamom *Elettaria cardamomum*. *Journal of Medicinal and Aromatic Plant Sciences*, 22, 683-685.
10. Noumi, E., Snoussi, M., Alreshidi, M. M., Rekha, P. D., Saptami, K., Caputo, L., De Feo, V. (2018). Chemical and biological evaluation of essential oils from cardamom species. *Molecules*, 23(11), 2818.
11. Ravindran, M. K. (Ed.). (2002). *Cardamom: the genus Elettaria*. New York: Taylor and Francis.
12. Singh, G., Kiran, S., Marimuthu, P., Isidorov, V. and Vinogorova, V. (2008). Antioxidant and antimicrobial activities of essential oil and various oleoresins of *Elettaria cardamomum* (seeds and pods). *Journal of the Science of Food and Agriculture*, 88(2), 280-289.
13. Souissi, M., Azelmat, J., Chaieb, K. and Grenier, D. (2020). Antibacterial and antiinflammatory activities of cardamom (*Elettaria cardamomum*) extracts: Potential therapeutic benefits for periodontal infections. *Anaerobe*, 61, 102089.

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**MELİH CEVDET ANDAY'IN MÜFETTİŞLER ADLI TİYATRO ESERİNDE PERSONA İLKÖRNEĞİ (ARKETİPİ)
PERSONA ARCHETYPE IN MELİH CEVDET ANDAY'S THEATER PLAY TITLED INSPECTORS**

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Abstract

The concept of archetype, which Carl Gustav Jung theorized, includes a number of phenomena specific to the human species. These phenomena, which are thought to have been formed since the beginning of human life, emerge in the form of various symbols, images or behavioral patterns. Developed on the basis of Jung's theory of the collective unconscious and archetypes, archetypal criticism is a method of criticism that analyzes the characters, events and themes of literary works through certain archetypes. One of these first examples, the persona (mask), is a set of masks that emerged in order to be accepted in society and to successfully fulfill the social role it assumed. For centuries, people have used these masks to be accepted in their socio-cultural environments and to survive in that environment. The first example of persona symbolizes the masks individuals wear and the roles they play in the face of social expectations. The first-principles method of criticism helps to better understand the situations and character behaviors in the work by making a critique of the work. This study is based on the analysis of Melih Cevdet Anday's theater work "Müfettişler" through the first image of persona described by Carl Gustav Jung. The main problematic in the work is based on the context of individuals hiding their true identities and wearing different masks in the face of social norms and authority figures. In this context, the conflict between the characters' inner worlds and their outward personalities is analyzed within the framework of the persona principle. The scope of the research is limited to the analysis of the main characters in the work in terms of the principle of persona. The social roles of the characters and the relationship between their masks and their real identities are evaluated through specific scenes and dialogues. In the analysis of literary texts, beyond the determination of certain facts or character structures, the search for literary value constitutes the main activity. In this study, not only the personality structures were determined, but also the aesthetic situations revealed by these structures were tried to be comprehended.

Keywords: Melih Cevdet Anday, Müfettişler, persona archetype, theater.

Özet

Carl Gustav Jung'un kuramsal temelini oluşturduğu ilkörnekte (arketip) kavramı insan türüne özgü birtakım olguları içerir. İnsan yaşamının başlangıcından bu yana olduğu düşünülen bu olgular çeşitli semboller, imgeler ya da davranış biçimleri şeklinde ortaya çıkmaktadır. Jung'un ortak (kolektif) bilinçdışı ve arketip kuramına dayandırılarak geliştirilmiş olan ilkörnekte (arketipsel) eleştiri, edebî eserlerin karakterleri, olayları ve temalarını belirli ilkörnektekiler üzerinden analiz eden bir eleştiri yöntemidir. Bu ilkörnektekilerden biri olan persona (maske) ilkörnekteği toplum içerisinde kabul görme, üstlendiği sosyal rolü başarılı bir şekilde yerine getirme amacıyla ortaya çıkmış maskeler bütünüdür. Yüz yıllardır, insanlar buldukları sosyo-kültürel ortamlarda kabul görmek ve o ortamda hayatta kalmaya devam edebilmek için bu maskeleri kullanmışlardır. Persona ilkörnekteği, bireylerin toplumsal beklentiler karşısında takındıkları maskeleri ve oynadıkları rolleri simgeler. İlkörnektekte eleştiri yöntemi, esere yönelik bir eleştiri yaparak eserdeki durumların ve karakter davranışlarının daha iyi anlaşılmasına yardımcı olur. Bu çalışma, Melih Cevdet Anday'ın "Müfettişler" adlı tiyatro eserini Carl Gustav Jung'un tariflediği persona ilk imgesi üzerinden inceleme esasına dayanmaktadır. Eserdeki temel sorunsal,

toplumsal normlar ve otorite figürleri karşısında bireylerin gerçek kimliklerini gizlemeleri ve farklı maskeler takmaları bağlamına temellendirilmiştir. Bu bağlamda, karakterlerin içsel dünyaları ile dışa yansıttıkları kişilikleri arasındaki çatışma, persona ilkörneği çerçevesinde incelenmiştir. Araştırmanın kapsamı, eserdeki ana karakterlerin persona ilkörneği yönünden incelenmesi ile sınırlıdır. Karakterlerin toplumsal rolleri ve maskeleri ile gerçek kimlikleri arasındaki ilişki, belirli sahneler ve diyaloglar üzerinden değerlendirilmiştir. Edebî metin çözümlemelerinde birtakım olguların ya da karakter yapılarının belirlenmesinin ötesinde edebî değer araştırması yapmak aslî etkinliği oluşturur. Bu çalışmada da sadece kişilik yapıları belirlenmekle yetinilmemiş, bu yapıların ortaya çıkardığı estetik durumlar da kavranmaya çalışılmıştır.

Anahtar kelimeler: Melih Cevdet Anday, Müfettişler, persona (maske) ilkörneği, tiyatro.

GİRİŞ

Edebiyat, insan ruhunun en derin kıvrımlarına ulaşabilen, duygu ve düşüncelerin karmaşık yapısını betimleyebilen bir sanat ve aynı zamanda bilim dalıdır. Edebi eserler, bireylerin ve toplumların iç dünyalarını, bilinçaltı dürtülerini ve ruhsal durumlarını keşfetme imkanı sunar. Aynı zamanda edebi eserler okundukça farklı manalara çıkabilen yapıtlardır ve bu yapıtları anlamlandırabilmek için edebiyat araştırmacıları çeşitli kuramlara başvururlar. İsmail Çetişli, Edebiyat Sanatı ve Bilimi adlı eserinde bu konuyu “Edebiyat eserin her okunuşunda yeniden yaratılması ve çok anlamlı olması, özellikle okuyucuyu merkeze alan edebiyat kuramlarında çok daha önemsenir ve en uç noktaya götürür.” cümleleri ile ifade etmiştir (Çetişli, 2017: 141). Psikolojinin ana unsuru olan insan, edebiyat incelemelerinde de gerek yazar gerek karakterler konusunda araştırmaya yardımcı olacak önemli ipuçları sağlar. Bu bağlamda, edebiyat ve psikoloji arasındaki ilişki, metinlerin analizinde yeni kapılar açar. Özellikle Carl Gustav Jung'un ilkörnekteki teorisi, edebi eserlerdeki karakterlerin ve olay örgülerinin altında yatan evrensel semboller ve mitlerle dolu bilinçdışı motifleri anlamada güçlü bir araçtır. Yaşamın başlangıcından bu yana tekrarlanan ve bilinç dışı düzeyinde aktarılan davranış kalıpları olarak tanımlanan ilkörnekte Jung'un “Analitik Psikoloji” olarak adlandırdığı psikolojik çalışmaların temelini oluşturmaktadır. İlkörnekler, edebi tahlillerde karakterlerin ruhsal durumlarını ve bu durumların toplumdaki yansımalarını incelemek için kullanılabilir etkili bir yöntem sunar. Edebiyat araştırmaları için arketipsel eleştiri yöntemi, eserde kullanılan ilk imgelerin esere estetik ve muhteva yönünden katkı sağlayıp sağlamadığını anlamak açısından incelenir. Berna Moran, Edebiyat Kuramları ve Eleştiri adlı eserinde psikanalitik inceleme ile ilgili düşüncelerini “Sanatçının yaşantısını, nevrozunu psikanaliz yoluyla keşfetmenin eseri değerlendirmekte işe yaramayacağı doğrudur. Ancak psikanalize dayanan yöntem her zaman sanatçının psikolojisine yönelmez, bazen de doğrudan doğruya eseri çözümlemeye çalışabilir. Eserdeki karakterleri bu açıdan inceleyince bunların davranışlarını, kişiliklerini daha iyi kavrayabiliriz.” şeklinde ifade etmiştir (Moran, 2021: 156). Jung, “Ruh-İnsan, Sanat, Edebiyat” adlı eserinde edebiyat ve sanat arasındaki ilişkiyi şu şekilde açıklamıştır:

“Bir psişik süreç incelemesi olan psikolojinin edebiyat araştırmasına da pekâlâ uygulanabileceği açıktır, çünkü insan psişesi bütün sanat ve bilimlerin rahmidir. Dolayısıyla psişenin incelenmesi, bir yandan sanat eserinin psikolojik yapısını açıklayabilmeli, öte yandan bir kişiyi sanatsal açıdan yaratıcı yapan faktörleri ortaya çıkarabilmelidir.” (Jung, 2017: 115)

Yazın hayatı süresince şiir, tiyatro oyunu, deneme, makale, roman türlerinde eserler kaleme alan Melih Cevdet Anday, şiirlerinde olduğu kadar tiyatro eserlerinde de derin ve düşündürücü bir bakış açısı sunar. Anday'ın tiyatro eserleri, toplumun sosyokültürel yapısını eleştirel bir gözle incelemenin yanı sıra, bireyin iç dünyasına ve varoluşsal sorgulamalarına da odaklanır. Bu yönüyle eserleri, bireysel ve toplumsal olanı bir arada ele alarak izleyiciye çok katmanlı bir deneyim sunar. Bu çalışmada Melih Cevdet Anday'ın Müfettişler adlı eseri Carl Gustav Jung'un temel ilkörnektekinden biri olan persona (maske) ilk imgesi çerçevesinde incelenecektir. Anday'ın, bireyin iç dünyasını ele alan tiyatro eserlerinden biri olan Müfettişler adlı eseri karakterlerin iç dünyasındaki duygu durumlarının incelenmesi açısından ilkörnekteki eleştiri yöntemi ile incelenecek ve persona (maske) ilkörneği hangi diyalog ve durumlarda ortaya çıktığı tespit edilecektir.

ARAŞTIRMA VE BULGULAR

İlkörnekteki Eleştiri ve Persona (Maske) İlkörnekte

Başlangıçta Freud'un etkisinde kalan ve onun çalışmalarını ve düşüncelerini benimseyen Jung, zamanla Freud'un görüşlerinden ayrılarak bağımsız bir yol izlemiştir. Bu süreçte, “Analitik Psikoloji” adını

verdiği kendi psikolojik ekolünü geliştirerek, özgün fikir ve yaklaşımlarını ortaya koymuştur (Kavut, 2020: 683). Freud'un libido olarak tanımladığı ruhsal enerjiyi psişik enerji olarak adlandıran Jung, psişik enerjinin Freud'un dile getirdiği gibi sadece cinsel güdülerden kaynaklanan bir enerji olmadığını ruhun bütün yapısını içeren bir güce sahip olduğunu açıklamıştır (Ukray, 2016: 11). Jung, Freud'un bireysel bilinçdışı kavramını genişleterek, her insanın paylaştığı daha derin bir bilinçdışı seviyesinin var olduğunu öne sürmüştür. Bu seviyeye "kolektif bilinçdışı" adını vermiştir. Kolektif bilinçdışı, bireylerin kişisel deneyimlerinden bağımsız olarak paylaştıkları, insanlığın ortak deneyim ve imgelerinden oluşan bir bilinçdışı katmanıdır. Bu katman, insanlığın kültürel, mitolojik ve dini geçmişinden gelen semboller ve motiflerle doludur. Jung ilk defa gördüğü bir rüyanın ardından kişisel bilinçdışı düşüncesinin oluştuğunu belirtmiştir. Çalışmalarının devamında Jung, bunların içgüdü formları yani kendi verdiği isimle arketipler olduğunu ifade etmiştir (Jung, 2017: 195). İlkörnek kavramı, bireylerin davranışlarını, düşüncelerini ve duygusal tepkilerini anlamada önemli bir rol oynar. Kolektif bilinçdışının temel bileşenlerinden biri arketiplerdir. İlkörnekler, insan zihninde var olan evrensel imgeler, semboller ve motiflerdir. Jung'a (2020) göre, arketipler, mitolojilerde, rüyalarda, masallarda ve sanat eserlerinde tekrar tekrar karşımıza çıkan ortak temaları temsil eder. Bu arketipler, her kültürde farklı şekillerde ortaya çıksa da temel anlamları ve etkileri evrenselidir.

Latince "maske" anlamına gelen "persona" kelimesi, antik tiyatrolarda oyuncuların kullandığı maskelere atıfta bulunur ve bireyin toplumla etkileşim kurarken taktığı maskeyi simgeler. Jung'a (2016) göre, persona arketipi, kişinin kendini toplumun beklentilerine ve normlarına uyumlu hale getirmek amacıyla geliştirdiği bir rol ya da kimliktir. Bu ilkörnek, bireyin sosyal ortamlarda nasıl davranacağını belirler ve kişinin gerçek benliği ile toplumun ondan beklediği roller arasında bir köprü kurar. Örneğin, bir kişinin iş hayatındaki tutumu, arkadaşlarıyla olan ilişkisi veya aile içindeki rolü, farklı personaların yansımaları olabilir.

TARTIŞMA

Müfettişler Tiyatro Eserinde Persona (Maske) İlkörneği

Müfettişler adlı eser, özel isimleri eserde belirtmeyen bir Adam ve Kadın'ın yaşadıkları evi satıp deniz kenarında bir ev satın alma isteğini konu almaktadır. Bu isteğin altında yatan asıl sebep ise Adam karakterinin müşteriler tarafından sürekli takip edildiğini düşünmesidir.

"ADAM: Peki müfettişler niçin peşimi bırakmıyor? Demek suçsuz olmak da yetmiyor, emekli olmak da yetmiyor. Ölüncüye değin müfettişlerin soluğunu duyacaksın ensende. Titreyeceksin, üşüyeceksin, ürpereceksin, çenelerin birbirine vuracak. Ama sinirlenmeyeceksin, sarsılmayacaksın. Müfettişlerle birarada yaşamayı öğreneceksin." (Anday, 1987: 142)

Evi satıp deniz kenarında bir eve taşındıklarında bu evi geçmiş yaşantı ve anıları ile birlikte geride bırakacakları düşüncesi sıklıkla tekrarlanmaktadır.

"ADAM: Demek onları burada bırakacağız."

KADIN: Burada bırakacağız."

ADAM (neşe ile ellerini uğuşturur): Burada bırakacağız... Kendi başlarına kalacaklar. Ne güzel! Evimizi onlara satınca bağlanacaklar buraya, arkamızdan baka kalacaklar. Ne güzel!" (s. 142)

Geçmiş yaşantıları ile ilgili kesin bilgiler verilmemesinin yanı sıra adamın otuz yıllık bir meslek hayatını geride bıraktığı ve işinden kovularak ayrıldığı şu diyaloglardan anlaşılabilir:

"ADAM (geniş adımlarla odayı arşınlar, karşı yanda birden geri döner): Otuz yıl, tam otuz yıl, yirmi yaşından elli yaşına kadar kağıtların arasında yaşadım çitir çitir. Koca koca defterlerle sarardım soldum, kayıtlar düştüm, girişler çıkışlar arasında bağlantı kurdum ve hiç aksamadım. Ama kuduz bir köpek gibi de kovalandım." (s. 141)

Eserin başından itibaren karakterler birbirleriyle kimi zaman anlaşarak kimi zaman birbirinden gizlice pencereden aşağıdaki insanları kontrol etmektedir. Eserde aşağıda bulunan iki kişiden söz edilir. Bu kişiler belirsiz zaman aralıklarıyla orada beklemektedir. Karakterler bu kişilerin tellal ve müşteri olduğunu ve eve bakmak için orada beklediğini belirtmektedir. Fakat bir diyalogda rastlandığı üzere aşağıda bulunan iki kişinin benzer görünüşte olduğu anlaşılabilir.

"ADAM: Tamam tamam, müşteri. İki de birbirine benziyorlar da..."

KADIN: Çok benziyorlar ikiz gibi."

ADAM: İkiz gibi."

KADIN: Kılıkları da aynı."

ADAM: Kılıkları da aynı.” (s. 148)

Gerçek hayatta bir ev almak isteyen müşteri ve tellalın oyunda belirtildiği gibi 9 gün ya da 15 gün evin kapısında sessizce beklemeyeceği göz önüne alındığında aşağıda bekleyenlerin Kadın ve Adam’ın sandığı gibi Müşteri ve Tellal olma ihtimali düşmektedir. Eserin devamında müşteri ve tellal yukarı çıkıp zili çalarlar. Adam telaşlanarak saklanmak; ister Kadın ise onu sakinleştirir. Müşteri ve Tellal eve girdikten sonra gözlerini Adam karakterinden hiç ayırmazlar. Kadın ve tellalın şu diyalogu onların müşteri olma ihtimalini daha da düşürmektedir:

“KADIN: ... Siz nerden duydunuz evi satacağımızı?

TELLAL (gözleri Adam’da): Biz mi?

KADIN: Evet. Gazetede mi okudunuz?

TELLAL (konuşmağa daldıkça kimi zaman gözlerini Adam’dan ayırır, ama hemen sonra gene bakmağa başlar): Gazetede okuduk.

KADIN: Ne tuhaf! Oysa biz gazeteye ilan vermedikti. Belki başkası vermiştir. Evi satmak istediğimizi bilen biri. Ohur ya! ...” (s. 153)

Bu diyalogda anlaşıldığı üzere Tellal olarak gelen adamın evin satışıyla bir ilgisi olamamakla birlikte Kadın’ın söylediklerine ayak uydurmaya çalışmaktadır. Bunun sebebi Tellal maskesini takarak kendi amacına hizmet etmeyi sürdürebilmektir. Kadın’ın *“Oysa biz gazeteye ilan vermedikti. Belki başkası vermiştir...”* (s. 153) cümleleri ise kendini güvende hissedebilmek ve onun Tellal olduğuna inanmak için sarf ettiği çabayı ortaya koymaktadır. Böylelikle karşılıklı bir oyunun içine girerler. Kadın sakin bir ev sahibi personasına bürünmekte, Adam onların müfettiş olduğunu düşünmesine rağmen telaşlı davranışını gizlemek için sessiz kalmakta, diğer iki adam ise Müşteri ve Tellal personasının arkasında evi düzenli aralıklarla kontrole gelen müfettişleri saklamaktadırlar. Kadın kahve yapmak için odadan çıktığı anda üçü de personasını bir kenara bırakır ve kendileri olarak konuşur. Bu konuşma sırasında Adam bir sorguda gibi ne sorulursa cevap verir. Bununla birlikte Tellal ve Müşteri personasında eve gelen müşteriler de adama kötü bir üslupla sorular sorar. Müfettişler cümleler arasında *“alçak, namussuz, cezasını göreceksin”* şeklinde ifadelerle başvurarak adamı savunmasız bırakıp personasının ardına gizlenmesini engellerler. Kadın odadan çıktığı andan geri döndüğü ana kadar sorular evle ilgili değil adamın kendisiyle ilgilidir. Adam Müşteri ve Tellal’ın uzun süreli sözlü baskısına dayanamaz. Onların *“İtiraf ediyor musun? Suçunu kabul ediyor musun?”* şeklinde yönelttiği soruların hepsine kabullenerek yanıt verir. Yıllar süren bu teftiştten dolayı sağlığı ve psikolojisi etkilenmiş hatta intihara girişmiş fakat bu girişim başarılı olmamıştır. Adam yaşadığı tüm duygu durumları Tellal ve Müşteri’ye dürüstçe ve tedirginlikle anlatır. Tellal ve Müşteri Adam’ın söylediği bazı şeyleri not alır. Kadın geri geldiğinde sohbet yeniden ev üzerinden devam eder. Fakat Tellal ve Müşteri karakterleri tüm bu sohbet boyunca ev üzerinden onlara kişisel sorular sorarak daha fazla bilgi toplama niyetindedirler. Tellal ile Kadın arasında geçen bir diyalogda Tellal açıkça: *“Bizim işimiz bilmek değildir, öğrenmektir sadece.”* (s. 170) diyerek personasını zayıflatarak kendi benliğine yaklaşmış olur. Tellal ve Müşteri her ne kadar yarı gizli yarı açık şekilde sorularını yöneltse de kadın her seferinde ev üzerinden Adam’ı koruyacak cevaplarla bu sorguyu geçiştirmeye çalışır. Bu diyaloglar oyunun sonunda Adam fenalık geçirinceye kadar devam eder. En son Kadın *“Satmıyorum.”* Diye bağırarak onları bastırır. Nihayetinde Kadın Adam’ı sakinleştirmeye çalışırken Tellal ve Müşteri sessizce dışarı çıkarlar ve teftiş son bulur. Eser de Kadın’ın Adam’ı yeni alacakları deniz kenarındaki evde ne kadar mutlu olacaklarını anlatması ile sakinleştirme çabaları arasında son bulur. Buradan anlaşılacağı üzere sürekli değişen müfettişlerin belli aralıklarla Adam’ı ziyaret etmesi ve sürekli olarak takip etmesi, Adam ve Kadın’ın evlerini satma oyununa girişmelerine sebep olmuştur. Adam’ın psikolojik rahatsızlıkları vücudunda hastalıklara sebep olmuş ve bunu yatıştırabilmek için Kadın kontrolü eline alarak Adam’ın pencereden müfettişlere bakmasına belli aralıklarla izin vermiş bunu yaparken de onların Tellal ve Müşteri olduğuna önce kocasını sonra kendisini inandırmıştır. Evlerini satan ve bunu huzurlu bir şekilde yapan toplumun normal bir parçası olarak bir persona belirlemiş ve bu personanın gereğince müfettişleri de Müşteri ve Tellal personasının arkasına yerleştirmişlerdir. Bu eserde persona kullanımı Adam ve Kadın’ın yaşadıkları teftiş baskısından kurtularak hayatlarına normalce devam edebilmeleri için ortaya çıkmıştır.

SONUÇ

Melih Cevdet Anday’ın "Müfettişler" adlı tiyatro eserinde, Carl Gustav Jung’un persona ilkörneği çerçevesinde yapılan inceleme, bireylerin toplum içinde varlıklarını sürdürebilmek ve sosyal rollerini yerine getirebilmek için çeşitli maskeler taktığını açıkça ortaya koymuştur. Eser, karakterlerin iç dünyaları ile toplumsal beklentiler arasındaki çatışmayı, persona ilkörneği üzerinden analiz ederek

bireyin kendi gerçekliğinden koparak toplumun normlarına uyum sağlama çabasını gözler önüne sermiştir. Adam ve Kadın karakterleri, yaşadıkları içsel ve dışsal baskılarla başa çıkabilmek için, sürekli olarak persona kullanmak zorunda kalmışlar ve bu maskeler aracılığıyla toplumun dayatmalarına karşı kendilerini koruma çabasına girmişlerdir.

Eserde, toplumun bireyler üzerindeki baskısı ve otoritenin denetimi, müfettişler sembolüyle temsil edilmiştir. Adam karakterinin sürekli olarak müfettişlerin takibi altında olduğuna inanması, onun içsel dünyasındaki güvensizliği ve huzursuzluğu yansıtmaktadır. Bu durumda, Adam ve Kadın'ın persona aracılığıyla, toplumun normlarına ve beklentilerine uygun davranışlar sergileyerek hayatta kalma mücadelesi verdikleri görülmektedir. Müşteri ve Tellal ise oyun ve maskelenmenin bir parçası haline gelmiş, karakterlerin kendi gerçek kimliklerini gizleme ve sosyal rollerini başarılı bir şekilde yerine getirme çabalarını derinleştirmiştir.

Bu çalışma, "Müfettişler" eserinin persona ilkörneği bağlamında analiz edilmesiyle, bireyin toplumsal rol ve kimlikleri arasında sıkışmışlığını ve bu sıkışmışlık karşısında takındığı maskelerin daha iyi anlaşılmasında bir kapı aralamıştır. Sonuç olarak, "Müfettişler" eseri, ilkörneksel eleştiri yöntemiyle incelendiğinde, bireyin sosyal çevresine uyum sağlama çabasının ve içsel çatışmalarının çözümlenmesini sunmaktadır.

KAYNAKÇA

- Anday, M. (1987). *Ölümsüzler – Toplu Oyunları 1*, Adam Yayınları, İstanbul.
- Çetişli, İ. (2017). *Edebiyat Sanatı ve Bilimi*, Akçağ Yayınları (4. Baskı), Ankara.
- Fordham, F. (1997). *Jung Psikolojisi*, (4. baskı). Çeviren: Aslan Yalçın, İstanbul: Say Yayınları.
- Jung, C.G. (2016). *Analitik Psikoloji Sözlüğü*, N.Nirven. (Çev.) İstanbul: Pinhan Yayıncılık.
- Jung, C. G. (2017). *Ruh-İnsan, Sanat, Edebiyat*, Çeviren: İsmail Hakkı Yılmaz, İstanbul: Pinhan Yayıncılık.
- Jung, C.G. (2017). *Anılar, Düşler, Düşünceler*, İ. Kantemir. (Çev.). İstanbul: Can Yayınları.
- Jung, C.G. (2020). *Dört Arketip*, Z. Aksu Yılmaz. (Çev.). İstanbul: Metis Yayınları.
- Kavut, S. (2020). Carl Gustav Jung: Kavramları, Kuramları ve Düşünce Yapısı Üzerine Bir İnceleme. *Uluslararası Kültürel ve Sosyal Araştırmalar Dergisi (UKSAD)*, 6 (2), Kış, s. 681-695.
- Moran, B. (2021). *Edebiyat Kuramları ve Eleştiri*. İletişim Yayınları (31. Baskı), İstanbul.
- Ukray, M. (2016). *Jung Psikolojisi*, Ankara: Yason Yayınları.
- Uğurlu, Y. S. (2022). Persona (Maske) Arketipi Açısından Orhan Kemal'in Murtaza Romanı. *Abant Sosyal Bilimler Dergisi*, 22(3), 1313-1319. doi: 10.11616/asbi.1159993

**FARKLI ÖĞRENİM SEVİYESİNDEKİ ORTAOKUL ÖĞRENCİLERİNİN ÖZ DÜZENLEME
BECERİLERİNİN İNCELENMESİ
EXAMINING THE SELF-REGULATION SKILLS OF MIDDLE SCHOOL STUDENTS AT
DIFFERENT LEARNING LEVELS**

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Özet

Teknolojinin ve sosyal iletişim ağlarının çok kullanıldığı 21. yüzyılda, dünyada ve ülkemizde, eğitim sistemlerinde öğrenciyi merkeze alan öğretim programlarından yararlanılmaktadır. Öğrenci merkezli öğretim programlarında öğrenciden beklenen birçok beceriler yer almaktadır. Yaşam becerileri kapsamında; iletişim, girişimcilik, eleştirel düşünme, yenilikçi düşünme, yaratıcılık ve öz düzenleme gibi beceriler ilk sırayı almaktadır. 2024 yılında Türkiye Yüzyılı Maarif Modelinde özellikle öz düzenleme becerisi öğrencilere kazandırılması gereken beceriler arasındadır. Bazı araştırmacılar “öz-düzenleme” terimini sadece duyguların kontrolünü içerecek şekilde çok dar bir şekilde tanımlarken, diğer araştırmacılar “öz-düzenleme” terimini oldukça geniş bir şekilde, yani insanlar kişisel, kişilerarası ve durumsal zorluklar karşısında hedeflerinin peşinden giderken dahil oldukları tüm bilişsel, üst-bilişsel, motivasyonel, iradi ve duygusal süreçleri içerecek şekilde tanımlamışlardır. Öz düzenleme becerisine sahip birey birçok beceriye sahiptir. Bu bağlamda, bu çalışmanın amacı farklı öğrenim seviyelerindeki ortaokul öğrencilerinin öz düzenleme becerilerini belirlemek ve bazı değişkenler açısından farklılık gösterip göstermediğini tespit etmektir. Betimsel çalışma kapsamında gelişimsel araştırmalardan enlemesine araştırma yöntemiyle Güneydoğu Anadolu’da bir devlet ortaokulunda öğrenim gören toplam 162 öğrenciyle çalışılmıştır. Eryılmaz ve Mammadov (2017) tarafından geliştirilen “Öz Düzenlemeli Öğrenme Ölçeği” veri toplama aracı olarak kullanılmış ve uygun bir istatistik program ile analizler yapılmıştır. Analiz bulgularına göre, farklı öğrenim seviyesindeki 6.,7. ve 8. sınıf öğrencilerinin öz düzenleme becerileri arasında anlamlı bir farklılık olmadığı sonucuna varılmıştır. Bunun yanında öğrencilerin öz düzenleme becerileri cinsiyet, anne eğitim durumu, karne notu, aylık gelir ve ders çalışma süresi değişkenlerine göre farklılık göstermezken, baba eğitim durumuna göre değerlendirildiğinde babanın eğitim düzeyi arttıkça öz düzenleme becerilerinin de arttığı ve anlamlı farklılık gösterdiği belirlenmiş, babanın öğrenim durumunun öz düzenleme becerisi üzerine etkisi olduğu sonucuna varılmıştır. Etkisi araştırılan değişkenler düşünüldüğünde sınıf seviyesi, cinsiyet, anne eğitim durumu, karne notu, aylık gelir, ders çalışma süresi öz düzenleme becerisine etki etmemesi düşündürücüdür. Bu konuda öğretmenlerin ve eğitimcilerin gerekli önlemleri alması önerilmektedir.

Anahtar kelimeler: Beceri, Ortaokul Öğrencileri, Öz Düzenleme

Abstract

In the 21st century, when technology and social communication networks are widely used, in the world and in our country, student-centered curricula are used in education systems. There are many skills expected from students in student-centered curriculum. Within the scope of life skills, skills such as communication, entrepreneurship, critical thinking, innovative thinking, creativity and self-regulation are ranked first. In the 2024 Turkey Century Education Model, especially self-regulation skills are among the skills that students should acquire. While some researchers have defined the term ‘self-regulation’ very narrowly to include only the control of emotions, other researchers have defined the term ‘self-regulation’ very broadly to include all cognitive, metacognitive, motivational, volitional and

emotional processes that people engage in when pursuing goals in the face of personal, interpersonal and situational challenges. Individuals with self-regulation skills have many skills. In this context, the aim of this study is to determine the self-regulation skills of secondary school students at different levels of education and to determine whether they differ in terms of some variables. Within the scope of the descriptive study, a total of 162 students studying in a state secondary school in Southeastern Anatolia were studied with the cross-sectional research method from developmental research. The 'Self-Regulated Learning Scale' developed by Eryılmaz and Mammadov (2017) was used as a data collection tool and analyses were performed with an appropriate statistical program. According to the findings of the analyses, it was concluded that there was no significant difference between the self-regulation skills of 6th, 7th and 8th grade students at different education levels. In addition, while students' self-regulation skills did not differ according to gender, mother's education level, report card grade, monthly income and study time variables, when evaluated according to father's education level, it was determined the more the father's education level increased, the more self-regulation skills increased and showed a significant difference, and it was concluded that the father's education level had an effect on self-regulation skills. Considering the variables whose effect was investigated, it is thought-provoking that grade level, gender, mother's education level, report card grade, monthly income, and study time did not affect self-regulation skills. It is recommended that teachers and educators take necessary precautions in this regard.

Keywords: Secondary School Students, Self-Regulation, Skill

GİRİŞ

Eğitim, insan beyni ve bilgi dağarcığı ilerledikçe sürekli gelişmek zorunluluğu olan bir kavramdır. Artık öğretmen merkezli yaklaşımlar yerini öğrenci merkezli yaklaşımların alması da bunun etkisidir. Aslında bireyin kendi hızında öğrenmesi de böyle ortaya çıkmıştır (Bishop ve Verleger, 2013).

İnsanın sosyal çevresiyle olan iletişimi doğumdan ölümüne kadar gelişme gösterir. Çevresine karşı uyumu aynı anda gelişir (Koçyiğit, 2019). Gelişimin kendisi doğumdan ölümüne kadar devam eder. Bunlar düşünüldüğünde günümüzde birey merkezli öğrenmenin geçerli olduğu fark edilmektedir. Temele birey merkezli öğrenme alınarak yapılan araştırmalara bakıldığında öz düzenleyerek öğrenme öne çıkan kavramlar arasındadır (Özturan Sağırılı, vd., 2010). “*Öz düzenleyici öğrenme, bireyin kişisel amaçlarına ulaşmak için döngüsel olarak uyarladığı ve planladığı duygu, düşünce ve eylemler bütünüdür*” (Zimmerman, 2000a:14).

Öz düzenleyerek öğrenme ile sosyal çevre arasındaki bağlantı birbirinin gelişimine katkı sağlanması ile açıklanır (Aran, 2015, s. 208). Geçmiş tecrübe birikimleri bireyin yaşantısındaki tepkilerine yön verdiği için öz düzenleme döngüsel bir süreçtir (Zimmerman, 2001). Bireyin öz düzenleme farkındalığı yüksek ise kendi farkındalığı da yüksektir ve elindeki imkanların bilincinde olarak nasıl kullanması gerektiğini daha iyi bilmektedir (Altun, 2005). Kendi öğrenmesine etki eden koşulların kontrolünde sağlıklı kararlar alabilmektedir (Dembo ve Eaton, 2000). Öz düzenleyerek öğrenme sürecinin oluşumunda bireyin motivasyon, bilişüstü ve davranış stratejileri açısından aktif olmasına önem verilmektedir (Williams, 2008; Winne ve Perry, 2000: 533). Öz düzenleyerek öğrenme stratejileri ile üst düzey bilişsel beceriler birbirini etkilemektedir (Fusch, Fusch, Prentice ve Burch, 2003). Öz düzenleyerek öğrenme, bireyin davranışını düzenlemesidir. Öğrencinin bir davranışı ortaya çıkarmadan önce planlaması, kontrol etmesi, sabretmesi, dürtüsel değil mantıksal hareket etmesi gibi durumlardır (Smith-Donald vd., 2007, s.174). Davranışı gösterirken kontrol altında tutması davranışı düzenlemesi demektir. Bilinçli olarak dikkat etmesi, davranışı değiştirmesi, durdurması veya devam etmesi çaba gerektiren kontrol olarak adlandırılır (Eisenberg vd., 2011, s. 78).

Öz düzenleme becerileri gelişen çocukların sosyal, duygusal becerileri de gelişmektedir. Dolayısıyla bununla birlikte etkili öğrenmeye yardımcı olan öz düzenleme, akademik başarıları da desteklenmektedir (Magdalena, 2014, s.734; Montroy vd., 2014, s. 307). Öz düzenleyerek öğrenme sadece bireyin kendisiyle ilgili değildir. Başkalarının duygularını kavramada yani empati yeteneğinin gelişmesinde de katkı sağlar. Motivasyon becerisi artan birey duygu ve davranışlarını daha kolay kontrol eder, sosyal iletişim yeteneği ve iş birliği kapasitesi gelişir (Fındık Tanrıbuyurdu, 2012, s. 27).

ALANYAZIN DERLEME

Alanyazındaki çalışmalar incelendiğinde, öz düzenleme becerileri başarı için önemli öngörülerde bulunmamıza yardımcı olmaktadır (Corno, 1986, 1989; Pintrich ve De Groot, 1990; Yumuşak, Sungur ve Çakıroğlu, 2007; Zimmerman ve Martinez-Pons, 1986).

Başarının gelebilmesi için yeni yüzyılda bireyin merkezde olduğu sistemler kullanılmaktadır. Dolayısıyla bireysel farklılıklar gözetilmektedir. Bireyler farklılaştıkça her bireyin öğrenme yöntemi değişmektedir. Gelişen teknoloji içinde bilgiye ulaşmak çok kolaydır; fakat bu bilgiyi bireyin kendine göre özümsemesi, hangi bilgiye ihtiyacı olduğunu fark etmesi ve o bilgiye nasıl kolay yolla ulaşabileceğini bulması daha çok önemsenmektedir. Bu ihtiyaca en yakın kavramlardan biri olan ise öz düzenlemedir (Eryılmaz ve Mammadov, 2017). Öz düzenleyerek öğrenme bir süreç ve bireysel farklılıkları gözetilen bir strateji olduğu için çocuğun özelliklerine göre (cinsiyet, kültür, mizaç vb.) öz düzenleme kapasitelerindeki gelişim ve değişim farklılık gösterir (Fox ve Riconscente, 2008).

Öz düzenlemede birey kendi benliğiyle ilgilendiği için özüne iner. Başarılı oldukça benlik huzuru da sağlanır. İç huzuru olan birey aynı zamanda sağlıklıdır. Durumları organize etmede başarılıdır (Robinson ve Aronica, 2018, s.24). Bireysel eylemlerini yönetebilen çocuklar yaşları ilerledikçe başka davranış yönetme biçimleri de geliştirir (Bronson, 2000).

Özellikle 2010 yılından itibaren öz düzenleme alanyazında çok sık karşımıza çıkmaktadır. Araştırmacıların bu konuya eğilmesinin en önemli sebebi yeni çağın gereklerinden biri olan bireysel farklılıklara verilen önemdir. Yapılan araştırmalara bakıldığında çoğunlukla İç Anadolu ve Marmara Bölgesinde yapıldığı görülmüştür. Öz düzenleme ile ilgili araştırmalara bakıldığında nitel araştırmaya rastlanmamıştır (Kazu ve Yavuz, 2021).

MEB Türkiye yüzyılı maarif modeli incelendiğinde, Sosyal-Duygusal Öğrenme Becerileri bölümü arasındaki Benlik Becerileri kısmında öz düzenleme bulunmaktadır. Öz düzenleme becerisi, '*Kişisel hedeflere ulaşabilmek için duygu, düşünce ve bilişsel stratejilerin izlenip değerlendirilmesi ve pekiştirilerek kontrol edilmesini ifade eder*' şeklinde açıklanmıştır.

Öz düzenleme için 5 adet süreç bileşeni belirlenmiştir:

"SB1. İhtiyaçlarını karşılamaya yönelik hedef belirlemek"

"SB2. Motivasyonu ayarlamak"

"SB3. Bir hedefi gerçekleştirebilmek için kendi duygu, düşünce ve davranışlarını izlemeye yönetmek"

"SB4. Bir hedefi gerçekleştirebilme sürecinde kendini değerlendirmek"

"SB5. Kendi öğrenme durumunu geliştirmeye yönelik çalışmalar yapmak"

(MEB, 2024). Bu süreç bileşenlere sahip bireyler yetiştirmeyi hedefleyen yeni Fen Bilimleri öğretim programı ile ilgili becerilerin kazandırılması gerekmektedir.

PROBLEM DURUMU

Öğrencilerin öz düzenleyerek öğrenme becerilerini kazanmaları birçok kazanımı beraberinde getirmektedir. Bunun için ilgili becerileri kazandırmadan önce mevcut durumun belirlenmesi ve ona göre önlemler alınması gerekmektedir. Dolayısıyla çalışmanın amacı farklı öğrenim seviyelerindeki ortaokul öğrencilerinin öz düzenleme becerilerini belirlemek ve bazı değişkenler açısından değerlendirmektir. Bu amaca ulaşabilmek için araştırmanın problemi aşağıdaki gibidir.

1. Farklı öğrenim seviyesindeki ortaokul öğrencilerinin öz düzenleyerek öğrenme becerileri,
 - a) Cinsiyete göre,
 - b) Sınıf düzeyine göre,
 - c) Anne ve baba eğitim düzeyine göre,
 - d) Aylık gelir durumuna göre,
 - e) Karne notuna göre,
 - f) Çalışma odasının varlığı durumuna göre,
 - g) Günlük ders çalışma saatine göre farklılık göstermekte midir?

YÖNTEM

Araştırmanın Modeli

Farklı öğrenim seviyesindeki ortaokul öğrencilerinin, öz düzenleme becerileri, öğrencilerin cinsiyetine, sınıf düzeyine, anne-baba eğitim düzeyine, aylık gelir durumuna, karne notuna, çalışma odası varlığı durumuna ve günlük ders çalışma saatine göre incelenmiştir. Bu nedenle bu çalışmada betimsel çalışma kapsamında gelişimsel araştırmalardan enlemesine araştırma yöntemi kullanılmıştır. Enlemesine yürütülen çalışmalarda bir özelliğin zaman içerisindeki gelişimi incelenmektedir (Özmen ve Karamustafaoglu, 2019). Bundan dolayı ilgili çalışma enlemesine araştırma kapsamında yürütülmüştür.

Evren ve Örneklem

Bu araştırmada Güneydoğu Anadolu’da bir devlet ortaokulunda öğrenim gören 5-6-7-8. sınıf düzeyindeki toplam 162 öğrenci ile çalışılmıştır. Seçkili (seçkisiz olmayan) örneklem alma çeşitlerinden biri olan uygun (elverişli) örnekleme yolu kullanılmıştır. En ulaşılabilir ve en yüksek tasarrufun sağlanabileceği grup ile çalışılmaktadır. Zamandan, paradan ve işgücünden tasarruf etmek amacıyla kullanılan bir yöntemdir (Büyüköztürk vd., 2013).

Veri Toplama Araçları ve Analizi

Eryılmaz ve Mammadov (2017) tarafından geliştirilen “Öz Düzenlemeli Öğrenme Ölçeği” veri toplama aracı olarak belirlenmiştir. Ölçek 47 maddeden oluşmaktadır. 4’lü likert tipinde olan ölçek (1) “hiç uygun değil”, (2) “uygun değil”, (3) “uygun” ve (4) “çok uygun” olarak derecelendirmiştir. En düşük puan 47, en yüksek puan 188’dir. Ölçek 3 aşama ve 14 alt aşamadan oluşmaktadır. Aşamalar “öngörü”, “performans” ve “öz yansıtma” olarak belirlenmiştir. Öngörü; görev analizi-amaç belirleme, stratejik plan yapma, motivasyonel inançlar-öz yeterlilik ve içsel ilgi/değer alt aşamalarına ayrılmıştır. Performans; öz kontrol-hayal, dikkati odaklaştırma, kendini eğitme, görev stratejileri, öz gözlemlenme-kendini kayıt ve kendini deneyimleme alt aşamalarına ayrılmıştır. Öz yansıtma; öz yargılama-nedensel yükleme, öz tepki-özdoyum/duygulanım ve uyum/savunma alt aşamalarına ayrılmıştır (Zimmerman, 2002). Ölçeğin her bir alt kategorisine ait güvenilirlik katsayıları hesaplanmıştır, 0.59 ile 0.83 aralığında olduğu belirlenmiştir.

Ölçeğin yazarlardan kullanım izni alınmıştır. Etik kurul onayı ve MEM’den öğrencilerde uygulama yapabilmek için gerekli izinler alınmıştır. Daha sonra araştırmacılarından birinin görev yaptığı okullarda 5, 6, 7 ve 8. sınıf öğrencilerine uygulanmıştır. Uygulama tamamlandıktan sonra veriler istatistikî programa yüklenmiştir. Öncelikle normallik, homojenlik, çarpıklık, basıklık analizleri yapılmıştır. Kullanılan ölçeğin eşit araklı olması, basıklık ve çarpıklık değerlerinin -1,5, +1,5 arasında olmasından dolayı parametrik analizler yapılmıştır. Cinsiyet ve çalışma odasının durumuna göre değerlendirmede bağımsız örneklem t-testi, sınıf seviyesi, anne, baba eğitim durumu, aylık gelir, karne notu, günlük ders çalışma süresi değişkenleri için ise One Way ANOVA analizleri yapılmıştır.

BULGULAR

Öz düzenleyerek öğrenme becerilerinin farklı değişkenler açısından incelendiği bu çalışmada ortaokul öğrencilerine uygulanan “Öz Düzenlemeli Öğrenme Ölçeği”nden elde edilen bulgular sunulmuştur. Çalışmanın problemi doğrultusunda cinsiyet değişkenine göre bağımsız örneklem t-testi sonucu ulaşılan veriler Tablo 1’de verilmiştir.

Tablo 1. Cinsiyet Değişkenine Göre Öz Düzenlemeli Öğrenme Bulguları

Cinsiyet	N	Ortalama	Standart Sapma	t	p
Kız	87	3,01	,413	-,981	,328
Erkek	75	3,07	,418		

Tablo 1 incelendiğinde, öz düzenlemeli öğrenme düzeyi kız öğrencilerin ortalaması 3,01 iken erkek öğrencilerin ortalaması 3,07 olduğu görülmektedir. Buna göre öz düzenlemeli öğrenme cinsiyete göre farklılaşmamaktadır ($t=-,981$, $p>,05$).

Ortaokul öğrencilerinin öz düzenlemeli öğrenme düzeylerinin sınıf seviyesine göre durumunun değerlendirilmesinde yapılan One Way ANOVA analizi sonuçları Tablo 2’de sunulmuştur.

Tablo 2. Sınıf Seviyesi Değişkenine Göre Öz Düzenlemeli Öğrenme Bulguları

Sınıf Seviyesi	N	Ortalama	Standart Sapma	F	p
5	40	3,13	,345	,961	,413
6	36	2,99	,494		
7	46	3,02	,512		
8	40	3,00	,241		

Sınıf seviyesine öz düzenlemeli öğrenmelerin çoklu karşılaştırması post hoc testleriyle yapılmış ve farklı sınıfların birbirleriyle öz düzenlemeli öğrenmeleri arasında anlamlı farklılık çıkmamıştır ($F=,961$, $p>,05$). Tablo 2’de görüldüğü gibi öğrencilerin ortalamaları 3,13-2,99 arasındadır. Ortaokul öğrencilerinin öz düzenlemeli öğrenmelerinin anne ve baba eğitim durumlarına göre değerlendirilmesi ayrı ayrı yapılmıştır. Anne eğitim durumuna göre yapılan analiz bulguları Tablo 3’te verilmiştir.

Tablo 3. Anne Eğitim Durumu Değişkenine Göre Öz Düzenlemeli Öğrenme Bulguları

Anne Eğitim Durumu	N	Ortalama	Standart Sapma	F	p
İlkokul	90	3,00	,382	,526	,665
Ortaokul	53	3,06	,435		
Lise	12	3,15	,582		
Üniversite	7	3,08	,386		

Tablo 3 değerlendirildiğinde anne eğitim durumuna göre öz düzenlemeli öğrenmelerin farklı öğrenim seviyesinde olan annelere göre anlamlı farklılık göstermediği görülmektedir. Ortalamaların 3,00-3,15 arasında değişkenlik gösterdiği belirlenmiştir.

Baba eğitim durumuna göre öğrencilerin öz düzenlemeli öğrenmeleri incelendiğinde farklılık gösterdiği belirlenmiştir. Yapılan analizler sonucu ulaşılan bulgular Tablo 4 ve 5’te sunulmuştur.

Tablo 4. Baba Eğitim Durumu Değişkenine Göre Öz Düzenlemeli Öğrenme Bulguları

Baba Eğitim Durumu	N	Ortalama	Standart Sapma	F	p
İlkokul	50	3,04	,366	2,656	,050
Ortaokul	73	2,96	,397		
Lise	31	3,15	,430		
Üniversite	8	3,28	,644		

Tablo 4’te görüldüğü gibi baba eğitim durumuna göre öz düzenlemeli öğrenmelerin ortalamaları 2,96-3,28 arasında değişmektedir. Anlamlılık değeri $p<0,05$ olduğu görülmektedir. Anlamlı farkın hangi eğitim durumu açısından olduğunu belirlemek için yapılan post hoc testi bulguları Tablo 5’te verilmiştir.

Tablo 5. Baba Eğitim Durumu Değişkenine Göre Öz Düzenlemeli Öğrenme Post Hoc Analizi Bulguları

(I) Baba Eğitim	(J) Baba Eğitim	Anlamlı Fark (I-J)	Std. Hata	Anlamlılık
İlkokul	Ortaokul	,085	,075	,256
	Lise	-,106	,093	,257
	Üniversite	-,238	,155	,128
Ortaokul	İlkokul	-,085	,075	,256
	Lise	-,192*	,087	,030
	Üniversite	-,324*	,152	,035
Lise	İlkokul	,106	,093	,257
	Ortaokul	,192*	,087	,030
	Üniversite	-,132	,162	,417
Üniversite	İlkokul	,238	,155	,128
	Ortaokul	,324*	,152	,035
	Lise	,132	,162	,417

Tablo 5 değerlendirildiğinde, baba eğitim durumu arttıkça öz düzenlemeli öğrenme puanlarının arttığı görülmekte ve aralarında anlamlı farklılık oluşmaktadır. Ancak analiz verilerine göre bu farklılık lise ve ortaokul mezunu baba eğitimine göre karşılaştırma yapıldığında lise mezunu lehine ($p=0,030$), üniversite ve ortaokul mezunu baba eğitimi karşılaştırmasında üniversite mezunu lehine ($p=0,035$) olduğu belirlenmiştir. Üniversite ve lise mezunu baba eğitimine göre yapılan karşılaştırmada anlamlı farklılık bulunmamıştır.

Ortaokul öğrencilerinin öz düzenlemeli öğrenmeleri aylık gelir durumuna göre değerlendirilmesiyle elde edilen bulgular Tablo 6'da verilmiştir.

Tablo 6. *Aylık Gelir Değişkenine Göre Öz Düzenlemeli Öğrenme Bulguları*

Aylık Gelir	N	Ortalama	Standart Sapma	F	p
Düşük	16	2,95	,431	1,593	,207
Orta	113	3,07	,422		
Yüksek	33	2,95	,373		

Ortaokul öğrencilerinin aylık gelir durumuna göre öz düzenlemeli öğrenmeleri karşılaştırıldığında ortalamaların 2,95-3,07 arasında değiştiği ve aralarında anlamlı farkın olmadığı Tablo 6'da görülmektedir.

Ortaokul öğrencilerinin karne notuna göre öz düzenlemeli öğrenmelerinin analiziyle elde edilen bulgular Tablo 7'de sunulmuştur.

Tablo 7. *Karne Notu Değişkenine Göre Öz Düzenlemeli Öğrenme Bulguları*

Karne Notu	N	Ortalama	Standart Sapma	F	p
0-44	7	3,29	,725	1,425	,244
45-69	54	3,02	,439		
70-100	101	3,02	,373		

Tablo 7 incelendiğinde, karne notuna göre öz düzenlemeli öğrenme puanlarının 3,02-3,29 arasında değiştiği görülmektedir. $P>0,05$ olduğu için karne notuna göre farklılaşma olmamıştır.

Ortaokul öğrencilerinin çalışma odasının varlık ya da yokluğuna göre öz düzenlemeli öğrenmeleri araştırılmış ve ulaşılan bulgular Tablo 8'de sunulmuştur.

Tablo 8. *Çalışma Odası Değişkenine Göre Öz Düzenlemeli Öğrenme Bulguları*

Çalışma Odası	N	Ortalama	Standart Sapma	t	p
Evet	61	3,05	,351	,411	,681
Hayır	101	3,02	,451		

Tablo 8'de görüldüğü gibi ortaokul öğrencilerinin çalışma odalarının durumuna göre öz düzenlemeli öğrenme puanlarının 3,05-3,02 olduğu ve aralarında anlamlı farklılık olmadığı ($p<0,05$) anlaşılmaktadır. Ortaokul öğrencilerinin günlük ders çalışma saati değişkenine göre öz düzenlemeli öğrenmelerinin analiz bulguları Tablo 9'da verilmiştir.

Tablo 9. *Günlük Ders Çalışma Saati Değişkenine Göre Öz Düzenlemeli Öğrenme Bulguları*

Günlük Ders Çalışma Süresi	N	Ortalama	Standart Sapma	F	p
1 saatten az	31	3,01	,567	,595	,619
1-2 saat	88	3,06	,391		
2-3 saat	22	2,93	,276		
3 saatten fazla	21	3,06	,380		

Tablo 9'a göre günlük ders çalışma saati değişkenine göre öz düzenlemeli öğrenme puanlarının 2,93-3,06 arasında değer aldığı ve aralarına anlamlı fark olmadığı ($p>0,05$) görülmektedir.

SONUÇ, TARTIŞMA VE ÖNERİLER

Son yüzyılda eğitimde içerikten ziyade içeriği öğrenebilmek için öğrencilerin tutum ve yetenek kazanmalarına daha çok önem verilmektedir. Öğrencilerin akademik başarılarının yükselmesi için öncelik kendilerini tanımaları ve yönetmeleridir (Thomas, 1993). Kendini yöneten birey öz düzenleyerek öğrenmeyi uygulamış olmaktadır. Dolayısıyla kendilerini bilinçli olarak değerlendirmiş olacaktır. Bu sebeplerden dolayı öz düzenleyerek öğrenmenin tercih edilmesi ve çoğunluğun benimsemesi gerekmektedir.

Bu araştırmada öz düzenlemeli öğrenmenin bazı değişkenler açısından farklılaşıp farklılaşmadığının tespit edilmesi amaçlanmıştır. Bulgular incelendiğinde ortaokul öğrencilerinin cinsiyet, sınıf seviyesi, aylık gelir durumu, karne notu, çalışma odası, günlük ders çalışma saati ve anne eğitim durumuna göre öz düzenlemeli öğrenmeleri incelenmiş ve anlamlı farklılık göstermediği saptanmıştır. Babanın eğitim durumuna bakıldığında ise anlamlı farklılık görülmüş, aralarında doğru orantı olduğu belirlenmiştir.

Ertürk Kara ve Gönen (2015) çalışmalarında cinsiyetin öz düzenleme becerileri açısından anlamlı farklılık olmadığını görmüşlerdir. Baysal ve Özgenel (2019) çalışmalarında ortaokul öğrencilerinin öz düzenleme ile öğrenmesinde cinsiyete göre anlamlı farklılık oluşmadığı görmüşlerdir. Dede, Keskin, Öztürk ve Keskin (2021) ortaokul öğrencileriyle yaptıkları çalışmada kız öğrencilerin öz düzenleme becerilerinin erkek öğrencilere göre daha yüksek olduğu gözlemlenmiştir. Gestsdóttir vd. (2014) araştırmalarında kendini düzenleme becerilerinin cinsiyete göre farklılığının kültürlere göre değişiklik sunduğunu bulmuşlardır. Wanless vd. (2013) 36-72 aylık çocuklarla yaptıkları araştırmada, Amerikalı kız çocuklarının öz düzenleme becerilerinin erkeklere göre yüksek olduğunu bulmuşlardır. Asyalı çocuklar incelendiğinde ise öz düzenleme becerilerinin cinsiyete göre farklılaşmadığını görmüşlerdir. Çalışmalara bakıldığında bu araştırmanın yapıldığı okulun demografik yapısı düşünülünce göçmen ailelerin çokluğu nedeniyle araştırmaya ırk değişkeninin entegre edilerek yapılması düşünülmüştür.

Dede, Keskin, Öztürk ve Keskin (2021) ortaokul öğrencileriyle yaptıkları analizler sonucunda öz düzenleme becerilerinin sınıf düzeyine göre farklılık göstermediği bulunmuştur. Ülker (2019) araştırma sonuçlarına bakıldığında sınıf düzeyi ve cinsiyet değişkenine göre bireylerin öz düzenlemelerinde farklılıklar belirlenmiştir. Alcı ve Altun (2007) araştırmalarında lise sınıf düzeyine göre öğrencilerin öz düzenleme becerilerinde anlamlı farklılıklar olduğunu ortaya koymuştur. Arslan vd. (2021) araştırmalarına bakıldığında okul öncesi dönem çocuklarının öz düzenleme becerilerinin cinsiyet, yaş, aile gelir düzeyine göre farklılaşabileceği belirlenmiştir. Kurtuluş ve Öztürk (2017) araştırmalarına göre ortaokul öğrencilerinin üstbilişsel farkındalık düzeyinin cinsiyete, sınıf düzeyine ve karne notuna göre anlamlı farklılaşma olduğu sonucuna varılmıştır. Karne notu yüksek olan öğrencilerin öz düzenleme becerilerinin de yüksek olduğu yorumlanmıştır. Gelir düzeyi ile öz düzenleme arasındaki ilişkiyi araştıran çalışmalara bakıldığında okul öncesi çocuklar üzerinde fazlaca yapıldığı görülmüştür. Bu sebeple ortaokul, lise ve üniversite öğrencileri ile de bu çalışmalar daha fazla yapılabilir. Cebesoy (2013) yaptığı araştırmada çalışma ortamı ile öz düzenleme arasında anlamlı bir ilişki bulamamıştır. Araştırmalara bakıldığında çalışma odası olup olmamasından ziyade genelde çalışma ortamını düzenleyip düzenlememesi ile öz düzenleme becerisi arasında yapılmıştır.

Çilmen (2022) çalışmasında okul öncesi çocuklarının öz düzenleme becerilerinin, babalarının öğrenim durumuna, çocuklarına ayırdıkları zamana ve aylık hane gelirine göre farklılaştığı saptamıştır. Özbey, Mercan ve Alisinanoğlu (2018) araştırmalarının sonucunda çocukların öz düzenleme becerileri ile anne-baba öğrenim durumu anlamlı farklılık göstermekte, cinsiyet değişkenine göre anlamlı bir farklılık göstermemektedir. Saraç, Abanoz ve Ogelman (2021) çalışmalarında öz düzenleme becerileri ile anna-baba eğitim durumunun doğru orantılı farklılık gösterdiğini bulmuşlardır. Koç ve Arslan (2016) yaptıkları çalışmada ortaokul öğrencilerinin biliş üstü farkındalıkları anne-baba eğitim durumlarına göre anlamlı farklılık göstermediğini bulmuşlardır.

Araştırmanın bulguları ve ilgili çalışmalar incelendiğinde, Türkiye'de ortaokul dönemi çocuklarının öz düzenleme becerilerine ilişkin çalışmalar arttırılmalıdır. Bu sayede öz düzenlemeye etki eden değişkenler çok yönlü olarak incelenebilecektir. Farklılaşma sadece baba eğitim durumu için ortaya çıksa da kurumun demografik yapısı düşünülerek iki ebeveynin de eğitim düzeylerinin arttırılması, çocukların tüm gelişim alanlarını destekleyecektir. Genelde anne-baba eğitim durumu ile öğrenci başarısı arasındaki ilişki incelenmiştir. Daha derine inerek öğrencinin başarısının sebebinin öz

düzenlemeleri ile ilgisi araştırılabilir. Bireyler öz düzenlemenin ne anlama geldiğini bilmiyor olabilir veya bunu nasıl uygulaması gerektiğini bilmiyor olabilirler. Bununla birlikte okullarda psikolojik danışmanlık ve rehberlik öğretmenleri başta olmak üzere, anne-babalara düzenli olarak çocukların öz düzenleme becerilerini desteklemek ile ilgili eğitimler verilmelidir. Bunlar yapılırken aynı zamanda çocuklar yıllar boyunca incelenerek gelişimlerine bakılabilir. Sadece ailelerin değil öğretmenlerin de desteğe ihtiyaçları olduğu düşünülebilir. Öğrencileri öz düzenleme becerilerini geliştirmeleri konusunda eğitim alan öğretmenler de destek olduğunda gelişim daha hızlı ilerleyebilir. Hem öğretmenler hem de öğrenciler mentörlük sistemi ile desteklenebilir. Sadece baba eğitim düzeyi ile öz düzenleme becerisinin farklılaşması sosyolojik olarak da patriyarkal bir sebebinin olup olmadığı incelenmesi gereken bir başka araştırma konusu olabilir.

Öz düzenlemeli öğrenme becerilerinin kazandırılması için anne, baba, öğretmen, öğrenci işbirliği içerisinde olmalı, zaman zaman toplantılar ve değerlendirmeler yapılarak becerinin gelişimi incelenebilir.

KAYNAKÇA

1. Alcı, B., & Altun, S. (2007). Lise öğrencilerinin matematik dersine yönelik öz düzenleme ve biliş üstü becerileri, cinsiyete, sınıfa ve alanlara göre farklılaşmakta mıdır?. *Çukurova Üniversitesi Sosyal Bilimler Enstitüsü Dergisi*, 16(1), 33-44.
2. Altun, S. (2005). Öğrencilerin öz düzenlemeye dayalı öğrenme stratejilerinin ve öz yeterlik algılarının öğrenme stilleri ve cinsiyete göre matematik başarısını yordamada gücü. Yayınlanmamış doktora tezi, Yıldız Teknik Üniversitesi, İstanbul.
3. Aran, Ö. C. (2015). Öz düzenleme ve çalışma becerileri arasındaki ilişki. *Pegem Eğitim ve Öğretim Dergisi*, 5(2), 207-220.
4. Arslan, Ö., Çavunt, F., Çoban, A., Dinç, E., et al. (2021). Okul öncesi dönem çocuklarının öz düzenleme becerilerinin incelenmesi. *International Primary Education Research Journal*, 5(2), 180-199.
5. Baysal, A., & Özgenel, M. (2019). Ortaokul öğrencilerinin bağlanma stilleri ve öz-düzenleme düzeyleri arasındaki ilişkinin incelenmesi. *Eğitimde Kuram ve Uygulama*, 15(2), 142-152. <https://doi.org/10.17244/eku.507650>
6. Bishop, J. L., & Verleger, M. A. (2013). The flipped classroom: A Survey of the Research. 120th ASEE Annual Conference & Exposition (pp. 1-18). Atlanta, GA
7. Büyüköztürk, Ş., Akgün, Ö. E., Karadeniz, Ş., Demirel, F. ve Kılıç, E. (2013). *Bilimsel araştırma yöntemleri*. Ankara: Pegem Akademi
8. Bronson, M.B. (2000). *Self-Regulation in Early Childhood: Nature and Nurture*.
9. Cebesoy, Ü. B. (2013). Pre-Service Science teachers' perceptions of self-regulated learning in physics. *Turkish Journal of Education*, (2)1, 4-18.
10. Corno, L. (1986). The metacognitive control components of self-regulated learning. *Contemporary Educational Psychology*, 11, 333-346.
11. Corno, L. (1989). Self-regulated learning: A volitional analysis. In B. J. Zimmerman ve D. H. Schunk (Eds.), *Self-Regulated Learning and Academic Achievement* (p.111-142). New York, USA: Springer-Verlag.
12. Çilmen, S. (2022). Okul öncesi çocuklarının babalarının otantiklik düzeyleri ile çocuklarının öz düzenleme becerileri arasındaki ilişki. Hasan Kalyoncu Üniversitesi Lisansüstü Eğitim Enstitüsü, Temel Eğitim Ana Bilim Dalı Yüksek Lisans Tezi.
13. Dede, N., Keskin, A., Öztürk, E., & Gülcan Keskin, M. (2021). Covid-19 Süreci ile başlayan uzaktan eğitimde ortaokul öğrencilerinin öz düzenleme ve derse katılım ilişkisinin incelenmesi. *Dicle Üniversitesi Ziya Gökalp Eğitim Fakültesi Dergisi* (39), 126-134.
14. Dembo, M. H. & Eaton, M. J. (2000). Self-regulation of academic learning in middle-level schools. *The Elementary School Journal*, 100, 473-490.
15. Eisenberg, N., Smith, C.L. & Spinrad, T.L. (2011). Effortful control: relations with emotion regulation, adjustment, and socialization in Childhood. Baumeister R. F. & Vohs K.D. (Ed.), *Handbook of self-regulation: Research, theory, and applications* (s. 259-282). New York: Guilford Press

16. Ertürk Kara, G. & Gönen, M. (2015). Okul öncesi dönemdeki çocukların öz düzenleme becerisinin çeşitli değişkenler açısından incelenmesi. *Eğitimde Kuram ve Uygulama Journal of Theory and Practice in Education*. 11 (4), 1207-1223.
17. Eryılmaz, A., & Mammadov, M. (2017). Zimmerman'ın modeli temelinde öz düzenlemeli öğrenme ölçeğinin geliştirilmesi. *Uluslararası Eğitim Bilimleri Dergisi*, 1(10), 79-93.
18. Fındık Tanrıbuyurdu, E. (2012). Okul Öncesi öz düzenleme ölçeği geçerlik ve güvenilirlik çalışması. Yüksek Lisans Tezi, Hacettepe Üniversitesi, Sosyal Bilimler Enstitüsü, Ankara.
19. Fox, E. & Riconscente, M. (2008). Metacognition and self-regulation in James, Piaget and Vygotsky. *Education Psychology Review*, 20, 373-389.
20. Fuchs, L. S., Fuchs, D., Karin, P. & Burch, M. (2003). Enhancing Third-Grade Students' Mathematical Problem Solving With Self-Regulated Learning Strategies. [Abstract] *Journal of Educational Psychology*, 95(2), 306-315.
21. Gestsdóttir, S., Von Suchodoletz, A., Wanless, S. B., Hubert, B., Guimard, P., Birgisdóttir, & F., McClelland, M. M. (2014). Early behavioral self-regulation, academic achievement, and gender: Longitudinal findings from Germany, France, and Iceland. *Applied Developmental Science*, 18(2), 90-109. doi:10.1080/10888691.2014.894870.
22. Kuzu, İ. Y., & Yavuz, F. S. (2021). Öz düzenleme becerileri üzerine yapılmış lisansüstü çalışmaların bibliyografik olarak incelenmesi. *Trakya Eğitim Dergisi*, 11(3), 1471-1483.
23. Koç, C., & Arslan, A. (2016). Ortaokul öğrencilerinin başarı yönelimlerinin ve okuma stratejileri bilişüstü farkındalıklarının incelenmesi. *Pegem Eğitim ve Öğretim Dergisi*, 5(5), 485-508.
24. Koçyiğit, M. (2019). *Sınıf Yönetimi*. Eğitim Yayınevi.
25. Kurtuluş, A., & Öztürk, B. (2017). Ortaokul öğrencilerinin üstbilişsel farkındalık düzeyi ile matematik öz yeterlik algısının matematik başarısına etkisi. *Dicle Üniversitesi Ziya Gökalp Eğitim Fakültesi Dergisi*(31), 762-778. <https://doi.org/10.14582/DUZGEF.1840>
26. Magdalena, S.M. (2014). The effects of parental influences and school readiness of the child. *Procedia - Social and Behavioral Sciences*, 127, 733-737
27. MEB. (2024). *Türkiye Yüzyılı Maarif Modeli*, Öğretim Programları Ortak Metni.
28. Montroy, J.J., Bowles, P.P., Skibbe, L.L., & Foster, T.D. (2014). Social skills and problem behaviors as mediators of the relationship between behavioral self-regulation and academic achievement. *Early Childhood Research Quarterly*, 29, 298-309.
29. Özbey, S., Mercan, M., & Alisinanoğlu, F. (2018). Okul öncesi eğitim kurumlarına devam eden 48-72 aylık çocukların yaşam kalitesi ile öz düzenleme becerileri arasındaki ilişkinin incelenmesi. *Eğitim ve Toplum Araştırmaları Dergisi*, 5(2), 157-173.
30. Özmen, H., & Karamustafaoğlu, O. (2019). *Eğitimde araştırma yöntemleri*. Ankara: Pegem Akademi.
31. Özturan Sağırlı, M., Çiltaş, A., Azapağası, E., & Zehir, K. (2010). Yüksek öğretimin öz-düzenlemeyi öğrenme becerilerine etkisi (Atatürk üniversitesi örneği). *Kastamonu Eğitim Dergisi*, 18(2), 587-596.
32. Pintrich, P. R. & De Groot, E. (1990). Motivational and self-regulated learning components of classroom academic performance. *Journal of Educational Psychology*, 82(1), 33-40.
33. Robinson, K., & Aronica L. (2018). *Öz: Eğitimde ve Hayatta Tutku Yaratmak* (D. Boyraz, çev.). Viking (2009).
34. Saraç, S., Abanoz, T., & Gülay Ogelman, H. (2021). Okul öncesi dönem çocuklarının öz düzenleme becerilerinin bazı demografik değişkenler açısından incelenmesi. *Gelişim Ve Psikoloji Dergisi*, 2(3), 1-11. <https://doi.org/10.51503/gpd.847786>
35. Smith Donald, R., Raver, C.C., Hayes, T., & Richardson, B. (2007). Preliminary construct and concurrent validity of preschool self-regulation assessment (PSRA) for field-based research. *Early Childhood Research Quarterly*, 22, 173-187.
36. Ülker, M. (2019). Öz düzenleme ve yansıtıcı düşünmenin matematik başarısına etkisinin incelenmesi. Yayınlanmamış yüksek lisans tezi. Balıkesir Üniversitesi Fen Bilimleri Enstitüsü,
37. Wanless S. B., McClelland M. M., Lan X., Son S. H., Cameron C. E., Morrison F. J., et al. (2013). Gender differences in behavioral regulation in four societies: The United States, Taiwan, South Korea, and China. *Early Childh. Res. Q.* 28, 621-633.
38. Williams, M. (2008). *Components of self regulated learning in high school students with learning disabilities*. Unpublished Doctoral Dissertation. Indiana University of Pennsylvania. UMI. 3315388.

39. Winne, P. H. (2001). Self-Regulated Learning Viewed From Models of Information Processing. In B. J. Zimmerman & D. H. Schunk (Ed.), *Self Regulated Learning and Academic Achievement. Theoretical Perspectives* (153-189). Mahwah, NJ: Lawrence Erlbaum Associates.
40. Yumusak, N., Sungur, S. & Cakiroglu, J. (2007). Turkish high school students' biology achievement in relation to academic self-regulation. *Educational Research and Evaluation*, 13(1), 53 – 69.
41. Zimmerman, B. J. (2000a). Attaining self-regulation: a social cognitive perspective. In M. Boekaerts, P. Pintrich, & M. Zeidner (Eds.), *Self-Regulation: Theory, Research, and Applications* (13-39). San Diego, CA: Academic Press.
42. Zimmerman, B. J. (2001). Theories of self-regulated learning and academic achievement: an overview and analysis. In B. J. Zimmerman, & D. H. Schunk (Eds.), *Self-regulated learning and academic achievement: theoretical perspectives* (2nd ed.) (pp. 1–38). Mahwah, NJ: Erlbaum.
43. Zimmerman, B. J. (2002). Achieving self-regulation: The trial and triumph of adolescence. *Academic motivation of adolescents*, 2, 1–27.
44. Zimmerman, B. J. & Martinez-Pons, M. (1986). Development of a structured interview for assessing student use of self-regulated learning strategies. *American Educational Research Journal*, 23, 614.

GELATİN EXTRACTİON FROM FİSH SCALES: THE İNFLUENCE OF EXTRACTİON TEMPERATURE ON GELATİN YİELD AND SOME PROPERTİES

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Özet

Balık işleme atıkları; endüstriyel açıdan önemli ürünler için ham madde olarak değerlendirilmektedir. Bu atıklar jelatinin hammaddesi olan kolajence zengin, deri, pul ve kemik gibi dokulardan oluşmakta ki bunlar balık işleme atıklarının %30'unu oluşturmaktadır. Genellikle kullanılamaz bir atık olarak kabul edilen balık pulu ise, yüksek oranda tip I kolajen proteini içeriği dikkat çekicidir. Bu çalışmada, sazan balığı (*Carasobarbus luteus*) pullarından üç farklı sıcaklıkta jelatin ekstraksiyonu yapılmış, elde edilen jelatin ekstraktları ve toz jelatinlerin bazı özellikleri araştırılmıştır. Ön işlemler ile yapısındaki kolajen izole edildikten sonra pullardan 45, 55 ve 65°C de sıcak su ekstraksiyonu ile jelatin ekstraktları elde edilmiştir. Farklı sıcaklıklarda elde edilen jelatin ekstraktlarının protein miktarı, protein geri dönüşüm oranları, geçirgenlik, iletkenlik ve pH değerleri tespit edilmiştir. Ayrıca farklı sıcaklıklarda elde edilen ekstraktlar kurutulduktan sonra toz jelatinlerin verim, biyokimyasal kompozisyonları ve viskozite değerleri ele alınmıştır. Elde edilen jelatin ekstraktlarının protein miktarları sıcaklığa bağlı olarak artış göstermiş ve 45, 55 ve 65°C için sırasıyla 0.51, 0.91 ve 1.07 mg/mL olarak ölçülmüştür. Balık pulunda var olan proteinin 45, 55 ve 65°C'lerdeki ekstraksiyonlar ile geri kazanım oranları sırasıyla, %27.64, 49.32 ve 57.88 olarak gerçekleşmiştir. Ayrıca ekstraktlarda geçirgenlik değerleri ekstraksiyon sıcaklığı arttıkça %87.02'den %70.60'a kadar azalma tespit edilirken, iletkenlik değerlerinde ise 1055'ten 1660 µS/cm kadar arttığı gözlemlenmiştir. Toz jelatin örneklerinde en yüksek jelatin verimi %30.05 ile 60°C de yapılan ekstraksiyondan elde edilmiştir. Buna karşın yüksek ekstraksiyon sıcaklığı toz jelatinlerin viskozite özelliği üzerinde olumsuz bir etki yaratmış ve 45, 55 ve 65°C'lerdeki ekstraksiyonlar için 4.01, 3.66 ve 3.14 cP viskozite değerleri gözlemlenmiştir. Toz jelatinlerin biyokimyasal kompozisyonunda en yüksek protein oranı %87 ile 45°C'deki örnekte tespit edilirken buna karşın 65°C'deki jelatin örneği en yüksek mineral madde oranına (%9.19) sahip olmuştur. Çalışmanın sonuçları, sazan balığı pullarının jelatin elde edilmesinde potansiyel bir kaynak olarak değerlendirilebileceğini ve diğer ekstraksiyon koşullarının araştırılması gerektiğini göstermiştir.

Anahtar Kelimeler: Balık pulu, Jelatin, Ekstraksiyon sıcaklığı, Jelatin verimi, Protein geri kazanımı.

Abstract

Fish processing residues are evaluated as raw materials for products of industrial importance. These wastes consist of collagen-rich tissues such as skin, scales, and bones, which are the raw materials for gelatin production and constitute 30% of the fish processing waste. Fish scales, typically regarded as unusable waste, are notable for their high content of type I collagen protein. In this study, gelatin extraction was performed from the scales of carp (*Carasobarbus luteus*) at three different temperatures, and some properties of the obtained gelatin extracts and powdered gelatins were investigated. After isolating the collagen from the scales through pretreatment processes, gelatin extracts were obtained via hot water extraction at 45, 55, and 65°C. The protein content, protein recovery rates, transparency, conductivity, and pH values of the gelatin extracts obtained at different temperatures were determined. Additionally, after drying the extracts obtained at different temperatures, the yield, biochemical composition, and viscosity values of the powdered gelatins were examined. Protein content of the obtained gelatin extracts increased with temperature and was measured as 0.51, 0.91, and 1.07 mg/mL for 45, 55, and 65°C, respectively. Protein recovery rates from the fish scales with extraction at 45, 55, and 65°C were 27.64%, 49.32%, and 57.88%, respectively. Additionally, permeability values in the extracts decreased from 87.02% to 70.60% with increasing extraction temperature, while conductivity values were observed to increase from 1055 to 1660 µS/cm. The highest gelatin yield of 30.05% in the

powdered gelatin samples was obtained from the extraction performed at 60°C. However, high extraction temperatures had a negative effect on the viscosity of the powdered gelatins, with viscosity values observed as 4.01, 3.66, and 3.14 cP for extractions at 45, 55, and 65°C, respectively. In the biochemical composition of the powdered gelatins, the highest protein content was observed as 87% in the sample extracted at 45°C, while the gelatin sample extracted at 65°C exhibited the highest mineral content at 9.19%. The results of the study indicate that carp scales could be considered a potential resource for gelatin production and suggest that further investigation into other extraction conditions is necessary.

Keywords: Fish scales, Gelatin, Extraction temperature, Gelatin yield, Protein recovery.

GİRİŞ

Jelatin, kolajenin kontrollü ve kısmi hidrolizi ile üretilen makromolekülerden oluşan, biyolojik olarak parçalanabilir hayvansal bir proteindir. Üretiminde; deri, kemik ve pul gibi kolajence zengin hayvansal bağ dokuların kullanıldığı jelatin, farklı oranlarda ve kombinasyonlarda amino asit kalıntılarında ileri gelmektedir (Cansu, 2024a). Jelatin daha çok sığır ve domuz derisinden üretilirken, son yıllardaki artan talep sonucu alternatif kaynaklara yönelmeye yol açmıştır (Jaziri vd., 2022). Alternatif kaynaklar arasında ön planda olan gruplar arasından ise balık işleme endüstrisinin yan ürünleri gelmektedir. Öyle ki balık işleme atıkları deri, pul ve kemiklerden ileri gelmekle birlikte bu atıklar toplam atıkların yaklaşık %30'nu oluşturmaktadır (Yang ve ark., 2022). Balık atıkları ve özellikle pullarının dünya çapındaki üretimi ve işlenmesinden açığa çıkan miktar giderek artan büyüklükte ciddi bir sorun oluşturmaktadır. Söz konusu atıklar başta çevresel sorunlara ve ekonomik kayıplara yol açmaktadır. Balık pullarının biyopolimerler gibi yenilenebilir ürünler için hammadde olarak kullanımı ile bu sorunların ortadan kaldırılması muhtemeldir.

Kolajenin jelatine dönüşüm oranı, işleme parametrelerine (sıcaklık, zaman ve pH), hammaddenin özelliklerine ve ön işleme bağlıdır. Bunun yanında hayvansal dokulardan izole edilen jelatinin verimi ve kalitesi; temizleme gibi ön işlemler, sıcaklık ve süre gibi ekstraksiyon koşullarına ve kurutma şekline bağlı olarak değişiklik göstermektedir. Jelatin üretiminde en önemli aşama olan ekstraksiyon aşaması, genellikle konveksiyonel sıcak su ile gerçekleştirilmektedir. Aynı zamanda ekstraksiyon sıcaklığı, jelatin üretim sürecindeki temel kontrol faktörlerinden biridir (Sha ve ark., 2019). Öte yandan, jelatinin ortalama molekül ağırlığının, ki özellikle kalitesini etkilemektedir, ekstraksiyon sıcaklığı ve ekstraksiyon süresi gibi ekstraksiyon koşullarından önemli ölçüde etkilendiği bildirilmiştir (Huang ve ark., 2017; Sinthusamran ve ark., 2018). Genel anlamda yüksek ekstraksiyon sıcaklığı jelatin verimini artırırken, jel özelliklerini ve molekül ağırlığının olumsuz etkilediği bildirilmiştir (Huang ve ark., 2017). Yapılan literatür araştırmasında balık pulundan jelatin ekstraksiyonu işleminde, farklı sıcaklıkların etkileri sınırlı bir şekilde incelendiği görülmektedir. Bu yüzden bu çalışmada; farklı ekstraksiyon sıcaklığının balık pulundan jelatin eldesi aşamasında özellikle elde edilen jelatin ekstraktlarının üzerindeki fiziksel etkisi incelenmiştir. Ayrıca balık pulundan jelatin ekstraksiyonunda farklı ekstraksiyon sıcaklıklarının jelatin verimi ve protein geri kazanım oranlarının yanında elde edilen toz jelatinlerin biyokimyasal kompozisyonları üzerindeki etkisi de ele alınmıştır.

MATERİYAL VE METOD

Materyal

Jelatin üretiminde kullanılan Sazan (*Carasobarbus luteus*) pulları Şanlıurfa'daki yerel marketlerden temin edilen Sazan derisinden ayrıştırılıp kullanılmıştır.

Metot

Ön işlemler ve jelatin ekstraksiyonu

Sazan pullarının jelatin ekstraksiyonu öncesi ön işlemleri Cansu (2024a)'tarafından belirtilen yöntem ile gerçekleştirilmiştir.

Balık pulundan jelatin ekstraksiyonu, farklı ekstraksiyon sıcaklığının etkisinin tespiti için 45, 55 ve 65°C'lerde sıcak su banyosu ile gerçekleştirilmiştir. Ekstraksiyon işlemi için 10 g pul 1/20 oranında saf su ile karıştırılarak su banyosu yardımıyla 4 saatte ve belirlenen farklı sıcaklıklarda gerçekleştirilmiştir (Huang ve ark., 2017). Elde edilen ekstraktlardan 20 mL ayrılmış ve geriye kalanlar 40°C'de etüv yardımıyla kurutulup toz haline getirilmiştir.

Jelatin verimi ve protein geri kazanım oranları

Farklı ekstraksiyon sıcaklıklarında gerçekleştirilen ve elde edilen ekstraktlarda protein analizi Biüret metoduna göre yapılmıştır. Elde edilen protein miktarı verilerine göre protein geri kazanım oranı Denklem 1'e göre, kuru jelatin verimi ise Denklem 2'ye göre hesaplanmıştır (Cansu, 2023).

$$Jelatin\ verimi\ (\%) = \frac{Jelatin\ ağırlığı(g)}{Kuru\ deri\ ağırlığı(g)} \times 100 \quad (1)$$

$$Protein\ geri\ kazanımı = \frac{Özütlenen\ protein\ miktarı\ (g)}{Kuru\ derideki\ protein\ miktarı\ (g)} \times 100 \quad (2)$$

Ekstraksiyon çözeltilerinin fiziksel özellikleri

Jelatin ekstraktların pH ve iletkenliği bir multimetre, Hanna, HI-2020 (Hanna instruments, Leighton Buzzard, İngiltere) yardımıyla belirlendi. Jelatin ekstraktlarının geçirgenlikleri Cho ve ark. (2004) tarafından belirtilen yöntemle tespit edilmiştir.

Toz jelatinlerin biyokimyasal kompozisyonları

Farklı ekstraksiyon sıcaklıklarında elde edilen ve kurutulan toz jelatin örneklerinin ham protein, nem, mineral madde oranları AOAC (1990) tarafından açıklanan yöntemlere göre tespit edilmiştir.

Toz jelatinlerin viskozite değeri

Farklı ekstraksiyon sıcaklığında elde edilen balık pulu jelatinlerinin viskozitesi GMIA (2019) tarafından belirtilen yöntemle göre belirlenmiştir.

SONUÇ VE TARTIŞMA**Jelatin verimi ve protein geri kazanımı**

Balık pulundan yapılan ekstraksiyon işlemi sonunda elde edilen ekstraktlara ait protein miktarı, protein geri kazanımı ve jelatin verimi Tablo 1'de verilmiştir. Elde edilen sonuçlarda ekstraksiyon sıcaklığının artmasıyla ekstraktlara geçen protein miktarının arttığı tespit edilmiştir. Daha yüksek üretim verimleri, daha yüksek sıcaklıklarda ve daha uzun ekstraksiyon süresinden kaynaklandığı bildirilmiştir (Peng ve ark., 2022). Dolayısıyla balık pulundaki jelatinin protein geri kazanım oranları da ekstraktlardaki protein miktarıyla beraber artmıştır. En yüksek protein geri kazanım oranı balık pulu için uygulanan en yüksek ekstraksiyon sıcaklığında (65°C) tespit edilmiştir.

Tablo 1. Farklı ekstraksiyon sıcaklığının balık pulu jelatin ekstraksiyonuna ait verim değerleri

Ekstraksiyon sıcaklığı (°C)	Protein miktarı (mg/mL)	Protein geri kazanımı (%)	Jelatin verimi (%)
45°C	0.51±0.00	27.64±0.12	15.85±0.08
55°C	0.91±0.01	49.32±0.58	26.05±0.80
65°C	1.07±0.02	57.88±1.15	30.05±0.40

Ekstraktların kurutulması ile elde edilen toz jelatinlerin verim değeri 45, 55 ve 65°C için sırasıyla 15.85, 26.05 ve 30.05 olarak gerçekleşmiştir (Tablo 1). Tu ve ark. (2015) yaptıkları çalışmada büyük başlı sazan (*Hypophthalmichthys nobilis*) pullarından 60°C ve 3 saatte % 46.67 oranında verim elde ettiklerini bildirmiştir. Ayrıca sıcaklıkla beraber artan verim değerleri, yüksek sıcaklığın doğrudan kolajen yapılarını ve α -zincirlerinin peptit bağlarını bozmak için daha fazla enerji sağlamak ve bu da kolajenden jelatine geçişin daha fazla olmasını sağlamaktadır (Tu ve ark., 2015).

Jelatin ekstraktlarının fiziksel özellikleri

Farklı ekstraksiyon sıcaklıklarının balık pulu jelatin ekstraktları üzerindeki etkisinin tespiti için yapılan analizlerin sonucu Tablo 2'de verilmiştir. Elde edilen sonuçlarda geçirgenlik değerlerinin ekstraksiyon sıcaklığıyla azaldığı ve en düşük değer (%70.60) 65°C'deki ekstraksiyonda olduğu tespit edilmiştir. Bu durum muhtemelen artan ekstraksiyon sıcaklığı ile beraber balık pulundan protein ve protein olmayan safsızlıkların geçişinin artmasıyla ilişkilendirilebilir.

Tablo 2. Farklı ekstraksiyon sıcaklığının balık pulu jelatin ekstraktlarına ait özellikler

Ekstraksiyon sıcaklığı (°C)	Geçirgenlik (%)	pH	İletkenlik (μS/cm)
45°C	87.02±0.74	3.43±0.04	1055±7
55°C	74.06±0.65	4.36±0.06	1312±4
65°C	70.60±0.85	4.66±0.08	1660±14

İletkenlik değerleri sonucu göz önünde bulundurulduğunda ise yine artan ekstraksiyon sıcaklığı ile beraber iletkenlik değerinin arttığı tespit edilmiştir. Bu durum jelatin gibi proteinlerin çözeltilerinde hem jelatin parçaları hem de serbest iyonların etkisiyle oluşmaktadır (Cansu, 2024b). Ayrıca biyokimyasal kompozisyon sonuçları da bunu desteklemektedir ki en yüksek mineral madde oranı 65°C'deki ekstraksiyon sonucu elde edilen jelatin örneğinde tespit edilmişti (Tablo 3). Ekstraktların pH değerleri ise 45, 55 ve 65°C dereceleri için sırasıyla 3.43, 4.36 ve 4.66 olarak tespit edilmiştir.

Biyokimyasal kompozisyon

Farklı sıcaklıkların toz balık pulu jelatinlerinin biyokimyasal kompozisyonlarına etkisi Tablo 3'te gösterilmiştir. Elde edilen sonuçlarda artan ekstraksiyon sıcaklığının protein oranını düşürdüğü ve buna karşın mineral madde oranını artırdığı tespit edilmiştir. Sıcaklık artışı ile balık pulunda bulunan özellikler mineral maddenin geçişini artırarak toz jelatin kitlesindeki toplam protein değerinin düşmesine neden olmuştur. Ayrıca kertenkele balığı pullarından elde edilen jelatinin protein (%86,9) ve kül içeriği (%2,33) içeriği 45°C'de elde edilen sazan balığı pulu jelatin değerleri ile örtüşmektedir (Wangtueai ve ark., 2009).

Tablo 3. Farklı sıcaklıklarda elde edilen toz jelatin biyokimyasal kompozisyonu ve viskozite değerleri

Ekstraksiyon sıcaklığı (°C)	Ham protein (%)	Mineral madde (%)	Nem (%)	Viskozite (cP)
45°C	87.00±2.12	2.32±0.12	7.51±0.20	4.01±0.08
55°C	83.25±1.06	5.02±0.63	6.60±0.27	3.66±0.03
65°C	80.25±1.00	9.19±0.23	6.80±0.41	3.14±0.09

Toz jelatin örneklerine ait viskozite değerleri sonuçlarına göre artan ekstraksiyon sıcaklığı viskozite değerlerinde düşüşe neden olmuştur (Tablo 3). Bu durum muhtemelen kolajenin jelatine dönüşümünde protein zincirlerinin aşırı parçalanması ile ortaya çıkan düşük moleküllü jelatin parçalarının sayısından kaynaklanmaktadır. Bunun yanında elde edilen jelatinlerdeki toplam protein oranı da viskoziteyi etkilemiş olabilir. Ayrıca, Wangtueai ve ark. (2009) yüksek ekstraksiyon sıcaklığı ve süresinin viskozite değerini düşürdüğünü belirtmiştir.

SONUÇ

Bu çalışmada elde edilen sonuçlar doğrultusunda sazan balığı pullarının jelatin ekstraksiyonu için bir alternatif kaynak olduğunu göstermektedir. Farklı ekstraksiyon sıcaklığının sazan balığı jelatini üzerinde etkiye sahip olduğu anlaşılmıştır. Artan sıcaklık değeri ile beraber verim değerleri artarken, ekstraktların geçirgenlik değerinin düştüğü tespit edilmiştir. Ayrıca yüksek ekstraksiyon sıcaklığının elde edilen toz jelatinlerin protein oranını düşürüp bunu yerine protein dışı safsızlıkların geçişini artırdığı tespit edilmiştir. Ancak sazan balığı pullundan jelatin ekstraksiyonunun daha kapsamlı bir şekilde ele alınarak diğer ekstraksiyon parametrelerinin etkileri incelenmelidir. Bu sayede sazan pullarından yüksek verim ve kalitede jelatin elde etmenin mümkün olacağı kanısına varılmıştır.

KAYNAKLAR

1. Cansu, Ü. (2023). Comparative evaluation of different separation and concentration procedures on some quality and functional properties of fish gelatin. *Innovative Food Science & Emerging Technologies*, 83, 103237.
2. Cansu, Ü. (2024a). Optimization of Collagen Isolation from Carp (*Carasobarbus luteus*) Scales using Response Surface Methodology. *Acta Aquatica Turcica*, 20(2), 140-150.
3. Cansu, Ü. (2024b). Utilization of Infrared Drying as Alternative to Spray-and Freeze-Drying for Low Energy Consumption in the Production of Powdered Gelatin. *Gels*, 10(8), 522.

4. Gelatin Manufacturers Institute of America. 2019. GMIA Standard Methods for the Testing of Edible Gelatin, New York, USA (pp. 13–15).
5. Huang, T., Tu, Z. C., Xinchun-Shangguan, Wang, H., Zhang, L., & Sha, X. M. (2017). Rheological and structural properties of fish scales gelatin: Effects of conventional and ultrasound-assisted extraction. *International journal of food properties*, 20(sup2), 1210-1220.
6. Jaziri, A. A., Shapawi, R., Mokhtar, R. A. M., Noordin, W. N. M., & Huda, N. (2022). Biochemical and microstructural properties of lizardfish (*Saurida tumbil*) scale collagen extracted with various organic acids. *Gels*, 8(5), 266.
7. Peng, J., Zi, Y., Xu, J., Zheng, Y., Huang, S., Hu, Y., ... & Zhong, J. (2022). Effect of extraction methods on the properties of tilapia scale gelatins. *International Journal of Biological Macromolecules*, 221, 1150-1160.
8. Sha, X. M., Hu, Z. Z., Ye, Y. H., Xu, H., & Tu, Z. C. (2019). Effect of extraction temperature on the gelling properties and identification of porcine gelatin. *Food Hydrocolloids*, 92, 163-172.
9. Sinthusamran, S., Benjakul, S., Hemar, Y., & Kishimura, H. (2018). Characteristics and properties of gelatin from seabass (*Lates calcarifer*) swim bladder: impact of extraction temperatures. *Waste and Biomass Valorization*, 9, 315-325.
10. Tu, Z. C., Huang, T., Wang, H., Sha, X. M., Shi, Y., Huang, X. Q., ... & Li, D. J. (2015). Physico-chemical properties of gelatin from bighead carp (*Hypophthalmichthys nobilis*) scales by ultrasound-assisted extraction. *Journal of food science and technology*, 52, 2166-2174.
11. Wangtueai, S., & Noomhorm, A. (2009). Processing optimization and characterization of gelatin from lizardfish (*Saurida* spp.) scales. *LWT-Food Science and Technology*, 42(4), 825-834.
12. Yang, H., Wang, H., Huang, M., Cao, G., Tao, F., Shen, Q., ... & Yang, H. (2022). Repurposing fish waste into gelatin as a potential alternative for mammalian sources: A review. *Comprehensive Reviews in Food Science and Food Safety*, 21(2), 942-963.

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İLGİLİ MAKAMA

12. Uluslararası Zeugma Bilimsel Araştırmalar Kongresi 2-4 Ekim 2024 tarihleri arasında Gaziantep, Türkiye’de (çevrimiçi olarak) 15 farklı ülkenin akademisyen/araştırmacılarının katılımıyla gerçekleşmiştir. Kongre 16 Ocak 2020 Akademik Teşvik Ödeneği Yönetmeliğine getirilen “Tebliğlerin sunulduğu yurt içinde veya yurt dışındaki etkinliğin uluslararası olarak nitelendirilebilmesi için Türkiye dışında en az beş farklı ülkeden sözlü tebliğ sunan konuşmacının katılım sağlaması ve tebliğlerin yarıdan fazlasının Türkiye dışından katılımcılar tarafından sunulması esastır.” değişikliğine uygun düzenlenmiştir.

Bilgilerinize arz edilir,
Saygılarımla

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