

**İstanbul Gelişim Üniversitesi
Sağlık Bilimleri Dergisi
(IGUSABDER)**

Sayı / Issue: 26

Yıl / Year: 2025

**Istanbul Gelisim University
Journal of Health Sciences
(IGUSABDER)**

ISSN: 2536-4499

e-ISSN: 2602-2605

© İstanbul Gelişim Üniversitesi Yayınları

© *Istanbul Gelisim University Press*

Sertifika No / Certificate Number: 47416

Her hakkı saklıdır. *All rights reserved.*

İstanbul Gelişim Üniversitesi kurumsal yayını olan Sağlık Bilimleri Dergisi, yılda üç kez yayımlanan uluslararası hakemli bir dergidir. Makalelerdeki görüş, düşünce, varsayım veya öneriler eser sahiplerine aittir; İstanbul Gelişim Üniversitesi sorumlu tutulamaz.

The Journal of Health Sciences is an international peer-reviewed journal and will be published three times a year. The opinions, thoughts, postulations or proposals within the articles are but reflections of the authors and do not, in any way, represent those of the Istanbul Gelisim University.

İLETİŞİM BİLGİLERİ / COMMUNICATION:

**İstanbul Gelişim Üniversitesi, Sağlık Bilimleri Fakültesi,
Cihangir Mah. Şehit Jandarma Komando Er Hakan Öner Sk.
No: 1, 34310 Avcılar / İstanbul / TÜRKİYE**

Tel: +90 212 4227000 Dahili 7333

Belgeç: +90 212 4227401

E-posta: igusabder@gelisim.edu.tr

**Ağ sayfası: <https://igusabder.gelisim.edu.tr>
<https://twitter.com/igusabder>**

Twitter: [@igusabder](https://twitter.com/igusabder)

Baskı ve cilt:
Printing and binding:

Servet İşler
Sertifika No. 40352
Tel: +90 212 5939467
E-posta: islercopy@hotmail.com

İSTANBUL GELİŞİM ÜNİVERSİTESİ SAĞLIK BİLİMLERİ DERGİSİ:
İNDEKSLENME VE HARMANLANMA BİLGİLERİ /
ISTANBUL GELİSİM UNIVERSITY JOURNAL OF HEALTH SCIENCES:
INFORMATION ABOUT INDEXING AND HARVESTING

DİZİNLENME / INDEXING

Dergimiz, TÜBİTAK ULAKBİM TR Dizin tarafından 2020 yılından bu yana dizinlenmektedir.



Dergimiz, Türkiye Atıf Dizini tarafından 2017 yılından bu yana dizinlenmektedir.



HARMANLANMA / HARVESTING

Dergimizin içeriği Dspace@Gelişim Kurumsal Açık Erişim Arşivi (<https://acikerisim.gelisim.edu.tr>) ve Avrupa Komisyonu'nun OpenAIRE 2020 Açık Erişim Projesi (The OpenAIRE2020 Project) (<https://www.openaire.eu/openaire2020-project>) tarafından harmanlanmaktadır.





İSTANBUL
GELİŞİM
ÜNİVERSİTESİ

İSTANBUL GELİŞİM ÜNİVERSİTESİ SAĞLIK BİLİMLERİ DERGİSİ (IGUSABDER)

Uluslararası Hakemli Dergi

Sayı 26 • Ağustos • 2025 • ISSN: 2536-4499 • e-ISSN: 2602-2605

İstanbul Gelişim Üniversitesi Adına Sahibi

Rektör Prof. Dr. Bahri ŞAHİN

Onursal Kurul

Dr. Öğr. Üyesi Necip Ozan TİRYAKİOĞLU

Yayın Kurulu

Prof. Dr. Hasan Hakan BOZKURT

Prof. Dr. Mahir GÜNDAY

Prof. Dr. Rifat MUTUŞ

Prof. Dr. S. Arda ÖZTÜRKCAN

Prof. Dr. Yakup Bilge SÜREL

Dr. Öğr. Üyesi Abdullah Yüksel BARUT

Editör

Dr. Öğr. Üyesi Abdullah Yüksel BARUT

Editör Yardımcıları

Prof. Dr. Rifat MUTUŞ,

Prof. Dr. S. Arda ÖZTÜRKCAN

Yazı İşleri Kurulu

Dr. Öğr. Üyesi Hande Nur ONUR ÖZTÜRK, Uzm. Ahmet Şenol ARMAĞAN,

Arş. Gör. Ebru DURUSOY

Türkçe Dil Editörleri

Dr. Öğr. Üyesi Beyza Aşlı BİLSEL

Arş. Gör. Ebru DURUSOY

Arş. Gör. Semanur OKTAY

İngilizce Dil Editörleri

Arş. Gör. Dr. Gizem UZLU DOLANBAY

Arş. Gör. Şebnem ÇELİK UÇURAN

Arş. Gör. Azize KÖSEOĞLU

Arş. Gör. Tuğba TÜRKCAN

Sorumlu Yazı İşleri Müdürü

Uzm. Ahmet Şenol ARMAĞAN

Kapak Tasarımı

Kübra ALBAYRAK

Servet İŞLER

İLETİŞİM:

İstanbul Gelişim Üniversitesi, Sağlık Bilimleri Fakültesi,
Cihangir Mah. Şehit Jandarma Komando Er Hakan Öner Sk. No: 1,

34310 Avcılar / İstanbul / TÜRKİYE

Tel: +90 212 4227000 Dahili: 7333

Belgeç: +90 212 4227401

E-posta: igusabder@gelisim.edu.tr

Ağ sayfası: <https://igusabder.gelisim.edu.tr>

Twitter: [@igusabder](https://twitter.com/igusabder)



ISTANBUL
GELISIM
UNIVERSITY

ISTANBUL GELISIM UNIVERSITY JOURNAL OF HEALTH SCIENCES (IGUSABDER)

International Peer–Reviewed Journal

Issue 26 • August • 2025 • ISSN: 2536-4499 • e-ISSN: 2602-2605

Owner on Behalf of Istanbul Gelisim University

Rector Prof. Dr. Bahri ŞAHİN

Honorary Board

Asst. Prof. Dr. Necip Ozan TİRYAKİOĞLU

Editorial Board

Prof. Dr. Hasan Hakan BOZKURT

Prof. Dr. Mahir GÜNDAY

Prof. Dr. Rifat MUTUŞ

Prof. Dr. S. Arda ÖZTÜRKCAN

Prof. Dr. Yakup Bilge SÜREL

Asst. Prof. Dr. Abdullah Yüksel BARUT

Editor

Asst. Prof. Dr. Abdullah Yüksel BARUT

Assistant Editors

Prof. Dr. Rifat MUTUŞ

Prof. Dr. S. Arda ÖZTÜRKCAN

Publication Board

Asst. Prof. Dr. Hande Nur ONUR ÖZTÜRK, Specialist Ahmet Şenol ARMAĞAN,

Res. Asst. Ebru DURUSOY

Turkish Language Editors

Asst. Prof. Dr. Beyza Aşlı BİLSEL

Res. Asst. Ebru DURUSOY

Res. Asst. Semanur OKTAY

English Language Editors

Res. Asst. Dr. Gizem UZLU DOLANBAY

Res. Asst. Şebnem ÇELİK UÇURAN

Res. Asst. Azize KÖSEOĞLU

Res. Asst. Tuğba TÜRKCAN

Director of Editorial Office

Specialist Ahmet Şenol ARMAĞAN

Cover Design

Kübra ALBAYRAK

Servet İŞLER

COMMUNICATION:

Istanbul Gelisim University, Faculty of Health Sciences,

Sehit Jandarma Komando Er Hakan Oner Sk. No: 1,

34310 Avcilar / Istanbul / TÜRKİYE

Phone: +90 212 4227000 Ext. 7333

Fax: +90 212 4227401

E-mail: igusabder@gelisim.edu.tr

Web page: <https://igusabder.gelisim.edu.tr>

Twitter: [@igusabder](https://twitter.com/igusabder)

BİLİMSEL DANIŞMA KURULU

Prof. Dr. Makbule Meziyet ARI - İstanbul Gelişim Üniv. - TÜRKİYE mmari@gelisim.edu.tr
Prof. Dr. Ali Rıza CENAL - İstanbul Gelişim Üniv. - TÜRKİYE arcenal@gelisim.edu.tr
Prof. Dr. Ahmet Tan CİMİLLİ - Sağlık Bilimleri Üniv. - TÜRKİYE ahmettan.cimilli@sbu.edu.tr
Prof. Dr. Anayit MARGİRİT COŞKUN - İstanbul Atlas Üniv. - TÜRKİYE coskunano@yahoo.com
Prof. Dr. İkbâl ÇAVDAR - İstanbul Atlas Üniv. - TÜRKİYE ikbal.cavdar@atlas.edu.tr
Prof. Dr. Fatma ÇELİK - Biruni Üniv. - TÜRKİYE fcelik@biruni.edu.tr
Prof. Dr. Ferda DOKUZTUĞ ÜÇSULAR - Rumeli Hisarı Akademi - TÜRKİYE ferda@rhakademi.com
Prof. Dr. Veli DUYAN - Ankara Üniv. - TÜRKİYE vduyan@health.ankara.edu.tr
Prof. Dr. Nefise Semra ERKAN - İstanbul Gelişim Üniv. - TÜRKİYE nserkan@gelisim.edu.tr
Prof. Dr. Metin ERGÜN - Ege Üniv. - TÜRKİYE metin.ergun@ege.edu.tr
Prof. Dr. Nuri Özgür KILIÇKESMEZ - Sağlık Bilimleri Üniv. - TÜRKİYE okilickesmez@yahoo.com
Prof. Dr. Gül KIZILTAN - Başkent Üniv. - TÜRKİYE gkizilta@baskent.edu.tr
Prof. Dr. Abdurrahim KOÇYİĞİT - Bezmialem Vakıf Üniv. - TÜRKİYE abdurrahimkocyigit@yahoo.com
Prof. Dr. Mehmet KUTLU - Hitit Üniv. - TÜRKİYE mehmetkutlu@hitit.edu.tr
Prof. Dr. Mustafa NİZAMLIOĞLU - İstanbul Gelişim Üniv. - TÜRKİYE mnizamlioglu@gelisim.edu.tr
Prof. Dr. Sıdika OĞUZ - Marmara Üniv. - TÜRKİYE soguz@marmara.edu.tr
Prof. Dr. Arif ÖNDER - İstanbul Gelişim Üniv. - TÜRKİYE aonder@gelisim.edu.tr
Prof. Dr. Levent ÖZTÜRK - Trakya Üniv. - TÜRKİYE leventozturk@trakya.edu.tr
Prof. Dr. G.C. PAPADOPOULOS - Selanik Aristoteles Üniv. - YUNANİSTAN gpapadop@vet.auth.gr
Prof. Dr. Hatice PEK - Haliç Üniv. - TÜRKİYE haticepek@halic.edu.tr
Prof. Dr. Ayla Güliden PEKCAN - Hasan Kalyoncu Üniv. - TÜRKİYE gulden.pekcan@hku.edu.tr
Prof. Dr. Helga REFSUM - Oslo Üniv. - NORVEÇ helga.refsum@medisin.uio.no
Prof. Dr. Osman SAĞDIÇ - Yıldız Teknik Üniv. - TÜRKİYE osagdic@yildiz.edu.tr
Prof. Dr. Daniel SERGELİDİS - Aristotle University of Thessalonik - YUNANİSTAN dsergkel@vet.auth.gr
Prof. Dr. Haydar SUR - Üsküdar Üniv. - TÜRKİYE haydar.sur@uskudar.edu.tr
Prof. Dr. Yakup Bilge SÜREL - TÜRKİYE
Prof. Dr. Mehveş TARIM - Marmara Üniv. - TÜRKİYE mtarim@marmara.edu.tr
Prof. Dr. Şaban TEKİN - Sağlık Bilimleri Üniv. - TÜRKİYE saban.tekin@sbu.edu.tr
Doç. Dr. Edibe EGİL - İstanbul Aydın Üniv. - TÜRKİYE edibeegil@aydin.edu.tr
Doç. Dr. Halime PULAT DEMİR - İstanbul Beykent Üniv. - TÜRKİYE halimededir@beykent.edu.tr
Doç. Dr. Hasan Basri SAVAŞ - Mardin Artuklu Üniv. - TÜRKİYE hasansavas@artuklu.edu.tr
Doç. Dr. Emel YURTSEVER - İstanbul Sabahattin Zaim Üniv. - TÜRKİYE emel.yesilkayali@izu.edu.tr
Dr. Öğr. Üyesi Bahar Nur AKDOĞAN - İstanbul Gelişim Üniv. - TÜRKİYE bnkanbur@gelisim.edu.tr
Dr. Öğr. Üyesi Hatice Merve BAYRAM - İstanbul Gelişim Üniv. - TÜRKİYE hmbayram@gelisim.edu.tr
Dr. Öğr. Üyesi Başak Gökçe ÇÖL - Dokuz Eylül Üniv. - TÜRKİYE basakgokce.col@deu.edu.tr
Dr. Öğr. Üyesi İsmail A. M. ELHATY - İstanbul Gelişim Üniv. - TÜRKİYE iaeismail@gelisim.edu.tr
Dr. Öğr. Üyesi Nurten ELKİN - İstanbul Gelişim Üniv. - TÜRKİYE nelkin@gelisim.edu.tr
Dr. Öğr. Üyesi Ebru KARPUZOĞLU - İstanbul Beykent Üniv. - TÜRKİYE ebrukarpuzoglu@beykent.edu.tr
Dr. Öğr. Üyesi Derya KAVGAOĞLU - İstanbul Gelişim Üniv. - TÜRKİYE dkavgaoglu@gelisim.edu.tr
Dr. Öğr. Üyesi Ashi KAYA - İstanbul Gelişim Üniv. - TÜRKİYE askaya@gelisim.edu.tr
Dr. Öğr. Üyesi Neşe KISKAÇ - İstanbul Gelişim Üniv. - TÜRKİYE nkiskac@gelisim.edu.tr
Dr. Öğr. Üyesi Fikri KÖKSAL - TÜRKİYE fkoksal@gelisim.edu.tr
Dr. Öğr. Üyesi Leena MAUNULA - Helsinki Üniv. - FİNLANDIYA Leena.Maunula@helsinki.fi
Dr. Öğr. Üyesi Nasır MUSTAFA - İstanbul Gelişim Üniv. - TÜRKİYE nmustafa@gelisim.edu.tr
Dr. Öğr. Üyesi Mahruk RASHİDİ - İstanbul Gelişim Üniv. - TÜRKİYE mrashidi@gelisim.edu.tr
Dr. Öğr. Üyesi Yonca SEVİM - Bahçeşehir Üniv. - TÜRKİYE yonca.sevim@hes.bau.edu.tr
Dr. Öğr. Üyesi Emrah TUNCER - İstanbul Gelişim Üniv. - TÜRKİYE etuncer@gelisim.edu.tr
Dr. Öğr. Üyesi Yonca Güneş YÜCEL ATALAY - İstanbul Gelişim Üniv. - TÜRKİYE ygyucel@gelisim.edu.tr
Dr. Öğr. Üyesi Hina ZAHOR - İstanbul Gelişim Üniv. - TÜRKİYE hzahoor@gelisim.edu.tr
Dr. Öğr. Üyesi Selva ZEREN - İstanbul Beykent Üniv. - TÜRKİYE selvazeren@beykent.edu.tr
Dr. Öğr. Üyesi Ashifa K. Mohammed ASHRAF - İstanbul Gelişim Üniv. - TÜRKİYE akariveliparambil@gelisim.edu.tr
Dr. A. Emre BARUT - Amazon - ABD
Dr. Noman NASIR - PAKİSTAN drnomanasir@hotmail.com
Diyetisten Fatma TURANLI - Acibadem Hastanesi - TÜRKİYE fatma.turanli@acibadem.com.tr

BU SAYININ HAKEMLERİ

Prof. Dr. Burcu Semin AKEL
Prof. Dr. Z. Candan ALGUN
Prof. Dr. İbrahim Halil CANKUL
Prof. Dr. İlke KESER
Prof. Dr. Ebru KOLSAL
Prof. Dr. Ayşe Emel ÖNAL
Prof. Dr. Cemile ÖZCAN
Prof. Dr. Sevil ŞAHİN
Prof. Dr. Oya YÖNAL

Prof. Dr. S. Ufuk YURDALAN
Doç. Dr. Şule AKTAÇ
Doç. Dr. Serkan ALAGÖZ
Doç. Dr. Dilşat BAŞ
Doç. Dr. H. Merve BAYRAM
Doç. Dr. Taygun DAYI
Doç. Dr. Hüseyin ERİŞ
Doç. Dr. Türkan İKİZCELİ
Doç. Dr. Berrin Göktuğ KADIOĞLU
Doç. Dr. Başar ÖZTÜRK
Doç. Dr. Çağlar SOYLU
Doç. Dr. Halil ŞENGÜL
Doç. Dr. Bayram Sönmez ÜNÜVAR
Dr. Öğr. Üyesi Hasan Fatih AĞÖZ
Dr. Öğr. Üyesi Hilal AKMAN DÖMBEKÇİ
Dr. Öğr. Üyesi Ali ALU
Dr. Öğr. Üyesi Meltem ASLAN
Dr. Öğr. Üyesi Demet AVCI ALPAR
Dr. Öğr. Üyesi F. Sila AYAN
Dr. Öğr. Üyesi Hatice Kübra AYDIN
Dr. Öğr. Üyesi Emine CİHAN
Dr. Öğr. Üyesi Mehmet Semih ÇAKIR
Dr. Öğr. Üyesi Hüsnüye Merve DEMİRER
Dr. Öğr. Üyesi Onur DİRİCAN
Dr. Öğr. Üyesi Çağır ERTÜRK
Dr. Öğr. Üyesi Mustafa FİLİZ
Dr. Öğr. Üyesi Demet GÜLLALDI
Dr. Öğr. Üyesi Bilgi GÜLSEVEN KARABACAK
Dr. Öğr. Üyesi Çiçek GÜNDAY
Dr. Öğr. Üyesi Duygu KARAARSLAN
Dr. Öğr. Üyesi Aşlı KAYA
Dr. Öğr. Üyesi Deniz KAYA MERAL
Dr. Öğr. Üyesi Özlem KOÇ
Dr. Öğr. Üyesi Gülşah KONAĞÖĞLU
Dr. Öğr. Üyesi Mehmet KORKMAZ
Dr. Öğr. Üyesi Büşra KUL
Dr. Öğr. Üyesi Nesibe MANAV MUTLU
Dr. Öğr. Üyesi Hayrettin MUTLU
Dr. Öğr. Üyesi Bedia Sultan ÖNAL
Dr. Öğr. Üyesi Gözde ÖNAL
Dr. Öğr. Üyesi Ali Veysel ÖZDEN
Dr. Öğr. Üyesi Berkay Eren PEHLİVANOĞLU
Dr. Öğr. Üyesi Mahruk RASHİDİ
Dr. Öğr. Üyesi Didem TETİK KÜÇÜKELÇİ
Dr. Öğr. Üyesi Emrah TUNCER
Dr. Öğr. Üyesi Burçin TÜZÜNER
Dr. Öğr. Üyesi Elif ULUĞ
Dr. Öğr. Üyesi Maksude YILDIRIM
Dr. Öğr. Üyesi Ramazan Cihad YILMAZ
Arş. Gör. Dr. Deniz PAMUK
Arş. Gör. Dr. Dolunay Özlem ZEYBEK
Uzm. Dr. Ali AYDİLEK
Uzm. Dr. Güner YURTSEVER
Dr. Mesut ALÇI
Dr. Mahmut BODUR
Dr. Abdulkareem İBLASİ
Dr. Karamova NATAVAN

SCIENTIFIC ADVISORY BOARD

Prof. Dr. Makbule Meziyet ARI - Istanbul Gelişim Univ. – TÜRKİYE mmari@gelisim.edu.tr
Prof. Dr. Ali Rıza CENAL - Istanbul Gelişim Univ. – TÜRKİYE arcenal@gelisim.edu.tr
Prof. Dr. Ahmet Tan CİMİLLİ - Sağlık Bilimleri Univ. – TÜRKİYE ahmettan.cimilli@sbu.edu.tr
Prof. Dr. Anayit MARGİRİT COŞKUN – Istanbul Atlas Univ. – TÜRKİYE coskunano@yahoo.com
Prof. Dr. İkbāl ÇAVDAR – Istanbul Atlas Univ. – TÜRKİYE ikbal.cavdar@atlas.edu.tr
Prof. Dr. Fatma ÇELİK – Biruni Univ. - TÜRKİYE fcelik@biruni.edu.tr
Prof. Dr. Ferda DOKUZTUĞ ÜÇSULAR - Rumeli Hisarı Akademi - TÜRKİYE ferda@rhakademi.com
Prof. Dr. Veli DUYAN – Ankara Univ. – TÜRKİYE vduyan@health.ankara.edu.tr
Prof. Dr. Nefise Semra ERKAN - Istanbul Gelişim Univ. – TÜRKİYE nserkan@gelisim.edu.tr
Prof. Dr. Metin ERGÜN – Ege Univ. - TÜRKİYE metin.ergun@ege.edu.tr
Prof. Dr. Nuri Özgür KILIÇKESMEZ - Sağlık Bilimleri Univ. – TÜRKİYE okilickesmez@yahoo.com
Prof. Dr. Gül KIZILTAN – Başkent Univ. - TÜRKİYE gkizilta@baskent.edu.tr
Prof. Dr. Abdurrahim KOÇYİĞİT - Bezmialem Vakıf Univ. – TÜRKİYE abdurrahimkocygigit@yahoo.com
Prof. Dr. Mehmet KUTLU - Hitit Univ. - TÜRKİYE mehmetkutlu@hitit.edu.tr
Prof. Dr. Mustafa NİZAMLIOĞLU - Istanbul Gelişim Univ. - TÜRKİYE mnizamlioglu@gelisim.edu.tr
Prof. Dr. Sıdika OĞUZ - Marmara Univ. - TÜRKİYE soguz@marmara.edu.tr
Prof. Dr. Arif ÖNDER - Istanbul Gelişim Univ. – TÜRKİYE aonder@gelisim.edu.tr
Prof. Dr. Levent ÖZTÜRK – Trakya Univ. - TÜRKİYE leventozturk@trakya.edu.tr
Prof. Dr. G.C. PAPADOPOULOS – Selanik Aristoteles Univ. - GREECE gpapadop@vet.auth.gr
Prof. Dr. Hatice PEK – Haliç Univ. – TÜRKİYE haticepek@halic.edu.tr
Prof. Dr. Ayla Gülden PEKCAN – Hasan Kalyoncu Univ. - TÜRKİYE gulden.pekcan@hku.edu.tr
Prof. Dr. Helga REFSUM – Oslo Univ. – NORWAY helga.refsum@medisin.uio.no
Prof. Dr. Osman SAĞDIÇ – Yıldız Teknik Univ. – TÜRKİYE osagdic@yildiz.edu.tr
Prof. Dr. Daniel SERGELİDİS – Aristotle University of Thessalonik - GREECE dsergkel@vet.auth.gr
Prof. Dr. Haydar SUR – Üsküdar Univ. - TÜRKİYE haydar.sur@uskudar.edu.tr
Prof. Dr. Yakup Bilge SÜREL - TÜRKİYE
Prof. Dr. Mehveş TARIM - Marmara Univ. – TÜRKİYE mtarim@marmara.edu.tr
Prof. Dr. Şaban TEKİN - Sağlık Bilimleri Univ. – TÜRKİYE saban.tekin@sbu.edu.tr
Assoc. Prof. Dr. Edibe EGİL - Istanbul Aydın Univ. – TÜRKİYE edibeegil@aydin.edu.tr
Assoc. Prof. Dr. Halime PULAT DEMİR - Istanbul Beykent Univ. - TÜRKİYE halimedomir@beykent.edu.tr
Assoc. Prof. Dr. Hasan Basri SAVAŞ - Mardin Artuklu Univ. – TÜRKİYE hasansavas@artuklu.edu.tr
Assoc. Prof. Dr. Emel YURTSEVER - Istanbul Sabahattin Zaim Univ. – TÜRKİYE emel.yesilkayali@izu.edu.tr
Asst. Prof. Dr. Bahar Nur AKDOĞAN - Istanbul Gelişim Univ. – TÜRKİYE bnkanbur@gelisim.edu.tr
Asst. Prof. Dr. Hatice Merve BAYRAM - Istanbul Gelişim Univ. – TÜRKİYE hmbayram@gelisim.edu.tr
Asst. Prof. Dr. Başak Gökçe ÇÖL - Dokuz Eylül Univ. - TÜRKİYE basakgokce.col@deu.edu.tr
Asst. Prof. Dr. İsmail A. M. ELHATY - Istanbul Gelişim Univ. – TÜRKİYE jaeismail@gelisim.edu.tr
Asst. Prof. Dr. Nurten ELKİN - Istanbul Gelişim Univ. – TÜRKİYE nelkin@gelisim.edu.tr
Asst. Prof. Dr. Ebruc KARPUZÖĞLU – Istanbul Beykent Univ. - TÜRKİYE ebruarpuzoglu@beykent.edu.tr
Asst. Prof. Dr. Derya KAVGAOĞLU - Istanbul Gelişim Univ. – TÜRKİYE dkavgaoglu@gelisim.edu.tr
Asst. Prof. Dr. Ash KAYA - Istanbul Gelişim Univ. – TÜRKİYE askaya@gelisim.edu.tr
Asst. Prof. Dr. Neşe KISKAÇ - Istanbul Gelişim Univ. – TÜRKİYE nkiskac@gelisim.edu.tr
Asst. Prof. Dr. Fikri KÖKSAL - TÜRKİYE fkoksall@gelisim.edu.tr
Asst. Prof. Dr. Leena MAUNULA – Helsinki Univ. – FINLAND Leena.Maunula@helsinki.fi
Asst. Prof. Dr. Nasır MUSTAFA - Istanbul Gelişim Univ. – TÜRKİYE nmustafa@gelisim.edu.tr
Asst. Prof. Dr. Mahruk RASHİDİ - Istanbul Gelişim Univ. – TÜRKİYE mrashidi@gelisim.edu.tr
Asst. Prof. Dr. Yonca SEVİM - Bahçeşehir Univ. - TÜRKİYE yonca.sevim@hes.bau.edu.tr
Asst. Prof. Dr. Emrah TUNCER - Istanbul Gelişim Univ. – TÜRKİYE etuncer@gelisim.edu.tr
Asst. Prof. Dr. Yonca Güneş YÜCEL ATALAY - Istanbul Gelişim Univ. – TÜRKİYE ygyucel@gelisim.edu.tr
Asst. Prof. Dr. Hina ZAHOR - Istanbul Gelişim Univ. – TÜRKİYE hzahoor@gelisim.edu.tr
Asst. Prof. Dr. Selva ZEREN - Istanbul Beykent Univ. - TÜRKİYE selvazeren@beykent.edu.tr
Asst. Prof. Dr. Ashifa K. Mohammed ASHRAF – Istanbul Gelisim Univ. – TÜRKİYE akariveliparambil@gelisim.edu.tr
Dr. A. Emre BARUT – Amazon – UNITED STATES
Dr. Noman NASIR - PAKISTAN dnomannasir@hotmail.com
Dietician Fatma TURANLI – Acıbadem Hospital - TÜRKİYE fatma.turanli@acibadem.com.tr

REFEREES FOR THIS ISSUE

Prof. Dr. Burcu Semin AKEL
Prof. Dr. Z. Candan ALGUN
Prof. Dr. İbrahim Halil CANKUL
Prof. Dr. İlke KESER
Prof. Dr. Ebru KOLSAL
Prof. Dr. Ayşe Emel ÖNAL
Prof. Dr. Cemile ÖZCAN
Prof. Dr. Sevil ŞAHİN
Prof. Dr. Oya YÖNAL

Prof. Dr. S. Ufuk YURDALAN
Assoc. Prof. Dr. Şule AKTAÇ
Assoc. Prof. Dr. Serkan ALAGÖZ
Assoc. Prof. Dr. Dilşat BAŞ
Assoc. Prof. Dr. H. Merve BAYRAM
Assoc. Prof. Dr. Taygun DAYI
Assoc. Prof. Dr. Hüseyin ERİŞ
Assoc. Prof. Dr. Türkan İKİZCELİ
Assoc. Prof. Dr. Berrin Göktuğ KADIOĞLU
Assoc. Prof. Dr. Başar ÖZTÜRK
Assoc. Prof. Dr. Çağlar SOYLU
Assoc. Prof. Dr. Halil ŞENGÜL
Assoc. Prof. Dr. Bayram Sönmez ÜNÜVAR
Asst. Prof. Dr. Hasan Fatih AKGÖZ
Asst. Prof. Dr. Hilal AKMAN DÖMBEKÇİ
Asst. Prof. Dr. Ali ALU
Asst. Prof. Dr. Meltem ASLAN
Asst. Prof. Dr. Demet AVCI ALPAR
Asst. Prof. Dr. F. Sila AYAN
Asst. Prof. Dr. Hatice Kübra AYDIN
Asst. Prof. Dr. Emine CİHAN
Asst. Prof. Dr. Mehmet Semih ÇAKIR
Asst. Prof. Dr. Hüsnüye Merve DEMİRER
Asst. Prof. Dr. Onur DİRİCAN
Asst. Prof. Dr. Çağır ERTÜRK
Asst. Prof. Dr. Mustafa FİLİZ
Asst. Prof. Dr. Demet GÜLLALDI
Asst. Prof. Dr. Bilgi GÜLSEVEN KARABACAK
Asst. Prof. Dr. Çiçek GÜNDAY
Asst. Prof. Dr. Duygu KARAARSLAN
Asst. Prof. Dr. Aslı KAYA
Asst. Prof. Dr. Deniz KAYA MERAL
Asst. Prof. Dr. Özlem KOÇ
Asst. Prof. Dr. Gülşah KONAĞOĞLU
Asst. Prof. Dr. Mehmet KORKMAZ
Asst. Prof. Dr. Büşra KUL
Asst. Prof. Dr. Nesibe MANAV MUTLU
Asst. Prof. Dr. Hayrettin MUTLU
Asst. Prof. Dr. Bedia Sultan ÖNAL
Asst. Prof. Dr. Gözde ÖNAL
Asst. Prof. Dr. Ali Veyssel ÖZDEN
Asst. Prof. Dr. Berkay Eren PEHLİVANOĞLU
Asst. Prof. Dr. Mahruk RASHİDİ
Asst. Prof. Dr. Didem TETİK KÜÇÜKELÇİ
Asst. Prof. Dr. Emrah TÜNCER
Asst. Prof. Dr. Burçin TÜZÜNER
Asst. Prof. Dr. Elif ULUĞ
Asst. Prof. Dr. Maksude YILDIRIM
Asst. Prof. Dr. Ramazan Cihad YILMAZ
Res. Asst. Dr. Deniz PAMUK
Res. Asst. Dr. Dolunay Özlem ZEYBEK
Specialist Dr. Ali AYDİLEK
Specialist Dr. Güner YURTSEVER
Dr. Mesut ALÇI
Dr. Mahmut BODUR
Dr. Abdulkareem İBLASİ
Dr. Karamova NATAVAN

Editörden

Merhaba,

Günümüzde yapay zekânın her alanda yaygınlaşması sonucunda sınırlarının konuşulması başladı. Yapay zekânın gelişimi ile robotlar üretiliyor, robotlar birbirleri ile iletişime geçiyor. Üretilen bu robotların kendi fikri yok, üreten insanlar tarafından yükleniyor. Zaman içerisinde, yüklenilen fikirlerden kendi mantığını üreten bir yapıya dönüşüyor, yüklenen istatistiksel verilerden ilişkiler oluşturuyor. Sorduğumuz sorularla bizden de öğrenmeye başlıyor.

Yıllardır sizlere ulaşan İstanbul Gelişim Üniversitesi Sağlık Bilimleri Dergisi (IGUSABDER), 2017 yılından bu yana yayınlanan, 2020 yılında TÜBİTAK ULAKBİM TR Dizin'de yer almaya başlamış akademik, hakemli bir dergidir. Geldiğimiz süreçte IGUSABDER, yapay zekânın her gün farklı boyutlarda yaşamımızı etkilemesine sessiz kalamazdı. 2026 yılı Temmuz ayında **“Sağlıkta Yapay Zekâ”** özel sayısını yayınlayacağız. Özel sayıda, çağrılı makaleler yanında diğer araştırmacıların makalelerine de yer vereceğiz. Makale başvuruları, her zaman olduğu gibi DergiPark sistemi üzerinden kabul edilecek olup, <https://dergipark.org.tr/tr/pub/igusabder> bağlantısından ulaşma olanağınız bulunmaktadır. Özel sayımıza makale yüklenmesi için son tarih 31 Ocak 2026 olarak belirlenmiştir. IGUSABDER ekibi adına sizlere bu sayımıza yapacağınız katkılarınızdan dolayı çok teşekkür ediyorum.

Sağlıcakla kalın, saygılarımla.

Dr. Öğr. Üyesi A. Yüksel BARUT
Editör

From the Editor

Dear All,

Today, with the widespread use of artificial intelligence in every field, its boundaries have begun to be discussed. With the development of artificial intelligence, robots are being produced, and these robots are able to communicate with one another. These robots do not have their own ideas; instead, they are programmed by the people who create them. Over time, they transform into structures that generate their own reasoning from the ideas uploaded to them, forming connections from the statistical data they are provided with. From the questions we ask, they also begin to learn from us.

Istanbul Gelişim University Journal of Health Sciences (IGUSABDER), which has reached you for many years, is an academic, peer-reviewed journal that has been published since 2017 and indexed in TÜBİTAK ULAKBİM TR Index since 2020. At this stage, IGUSABDER could not remain silent about the impact of artificial intelligence on our lives in various dimensions every day. In July 2026, we will publish a special issue on “**Artificial Intelligence in Healthcare.**” Alongside invited articles, the special issue will also include submissions from other researchers. As always, article submissions will be accepted through the DergiPark system, which can be accessed at <https://dergipark.org.tr/en/pub/igusabder>. The deadline for submissions to our special issue has been set as January 31, 2026. On behalf of the IGUSABDER team, I would like to thank you very much for your valuable contributions to this issue.

Stay healthy, with my best regards.

Asst. Professor A. Yüksel BARUT

Editor



— 
Sağlık Bilimleri
Fakültesi

İstanbul Gelişim Üniversitesi, Sağlık Bilimleri Fakültesi'nin aşağıdaki Bölümleri,
Almanya merkezli **Accreditation Agency in Health and Social Sciences /**
Akkreditierungsagentur im Bereich Gesundheit und Soziales (AHPGS)
tarafından

Beslenme ve Diyetetik (TR-İNG),
Fizyoterapi ve Rehabilitasyon (TR-İNG),
Hemşirelik (TR-İNG) bölümleri 2030 yılına kadar;

Çocuk Gelişimi (TR-İNG),
Ergoterapi,
Odyoloji,
Sağlık Yönetimi,
Sosyal Hizmet (TR-İNG) bölümleri 2018-2023 yılları arasında
koşulsuz olarak akredite edilmiştir.

&

*The Following Departments of Istanbul Gelisim University, Faculty of Health Sciences
have been unconditionally accredited by the Germany based **Accreditation Agency**
in Health and Social Sciences / Akkreditierungsagentur im Bereich
Gesundheit und Soziales (AHPGS)*

Nutrition and Dietetics (Turkish-English Tracks)
Physical Therapy and Rehabilitation (Turkish-English Tracks),
Nursing (Turkish-English Tracks) departments until 2030;

Audiology,
Child Development (Turkish-English Tracks),
Health Management,
Occupational Therapy,
Social Service (Turkish-English Tracks) departments were accredited
unconditionally between 2018-2023.

İÇİNDEKİLER / CONTENTS

	Sayfa/Page
<i>Editörden</i>	x
<i>From the Editor</i>	xi
<i>İçindekiler / Contents</i>	xiii

Özgün Araştırma Makaleleri (Original Research Articles)

Evaluating the Effectiveness of Interventions for Neck Pain in University Students with Problematic Internet Use: A Randomized Trial	418-429
<i>Problemlı İnternet Kullanımı Olan Üniversite Öğrencilerinde Boyun Ağrısına Yönelik Girişimlerin Etkinliğinin Değerlendirilmesi: Randomize Bir Çalışma</i>	
Gamze DEMİRCİOĞLU, Hazal GENÇ	
Preoperative Corrective Exercise Training in ACL Rupture: Effects on Pain, Stability, and Functional Outcomes: A Single-Blind Randomized Controlled Trial	430-438
<i>ACL Ruptüründe Ameliyat Öncesi Düzeltici Egzersiz Eğitimi: Ağrı, Stabilité ve Fonksiyonel Sonuçlar Üzerindeki Etkileri: Tek Kör, Randomize Kontrollü Bir Çalışma</i>	
Emre Serdar ATALAY, Fatmagül VAROL, Hasan BOMBACI	
The Effect of Midwife-Led Practices on Birth Expectancy and Experience Outcomes: Systematic Review and Meta-Analysis	439-450
<i>Ebe Liderliğindeki Uygulamaların Doğum Beklentisi ve Deneyimi Üzerine Etkisi: Sistematik İnceleme ve Meta-Analiz</i>	
Fatma Şule BİLGİÇ, Aysu YILDIZ KARAAHMET, Fatma AZİZOĞLU	
Comparison of Therapist-Supervised and Home Exercise Calisthenics Exercises in Post-Covid Syndrome: A Single Blind, Randomized Controlled Trial	451-463
<i>Post-Covid Sendromunda Terapist Gözetiminde ve Evde Yapılan Kalistenik Egzersizlerinin Karşılaştırılması: Tek Kör, Randomize Kontrollü Bir Çalışma</i>	
Alper PERÇİN, Sena BİLAZER, Havva Ezgi ALBAYRAK, Cansu ÖZDEMİR, Cahidenur KOÇAK	
Reliability and Validity of Analiz Sistem in Plantar Pressure Assessment for Unilateral Chronic Ankle Instability	464-476
<i>Tek Taraflı Kronik Ayak Bileği İnstabilitesinde Plantar Basınç Değerlendirmesinde Analiz Sistem'in Güvenilirliği ve Geçerliliği</i>	
Çağlar SOYLU, Ceren Şevval KARATAŞ, Görkem AÇAR	

The Relationship between Core Endurance, Hand Grip Strength, and Reaction Time in Young Adults 477-488

Genç Erişkinlerde Kor Endurans, El Kavrama Kuvveti ve Reaksiyon Süresi Arasındaki İlişki

Anıl TEKEOĞLU TOSUN, Ezgi ERYILDIZ, Çağdaş IŞIKLAR, Demet TEKİN DE LAS PEÑAS

Factors Related to Quality of Life in the Older Adults: Urinary Incontinence, Comorbidity and Polypharmacy 489-499

Yaşlılarda Yaşam Kalitesi ile İlişkili Faktörler: Üriner İnkontinans, Komorbidite, Polifarmasi

Özge ÖZ YILDIRIM, İlknur AYDIN AVCI

Quantitative Determination of α -Tocopherol and α -Tocopheryl Acetate in Pharmaceutical and Supplementary Soft Capsules by High Performance Liquid Chromatography 500-511

Farmasötik ve Takviye Edici Yumuşak Kapsüllerdeki α -Tokoferol ve α -Tokoferil

Asetat'ın Yüksek Performanslı Sıvı Kromatografisi ile Kantitatif Tayini

Nükte TOPRAKSEVER, Gamze ÖZGÜL ARTUÇ

Fieldwork Experiences in Special Education and Rehabilitation Centers: A Qualitative Approach to the Perspective of Child Development Students 512-524

Özel Eğitim ve Rehabilitasyon Merkezlerinde Alan Çalışması Deneyimleri:

Çocuk Gelişimi Öğrencilerinin Niteliksel Görüşleri

Esra Hazal ÇELEPİ, Rabia Nazıkar BOZACIOĞLU, Berk Efe ALTINAL

Sensory Processing Patterns in Preterm Toddlers 525-533

Yürümeye Yeni Başlayan Preterm Çocuklarda Duyusal İşleme Paternleri

Ayşe YILDIZ, Zehra Ebrar BAKIRCI, Ramazan YILDIZ

A Vicious Cycle of Access to Excluded Medicines: Evidence from a Qualitative Study 534-550

Kapsam dışı İlaçlara Erişimin Kısır Döngüsü: Nitel Bir Çalışmadan Elde Edilen Kanıtlar

Haşim ÇAPAR

Investigation of Malnutrition and Sarcopenia in Individuals Aged 65 and Over Receiving Both Nursing Home or Home Care Services 551-561

Huzurevinde ve Evde Bakım Desteği Alan 65 Yaş ve Üstü Bireylerin

Malnütrisyon ve Sarkopeni Yönünden İncelenmesi

Haydar ÖZPINAR, Şevval ÖZŞİRİN

The Role of Transobturator Tape (TOT) Operation in the Treatment of Pelvic Organ Prolapse and Stress Urinary Incontinence 562-572

Transobturator Bant (TOT) Operasyonunun Pelvik Organ Prolapsusu ve Stres

Üriner İnkontinans Tedavisindeki Rolü

Teymur BORNAUN

Investigating the Relationship between Affective Neuroscience Personalities, Job Satisfaction and Emotional Appetite in Long-Shift Healthcare Workers 573-583

Uzun Vardiyalı Sağlık Çalışanlarında Duygusal Sinir Bilimi Kişiliklerinin, İş Doyumunun ve Duygusal İştah Arasındaki İlişkinin Araştırılması
Öznur Özge ÖZCAN, Merve ELDOĞAN, Lütüye Büşra DEMİREZEN,
Mesut KARAHAN

Comparison of Intuitive Eating Behaviour, Eating Addiction and Nutritional Knowledge Level in Individuals Receiving Online and Face-to-Face Nutrition Counselling 584-596

Çevrimiçi ve Yüz Yüze Beslenme Danışmanlığı Alan Bireylerde Sezgisel Yeme Davranışı, Yeme Bağımlılığı ve Beslenme Bilgi Düzeyinin Karşılaştırılması
Nevin TİPİ, Elif EDE ÇİNTESUN

Understanding Emotional Eating in Bipolar Disorder: Self-Reports vs. Objective Assessments 597-610

Bipolar Bozuklukta Duygusal Yemeğin Anlaşılması: Öz-Bildirimler ve Objektif Değerlendirmeler
Pınar HAMURCU

Experiences of Academicians at a Faculty of Health Sciences Regarding Students of Generation Z: A Phenomenological Research 611-626

Sağlık Bilimleri Fakültesi Akademisyenlerinin Z Kuşağı Öğrencilerine İlişkin Deneyimleri: Fenomenolojik Bir Araştırma
Funda ÇİTİL CANBAY, Elif Tuğçe ÇİTİL GÜLDÜ

The Impact of Altitude on Sleep Quality, Daily Living Activities, and Quality of Life in Elderly Residents of Turkish Nursing Homes: A Cross-Sectional Analysis 627-639

Türkiye'deki Huzurevlerinde Kalan Yaşlılarda Bakımın Uyku Kalitesi, Günlük Yaşam Aktiviteleri ve Yaşam Kalitesi Üzerindeki Etkisi: Kesitsel Bir Analiz
Mustafa Özkan FIRAT, Berrak VARHAN

Strategies for Coping with Loneliness of Older Individuals whose Spouses Have Passed Away: Isparta Case Qualitative Research 640-651

Eşleri Vefat Eden Yaşlı Bireylerin Yalnızlıkla Başa Çıkma Stratejileri: Isparta Örneği Nitel Araştırma
Hatice Ceyda CANTÜRK, Özlem ÖZGÜR, Fatma Sıla AYAN, Gülüşan ÖZGÜN BAŞIBÜYÜK

The Relationship between Health Beliefs and their Adaptation to Drug Use in Patients with Chronic Disease 652-661

Kronik Hastalığa Sahip Hastaların İlaç Kullanmaya İlişkin Sağlık İnançları ile Tedaviye Uyumluluğu Arasındaki İlişki
Esra ÖZER, Nuray ŞAHİN ORAK

Examination of the Relationship between Adolescents' Psychological Resilience and Depression and Somatic Symptoms During the COVID-19 Pandemic 662-675

COVID-19 Salgın Sürecinde Ergenlerin Psikolojik Sağlamlıkları ile Depresyon ve Somatik Belirtileri Arasındaki İlişkinin İncelenmesi
Bidar Süreyya KARAASLAN, Deniz YILDIZ

Are Hairdressers a Threat to Children's Health? 676-685

Kuaförler Çocuk Sağlığı İçin Bir Tehdit Midir?
Hasret Yağmur SEVİNÇ AKIN, Elif DEMİR, Zeliha DEMİR GİDEN, Ramazan GİDEN

Bibliometric Evaluation of the Relationship between Selenium and Breast Cancer: A Synopsis 686-696

Selenyum ile Meme Kanseri Arasındaki İlişkinin Bibliyometrik Değerlendirmesi
Selim ÖĞÜT

Comparison of Liver Venous Deprivation and Portal Vein Embolization for Future Liver Remnant Hypertrophy: A Single-Center Retrospective Study 697-708

Gelecekteki Karaciğer Rezidüsü Hipertrofisi için Karaciğer Venöz Deprivasyonu ile Portal Ven Embolizasyonunun Karşılaştırılması: Tek Merkezli Retrospektif Bir Çalışma
Çağrı ERDİM, Tevfik GÜZELBEY, Mehmet CİNGÖZ, Mustafa Fatih ARSLAN, Ali DABLAN, Oğuzhan TÜRK SAYAR, Mehmet Hamza TÜRKCANOĞLU, Hüseyin KILAVUZ, İlhan Nahit MUTLU, Özgür KILIÇKESMEZ

Derleme Makaleler (Review Articles)

Investigation of Art Therapy Applications in Geriatric Rehabilitation from the Perspective of Occupational Therapy 709-721

Geriatrik Bireylerde Sanat Terapi Uygulamalarının Ergoterapi Perspektifiyle İncelenmesi
Derya ALİOĞLU, Sümeyye SARIŞAHİN, Gülşah ZENGİN YAZICI, Ümit UĞURLU

Epigenetically Mediated Health Effects of Intermittent Fasting 722-737

Aralıklı Açlık Diyetlerinin Epigenetik Aracılı Sağlık Etkileri
Tülay IŞIK

Gebelik Döneminde Beslenme ve Yeme Bozukluklarının Fetal ve Maternal Sağlık Üzerine Etkileri 738-750

The Effects of Feeding and Eating Disorders on Fetal and Maternal Health During Pregnancy
Sümeyye Begüm ATALAN, Aylin AÇIKGÖZ PINAR

Empowering Women in the Digital Age: A Narrative Review of Technological Opportunities and Barriers	751-761
Dijital Çağda Kadınların Güçlendirilmesi: Teknolojik Fırsatlar ve Engellerin Anlatısal Derlemesi Hülya YAMAN, Gökay ÇAKIROĞLU	
The Effects of Balance and Proprioceptive Training on Falling in Older Adults	762-770
<i>Yaşlı Bireylerde Denge ve Proprioseptif Eğitimin Düşme Üzerine Etkileri</i> Havva Ezgi ALBAYRAK, Hande Besna GÖÇEN, Suzan AYDIN, Mustafa Oğuz KETHÜDAOĞLU, Aygül KÖSEOĞLU KURT, Mehmet Kaan ALTUNOK, Bülent Abut ÖZSEZİKLİ	
The Effect of Auricular Vagus Nerve Stimulation on Heart Rate Variability	771-783
<i>Auriküler Vagus Sinir Uyarımının Kalp Hızı Değişkenliği Üzerindeki Etkisi</i> Gülşah KONAKOĞLU, Ayşem Ecem ÖZDEMİR, Öznur KAYA SAĞLAM, Büşra SAYIR	
Metaverse Applications in Healthcare: SWOT Analysis	784-799
<i>Sağlık Hizmetlerinde Metaverse Uygulamaları: SWOT Analizi</i> Nurgül ERDAL, Ali ÖZBEK, Barış GELAL	
<i>IGUSABDER Article Writing Rules</i>	

Evaluating the Effectiveness of Interventions for Neck Pain in University Students with Problematic Internet Use: A Randomized Trial

Gamze DEMİRCİOĞLU*, Hazal GENÇ**

Abstract

Aim: The proliferation of digital technology has made internet usage an integral part of daily life, inadvertently leading to increased physical inactivity among peers. This study aims to examine the effectiveness of different interventions for neck pain in university students with problematic internet use.

Method: This randomized controlled trial (RCT) was conducted with 40 participants, aged 18 to 20, experiencing non-specific neck pain. All participants were randomly divided into the home exercise group (Group 1; n=20) and the walking group (Group 2; n=20). Posture and stretching exercises were recommended to the home exercise group over eight weeks. The walking group was given a daily walking program of 7000 steps over the same eight weeks. After examining the subjects' demographic information, participants were assessed before and after the program using the Neck Disability Index, Perceived Stress Scale, Pittsburgh Sleep Quality Index, and Beck Anxiety Inventory.

Results: The study revealed that symptoms associated with neck pain significantly decreased in the home exercise group ($p=0.001$). No significant improvements in stress and anxiety levels were observed in either group ($p>0.05$). Although sleep quality improved significantly in both the home exercise group ($p=0.005$) and the walking group ($p=0.016$), there was insufficient supportive evidence that one group was more effective.

Conclusion: The increasing prevalence of internet usage contributes to heightened physical inactivity among peers. Establishing regular exercise routines and scheduling specific physical activity breaks are crucial to counteract the detrimental effects of this trend.

Keywords: Exercise therapy, internet use, neck pain, physical activity, walking.

Problemli İnternet Kullanımı Olan Üniversite Öğrencilerinde Boyun Ağrısına Yönelik Girişimlerin Etkinliğinin Değerlendirilmesi: Randomize Bir Çalışma

Öz

Amaç: Dijital teknolojinin yaygınlaşması, internet kullanımını günlük yaşamın ayrılmaz bir parçası haline getirmiş ve istemeden de olsa akranlar arasında fiziksel hareketsizliğin artmasına neden olmuştur. Bu çalışmanın amacı, problemli internet kullanımı olan üniversite öğrencilerinde boyun ağrısına yönelik farklı müdahalelerin etkinliğini incelemektir.

Yöntem: Bu randomize kontrollü çalışma (RKÇ), yaşları 18 ila 20 arasında değişen ve spesifik olmayan boyun ağrısı yaşayan toplam 40 katılımcı ile yürütülmüştür. Tüm katılımcılar rastgele iki gruba ayrılmıştır: ev egzersiz grubu (Grup 1; n=20) ve yürüyüş grubu (Grup 2; n=20). Ev egzersiz grubuna sekiz haftalık bir süre boyunca duruş ve esneme egzersizleri önerilmiştir. Yürüyüş grubuna ise aynı sekiz haftalık süre boyunca 7000 adımdan oluşan günlük bir yürüyüş programı verilmiştir. Deneklerin demografik bilgilerinin incelenmesinin ardından, katılımcılar programdan önce ve sonra Boyun Engellilik İndeksi, Algılanan Stres

Özgün Araştırma Makalesi (Original Research Article)

Geliş / Received: 09.08.2024 **Kabul / Accepted:** 07.07.2025

DOI: <https://doi.org/10.38079/igusabder.1531027>

* Asst. Prof., Istanbul Atlas University, Faculty of Health Sciences, Department of Physiotherapy and Rehabilitation, Istanbul, Türkiye. E-mail: gamzekantardemircioglu@gmail.com [ORCID https://orcid.org/0000-0002-0694-9140](https://orcid.org/0000-0002-0694-9140)

** Asst.Prof., Bahcesehir University, Faculty of Health Sciences, Department of Physiotherapy and Rehabilitation, Istanbul, Türkiye. E-mail: hazaloksuz@gmail.com [ORCID https://orcid.org/0000-0001-9999-1040](https://orcid.org/0000-0001-9999-1040)

ETHICAL STATEMENT: This study was carried out with the approval of the Ethics Committee of Istanbul Medipol University, dated 11/08/2023 and numbered E-10840098-772.02-4942. A signed subject consent form in accordance with the Declaration of Helsinki was obtained from each participant.

Ölçeği, Pittsburgh Uyku Kalitesi İndeksi ve Beck Anksiyete Envanteri kullanılarak değerlendirilmiştir.

Bulgular: Çalışma, boyun ağrısı ile ilişkili semptomların ev egzersizi grubunda önemli ölçüde azaldığını ortaya koymuştur ($p=0,001$). Her iki grupta da stres ve anksiyete düzeylerinde anlamlı bir iyileşme gözlenmemiştir ($p>0,05$). Uyku kalitesi hem ev egzersizi grubunda ($p=0,005$) hem de yürüyüş grubunda ($p=0,016$) önemli ölçüde iyileşmiş olsa da bir grubun diğerinden daha etkili olduğuna dair yeterli destekleyici kanıt bulunamamıştır.

Sonuç: İnternet kullanımının giderek yaygınlaşması, akranlar arasında fiziksel hareketsizliğin artmasına katkıda bulunmaktadır. Düzenli egzersiz rutinleri oluşturmak ve belirli fiziksel aktivite molaları planlamak, bu eğilimin zararlı etkilerine karşı koymak için çok önemlidir.

Anahtar Sözcükler: Egzersiz tedavisi, internet kullanımı, boyun ağrısı, fiziksel aktivite, yürüme.

Introduction

Internet usage constitutes a widely embraced global technology that significantly impacts our daily lives. The International Telecommunication Union (ITU) reported that approximately 5.4 billion individuals, comprising 67% of the world's population, actively use the internet^{1,2}. According to the 2023 data from the Turkish Statistical Institute (TÜİK), internet usage has steadily risen, reaching 87.1% among the population³. The increasing popularity of the internet is particularly impacting adolescents and adults. Previous studies have indicated that problematic internet use is more prevalent among adolescents globally, with rates reaching approximately 25%, and among adults, about 23%⁴.

Problematic internet use, or internet addiction, is characterized by an inability to regulate internet consumption, thereby interfering with daily activities and responsibilities and resulting in psychological or physical health issues⁵. Research has emphasized the adverse health impacts of increased physical inactivity, noting that problematic internet use often entails prolonged static postures that compromise body ergonomics, induce muscle tension in the neck, and result in neck pain⁶. Studies have consistently demonstrated a correlation between prolonged screen time and musculoskeletal disorders, particularly in the cervical spine, which can lead to chronic pain if not addressed early^{7,8}.

Neck pain is the second most prevalent musculoskeletal complaint and a significant cause of disability worldwide among individuals aged 15 to 64 years⁷. It is often caused by muscle tension, poor posture, or trauma. Prolonged focus on a fixed point can lead to decreased neck mobility and increased discomfort^{6,7}. Previous studies have confirmed that extended periods of internet use contribute significantly to the prevalence of neck pain, particularly in younger populations. This can be attributed to the poor ergonomic setup during internet use, such as slouched postures or prolonged staring at screens, which strains the neck muscles and leads to discomfort^{6,8}. In addition, research conducted by Alaca supports these findings and reveals a high prevalence of neck pain among young people with problematic internet use⁹.

It is, therefore, important to effectively manage neck pain associated with problematic internet use in young adults. Exercise interventions are crucial in managing neck pain related to problematic internet use among young adults¹⁰. Previous research has

demonstrated that neck-focused exercises, such as stretching and strengthening, have been shown to alleviate pain in various studies^{11,12}. Additionally, regular moderate-intensity aerobic exercise positively impacts overall health. Brisk walking on flat terrain, a highly effective form of aerobic exercise, has been reported to significantly improve musculoskeletal health and reduce neck pain^{10,12}. The effects of exercise on reducing stress and improving sleep quality have also been well-documented, suggesting that exercise can address multiple psychological and physical symptoms commonly associated with problematic internet use¹². Based on this information, our study is designed to compare the effects of integrating neck exercises and walking programs into daily routines. The aim is to investigate the impact of these interventions on alleviating neck pain symptoms, sleep quality, stress, and anxiety in university students with problematic internet use.

Material and Methods

Participants

University student internet users with neck pain at Bahcesehir University were invited to participate in this study. The inclusion criteria are listed as follows: (1) Subclinical chronic neck pain that has persisted for more than three months; (2) Neck Disability Index (NDI) score range of 5–14/50¹³; (3) a score of ≥ 50 on the Internet Addiction Test⁹; (4) 18–25 years of age; (5) According to the International Physical Activity Questionnaire score, being inactive or minimally active¹⁴. Participants were excluded from the study if they met any of the following conditions: (1) visual, auditory, vestibular, or neurological deficits; (2) traumatic injuries, fractures, or surgical interventions to the spine or lower extremities within the year preceding the study; (3) severe pain that restricts joint movement or shows clinical symptoms; (4) participation in any neck muscle strengthening programs in the past 12 months.

Material and Methods

Participants who agreed to participate in the study were randomly divided into two groups: the home exercise group (Group 1; n=20) and the walking group (Group 2; n=20). Randomization was performed using www.random.org. The purpose and process of the study were explained to participants in both groups, and each potential participant was screened using an online form designed specifically for this study.

Participants completed forms that included demographic information (gender, age, height, and weight), the International Physical Activity Questionnaire for physical activity levels, and the Internet Addiction Test for internet usage levels. To be included in the study, participants needed to meet specific score thresholds on ***the International Physical Activity Questionnaire and the Internet Addiction Test***; those scoring below the required thresholds were excluded. To assess intervention outcomes, participants in both groups were evaluated before the treatment protocol began and after the eight-week program. The Neck Disability Index was used to evaluate neck pain, the Pittsburgh Sleep Quality Index for sleep quality, the Beck Anxiety Inventory for anxiety, and the Perceived Stress Scale for stress levels.

The International Physical Activity Questionnaire (IPAQ), designed to evaluate physical activity levels in people between the ages of 15 and 65, includes

inquiries regarding recent physical activity. IPAQ categorizes physical activity into three levels: “inactive,” “minimally active,” and “highly active.” Physical activity levels were classified as inactive (<600 MET-min/week), minimally active (600–3000 MET-min/week), and very active (>3000 MET-min/week), considering the numerical data obtained as well as MET calculation¹⁵.

The Internet Addiction Test (IAT) was developed by Young as a 20-item self-report scale to measure the severity of Internet dependency. Each question is rated on a 6-point Likert scale ranging from "Never" (0 points) to "Continually" (5 points). According to the scoring system, a total score between 0 and 30 indicates no internet addiction and a low risk. Scores between 31 and 49 suggest mild internet addiction with a low to moderate risk. Scores from 50 to 79 reflect moderate internet addiction, implying a moderate to high risk. Finally, a score between 80 and 100 indicates severe internet addiction and a high risk¹⁶.

The Neck Disability Index (NDI) evaluates neck-related disability based on responses from the previous week. It consists of ten items, each scored on a 6-point scale ranging from 0 to 5, with 0 representing no disability and 5 representing complete disability, resulting in a total score ranging from 0 to 50. Higher scores indicate a more significant disability. Scores below 21 suggest mild to moderate disability, scores between 22 and 35 indicate severe disability, and scores above 36 reflect complete disability¹⁷.

The Pittsburgh Sleep Quality Index (PSQI) is a comprehensive tool designed to evaluate an individual's sleep quality over the preceding month. This 24-item measure comprehensively evaluates several elements of sleep, such as duration, disruptions, efficiency, daytime dysfunction, and general sleep quality. Higher scores on the PSQI indicate lower sleep quality. The total score ranges from 0 to 21. The validity and reliability of the Turkish version of the PDQ was performed by Ağargün et al. in 1996^{18,19}.

The Beck Anxiety Inventory (BAI) scale is widely used to evaluate neck dysfunction and related pain perception while going about daily tasks. BAI is a valid and dependable measure utilized in clinical practice and research. This scale measures the degree of neck pain felt during various everyday tasks and activities, such as driving, dressing, lifting, reading, getting a headache, concentrating, engaging in work-related tasks, and engaging in leisure activities. Each result or lack of pain is represented by a number on the scale, which goes from "0," the most favorable outcome, to "50," which is the most significant degree of discomfort or disability^{20,21}.

Perceived Stress Scale (PSS), developed by PSS, Cohen, Kamarck, and Mermelstein, measures stress perceptions. In this scale, which has 14 questions in total, the answers are “Never”, “Rarely”, “Sometimes”, “Quite often” and “Very often”. In this test, the lowest "0" and the highest "56" points can be obtained; high values indicate the height of the person's perceived stress²².

Participants in Group 1, the home exercise group, were instructed to follow a standard home exercise program five times a week for eight weeks. The exercise protocol included a general range of motion exercises for warming up and cooling down, followed by stretching/mobilization and strengthening exercises targeting the cervical and upper thoracic spine. The stretching/mobilization exercises consisted of neck flexion and

extension stretches, upper trapezius stretches, and upper thoracic extension mobilization performed while seated. The strengthening exercises included chin tucks, isometric neck flexion, extension, lateral flexion, chin tucks with overpressure, shoulder blade pulls, shrugs, and shoulder rotations. Each exercise was performed for 8 to 10 repetitions, with rest intervals of 30 to 60 seconds between exercises. A complete exercise session lasted between 20 to 30 minutes²³. Participants in Group 1 received a brochure detailing the prescribed neck exercises. The exercises were demonstrated to the participants in the first week and were subsequently reinforced by a physiotherapist during their weekly visits to the Department of Physiotherapy and Rehabilitation. Exercise adherence was monitored using daily exercise diaries maintained by the participants. These diaries were reviewed weekly by the physiotherapist to evaluate adherence to the program. Feedback was provided during the weekly visits to ensure proper execution of the exercises. Participants who performed the home exercises fewer than three times a week were excluded from the study²⁴. Participants in Group 2, the walking exercise group, were instructed to follow a structured walking program five times a week for eight weeks. Each participant was asked to install the Runtastic Pedometer© (Runtastic, Austria) smartphone application on their devices. Daily walking data were collected using this application, which is considered valid and reliable for tracking steps⁸. Participants were instructed to walk 7000 steps daily on flat surfaces while carrying their smartphones in their pockets, adhering to the recommendations of the American College of Sports Medicine for achieving health benefits through specific physical activity levels²⁵. To ensure adherence and monitor progress, participants were required to maintain a daily log of their steps, which was reviewed weekly by a physiotherapist. Participants who performed fewer than three sessions per week were excluded from the study in Group 1 and Group 2. This approach allowed for ongoing adjustments to the program and addressed any issues related to compliance, ensuring that participants consistently met the activity goal throughout the study.

Ethical Statement

The study was randomized from August 2023 to March 2024 at Bahçeşehir University's Faculty of Health Sciences, Department of Physiotherapy and Rehabilitation. Approval for the study was granted by the Istanbul Medipol University Ethics Committee (Date: 11/08/2024; reference number E-10840098-772.02-4942). The study adhered to the principles outlined in the Helsinki Declaration and was registered with ClinicalTrials.gov (Identifier: NCT06009081). Individuals who signed the Informed Consent Form and agreed to participate were included in the study.

Statistical Analysis

Using G*Power version 3.1.9.4, the sample size was calculated through repeated measures analysis of variance (ANOVA) between groups. The alpha and power (1- β error probability) were set at 0.05 and 0.85, respectively. An anticipated effect size of 0.576 from Kutlu's²⁶ study was used as a reference for group 2. Based on these findings, the sample size for each group was initially determined to be 19, totaling 38 participants. To account for potential participant dropout, 45 individuals who met the inclusion criteria were randomly assigned to the study. However, 5 participants dropped out during the follow-up period, and the study was completed with 40 participants. All participants

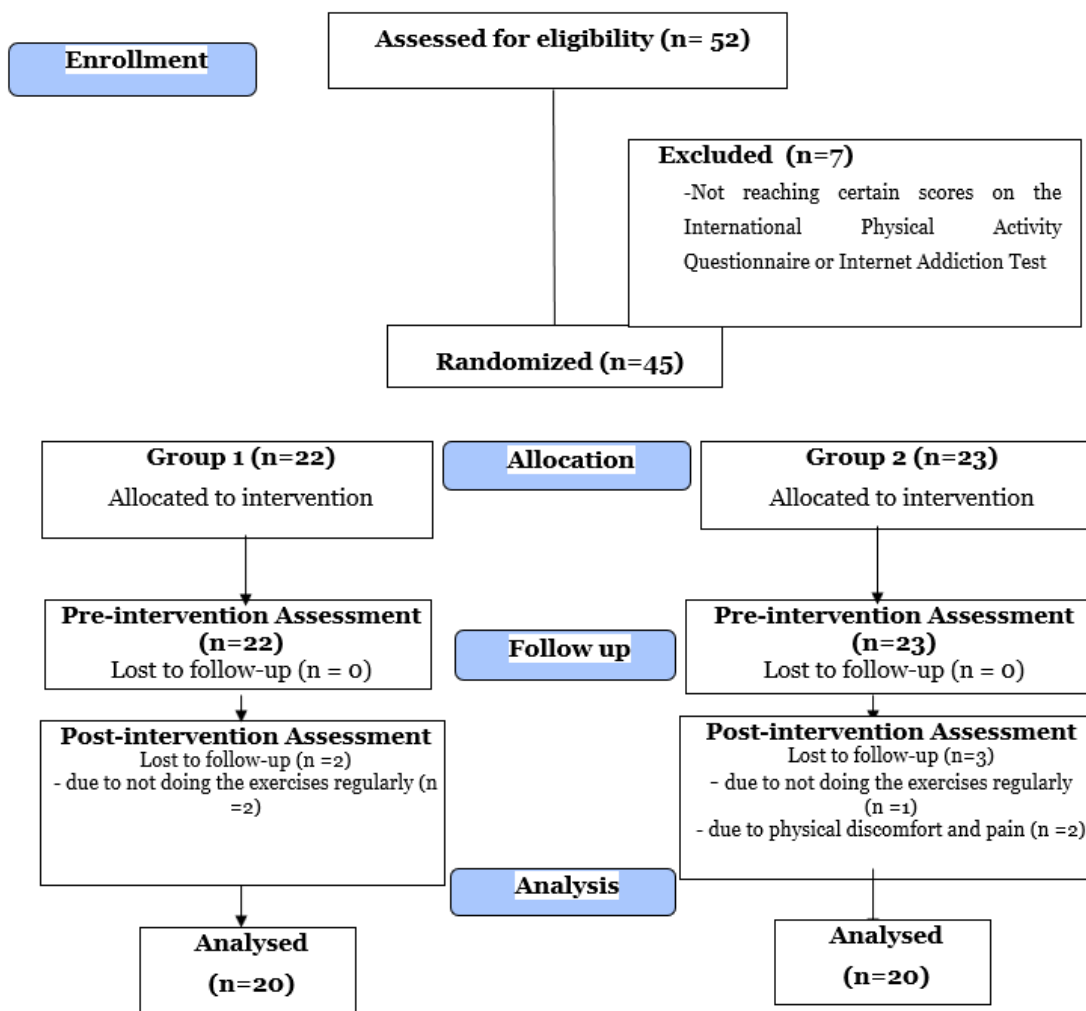
were informed about the study and provided their written consent. Participants were informed about the study, and their written consent was obtained.

The collected data were examined using SPSS version 26.0 (IBM Corp., Armonk, NY, USA). In the case of continuous data that was not normally distributed, the median and interquartile ranges were used to represent the data. Frequency and percentage were used to depict categorical data—the repeated measures t-test was employed to look at dependent changes in each group for inferential analysis. A p-value of less than 0.05 indicated statistical significance. Each group's dependent variables' assumed normal distribution was examined. The assumption of homogeneity of variances is satisfied because the Levene test of equality of error variances was met, and Box's M test revealed a p-value>0.001.

Results

After baseline assessments, students were divided into two groups using a computer-assisted randomization table (Group 1, n=20 and Group 2, n=20) (Figure 1).

Figure 1. Consolidated standards of reporting trials (consort) flow chart for trial recruitment.



The characteristics of the participants, including their pre-program physical activity levels and internet addiction scores, are presented in Table 1. There were no significant differences among all variables regarding age, gender, BMI, IPAQ, and IAT scores ($p>0.05$).

Table 1. The comparison of participants' characteristics, physical activity levels, and internet addiction scores.

	Group 1 (n=20)	Group 2 (n=20)	p
Female (%)	25	40	0.343
Male (%)	75	60	
Age (year, $\bar{x}\pm sd$)	22.05 $\pm$ 1.15	22.40 $\pm$ 1.35	0.450
BMI (kg/m², $\bar{x}\pm sd$)	24.28 $\pm$ 4.86	23.79 $\pm$ 2.87	0.759
IPAQ	802 $\pm$ 880.2	927 $\pm$ 574.9	0.637
IAT	62.10 $\pm$ 10.18	56.25 $\pm$ 6.02	0.290

Results are given as $\bar{x}\pm sd$ or %. BMI: Body Mass Index, IPAQ: The International Physical Activity Questionnaire, IAT: Internet Addiction Test, n: number of patients, $\bar{x}$: mean, sd: standard deviation, kg: kilogram, m²: meters-square.

Comparative data on pre- and post-program parameters for the groups are shown in Table 2. Post-treatment NDI scores indicated a statistically significant improvement in Group 1 compared to Group 2, both within groups ($p=0.001$) and between groups ($p=0.008$) comparisons ($p<0.05$). Significant increases in PSQI scores were observed in both groups (Group 1: $p=0.005$, Group 2: $p=0.016$; $p<0.05$), although no significant differences were found between the groups ($p>0.05$). Additionally, BAI and PSS scores did not show statistically significant differences within or between groups.

Table 2. Comparative analysis of pre-and post-program parameters for groups.

	Group 1 (n=20)			Group 2 (n=20)			Inter-group p
	Pre-Program ($\bar{x}\pm sd$)	Post-program ($\bar{x}\pm sd$)	p	Pre-programs ($\bar{x}\pm sd$)	Post-program ($\bar{x}\pm sd$)	p	
NDI	10.2 $\pm$ 3.76	8.75 $\pm$ 3.66	0.001*	9.30 $\pm$ 3.72	9.1 $\pm$ 3.74	0.408	0.008*
PSQI	14.25 $\pm$ 3.69	13.20 $\pm$ 3.94	0.005*	14.75 $\pm$ 4.31	14.30 $\pm$ 4.34	0.016*	0.113
BAI	29.9 $\pm$ 12.9	29.7 $\pm$ 12.66	0.163	19.8 $\pm$ 14.05	19.75 $\pm$ 13.98	0.330	0.646
PSS	31.23 $\pm$ 6.41	27.45 $\pm$ 4.71	0.058	29.5 $\pm$ 6.21	28.75 $\pm$ 8.37	0.611	0.641

NDI: Neck Disability Index, PSQI=Pittsburgh Sleep Quality Index, BAI: Beck Anxiety Inventory, PSS= Perceived Stress Scale $\bar{x}\pm sd$: mean $\pm$ standard deviation, * $p<0.05$.

Discussion

This study comparing home-based and walking exercise interventions for reducing neck pain symptoms in university students with problematic internet use revealed that only the home exercise group demonstrated a significant reduction in neck disability. Both interventions improved sleep quality, with no superior effect observed for either method.

Additionally, neither intervention led to significant improvements in stress and anxiety levels in the participants.

Recent research has extensively investigated the effects of regular physical exercise on the general population. A meta-analysis has demonstrated that consistent physical activity can benefit pain, sleep quality, and stress levels. Notably, exercise interventions ranging from 2 to 10 weeks have significantly improved overall health²⁷. Studies examining the influence of physical exercise on the negative consequences of prolonged internet use—such as musculoskeletal pain, stress, and sleep disturbances—have underscored the potential benefits of these interventions^{7,11,28}. However, to our knowledge, no studies have specifically investigated the effects of walking and neck exercises on neck pain associated with problematic internet use.

Extensive research has documented the association between elevated internet usage and musculoskeletal pain²⁹. The neck is notably one of the most affected areas among individuals with heightened internet use. Moreover, severe pain in the cervical spine is frequently linked to reduced physical activity^{30,31}. Given the existing literature, our study aimed to investigate the effects of different exercise interventions on NDI scores in students with problematic internet use. The findings of the studies notably demonstrated improvements in NDI scores exclusively within the home exercise group. These home-based exercises likely targeted neck-specific muscles directly, thereby addressing cervical spine issues more effectively than walking interventions. Similarly, a meta-analysis has shown that home exercises focusing on self-mobilization positively impact NDI scores, whether alone or in conjunction with other treatments³². Specifically, isometric and stretching exercises performed at home have been reported to enhance cervical lordosis and alleviate pain³³. Consistent with these findings, our study observed a significant improvement in NDI scores within the home exercise group, where neck-specific exercises were implemented.

In contrast, Sithipornvorakul reported reduced neck pain during a 6-month follow-up for participants who increased their daily walking to a minimum of 7,000 steps, exceeding the threshold examined¹⁰. However, our study did not significantly improve neck pain within the walking group despite participants meeting the 7000 steps daily target. This discrepancy may be attributed to insufficient walking steps or differences in the pain assessment tools used in this study.

Problematic internet use leads to numerous adverse outcomes, including sleep disturbances and anxiety issues. Research indicates that college students with high levels of internet use and sleep problems are more likely to exhibit elevated anxiety and depressive symptoms^{34,35}. A study on prolonged internet use in students suggested enhancing physical activity could help alleviate symptoms associated with excessive internet use³⁶. Another study found that exercise had extensive positive effects on anxiety, depression, interpersonal sensitivity, loneliness, and overall mental health in students with problematic internet use³⁷. Furthermore, a longitudinal study demonstrated that a 12-week exercise program significantly reduced internet use, decreased depression, and improved sleep quality, with sleep assessed using the PSQI questionnaire, similar to our study³⁸. Consistent with our findings and the existing literature, improvements in sleep scores were observed in both the exercise and walking

group³⁹.

Previous research has demonstrated that exercise can be an effective strategy for managing and coping with stress, provided the exercise is appropriately tailored to the individual's needs³⁸. Yan et al. demonstrated in a meta-analysis that exercise interventions have a positive impact on internet addiction and psychological symptoms such as stress⁴⁰. However, this intervention did not significantly affect individuals with moderate to severe internet use⁶. This study mainly involved students with moderate internet usage. Despite this, there was no significant increase in PSS and BAI scores, which measure stress and anxiety, in either intervention group. Surprisingly, the home exercise and walking programs implemented in our study did not produce discernible effects on stress and anxiety levels. This unexpected outcome may be attributed to the baseline stress and anxiety levels of the participants, which may not have been significantly elevated at the start of the study.

This study has several limitations that should be considered. First, the sample size may be insufficient to generalize the findings to a broader population. Additionally, the reliance on self-reported measures, such as surveys and scales, may introduce subjective bias, potentially affecting the accuracy of the data. The homogeneity of the study group, consisting of individuals with specific demographic or clinical characteristics, may also limit the applicability of the results to other populations. Future research should consider increasing the sample size and employing diverse assessment methods to strengthen the findings. Furthermore, as this study focused on participants with a specific level of internet addiction, future studies should examine the effects of interventions across different levels of addiction, providing deeper insights into how interventions may affect individuals at various stages of internet addiction.

Conclusion

As a result of this study, problematic internet use and related symptoms can be alleviated by exercise, but it is unknown which exercise is more effective. Research should examine the mechanisms of exercise-based interventions against problematic internet use and investigate which symptoms of increased internet use may be better reduced by exercise. We also suggest that the effect of exercise intervention on stress in other musculoskeletal pain conditions associated with increased internet use should be examined.

Conflict of Interest Statement: The authors have no conflicts of interest to declare.

Financial Disclosure: The authors declared that this study has no financial support.

Ethical Approval: This study was approved by Medipol University Non-Interventional Clinical Research Ethics Committee (Date:11/08/2024; Number: E-10840098-772.02-4942).

Author Contributions: GD: Concept, Design, Data Collection and Processing, Analysis and/or Interpretation, Literature Review, Article Writing. HG: Concept, Consulting, Analysis and/or Interpretation, Article Writing.

REFERENCES

1. Soriano-Molina E, Limiñana-Gras RM, Patró-Hernández RM, Rubio-Aparicio M.

The association between internet addiction and adolescents' mental health: a meta-analytic review. *Behavioral Sciences*. 2025;15(2):116.

2. Union IT. ICT statistics. 2023. <https://www.itu.int/en/mediacentre/Pages/PR-2023-09-12-universal-and-meaningful-connectivity-by-2030.aspx>. Published September 2023. Accessed 22 April 2024.
3. Türkiye İstatistik Kurumu. Hanehalkı bilişim teknolojileri (BT) kullanım araştırması. 2023. [https://data.tuik.gov.tr/Bulten/Index?p=Hanehalki-Bilisim-Teknolojileri-\(BT\)-Kullanim-Arastirmasi-2023-49407](https://data.tuik.gov.tr/Bulten/Index?p=Hanehalki-Bilisim-Teknolojileri-(BT)-Kullanim-Arastirmasi-2023-49407). Published August 2023. Accessed 22 April 2024.
4. Kuss DJ, Griffiths MD, Karila L, Billieux J. Internet addiction: A systematic review of epidemiological research for the last decade. *Curr Pharm Des*. 2014;20(25):4026-4052.
5. Özer Ş, Odacı H. What are the relationships between problematic internet use and subjective well-being and self-esteem? Investigation of an adolescent sample. *Ilkogretim Online*. 2020;19(3):1592-1604.
6. Tanabe R, Hisamatsu T, Fukuda M, et al. The association between problematic internet use and neck pain among Japanese schoolteachers. *J Occup Health*. 2021;63(1).
7. Cieza A, Causey K, Kamenov K, et al. Global estimates of the need for rehabilitation based on the Global Burden of Disease Study 2019: A systematic analysis for the Global Burden of Disease Study 2019. *Lancet*. 2021;396(10267):2006-2017.
8. Yang G, Cao J, Li Y, et al. Association between internet addiction and the risk of musculoskeletal pain in Chinese first-year college students: A cross-sectional study. *Front Psychol*. 2019;10:1959.
9. Alaca N. The impact of internet addiction on depression, physical activity level, and trigger point sensitivity in Turkish university students. *J Back Musculoskeletal Rehabil*. 2020;33(4):623-630.
10. Sitthipornvorakul E, Sihawong R, Waongenngarm P, Janwantanakul P. The effects of walking intervention on preventing neck pain in office workers: A randomized controlled trial. *J Occup Health*. 2020;62(1):e12106.
11. Junaid M, Yaqoob I, Shakil Ur Rehman S, Ghous M. Effects of post-isometric relaxation, myofascial trigger point release and routine physical therapy in the management of acute mechanical neck pain: A randomized controlled trial. *JPMMA*. 2020;70(10):1688-1692.
12. Park S. Associations of physical activity with sleep satisfaction, perceived stress, and problematic Internet use in Korean adolescents. *BMC Public Health*. 2014;14(1):1143.
13. Wah SW, Chatchawan U, Chatprem T, Puntumetakul R. Prevalence of static balance impairment and associated factors of university student smartphone users with subclinical neck pain: Cross-sectional study. *Int J Environ Res Public Health*. 2022;19(17):10723.

14. Karaaslan Y, Ucuzoglu ME, Yüksel S, Yılmaz Yalçınkaya E. The relationship of pain, disability, physical activity, and body awareness with kinesiophobia in pregnant women with low back pain. *Somatosens Mot Res.* 2023;40(4):156-160.
15. Şermet KŞ, Seviğ EÜ, Zincir H. The effect of solution-focused education and counselling on problematic internet usage, sleep quality and school achievement: A randomized controlled trial. *Int J Nurs Pract.* 2023;29(1):e13097.
16. Özüdoğru Emir Y, Aysan F. Young internet addiction test short form's Turkish adaptation: Validity and reliability study among university students and adolescents. *Anadolu Psikiyatri Derg.* 2016;17(1):69-76.
17. Batool SA, Shakil-Ul-Rehman S, Tariq Z, Ikram M. Effects of fasciatherapy versus fascial manipulation on pain, range of motion and function in patients with chronic neck pain. *BMC Musculoskelet Disord.* 2023;5;24(1):789.
18. Karakaş SA, Gönültaş N, Okanlı A. Sleep quality in shift-working nurses. *ERÜ Sağlık Bilimleri Fakültesi Dergisi.* 2017;4(1):17-26.
19. Secer E, Tanik F, Korucu TS, Gursan IN, Ucurum SG. The relationship between pain level and sleep quality, quality of life and psychological status in patients with chronic neck pain. *JBACHS.* 2020;4(3):258-263.
20. Chapman LK, Williams SR, Mast BT, Woodruff-Borden J. A confirmatory factor analysis of the Beck Anxiety Inventory in African American and European American young adults. *J Anxiety Disord.* 2009;23(3):387-392.
21. Aktürk Z, Dağdeviren N, Mevlut T, Tuğlu C. Birinci basamak için Beck Depresyon Tarama Ölçeği'nin Türkçe çeviriminin geçerlik ve güvenirliği. *Türkiye Aile Hekimliği Dergisi.* 2005;9(3):117-122.
22. Eskin M, Harlak H, Demirkıran F, Dereboy Ç. Algılanan stres ölçeğinin Türkçeye uyarlanması: Güvenirlik ve geçerlik analizi. *New/Yeni Symposium Journal.* 2013;51(3):132-140.
23. Wang W, Ji C, Andersen LL, et al. Effectiveness of manual therapy, computerised mobilisation plus home exercise, and home exercise only in treating work-related neck pain: study protocol for a randomised controlled trial. *BMC Musculoskelet Disord.* 2022;23(1):1119.
24. Martel J, Dugas C, Dubois JD, Descarreaux M. A randomised controlled trial of preventive spinal manipulation with and without a home exercise program for patients with chronic neck pain. *BMC Musculoskelet Disord.* 2011;12:41.
25. U.S. Department of Health and Human Services. 2008 physical activity guidelines for Americans. Hyattsville, MD: U.S. Department of Health and Human Services; 2008. Accessed January 8, 2016. <http://health.gov/paguidelines/guidelines>.
26. Kutlu M, Savcı M, De H. Exercise rehabilitation for smartphone addiction. *Journal of Exercise Rehabilitation.* 2013;9(6):500-5.
27. Barakou I, Sakalidis KE, Abonie US, et al. Effectiveness of physical activity interventions on reducing perceived fatigue among adults with chronic

conditions: A systematic review and meta-analysis of randomised controlled trials. *Sci Rep.* 2023;13(1):14582.

28. Xu J, Tang L. The relationship between physical exercise and problematic internet use in college students: The chain-mediated role of self-control and loneliness. *BMC Public Health.* 2024;24(1):1719.
29. Hellström C, Nilsson KW, Leppert J, Åslund C. Effects of adolescent online gaming time and motives on depressive, musculoskeletal, and psychosomatic symptoms. *Ups J Med Sci.* 2015;120(4):263-75.
30. Borhany T, Shahid E, Siddique WA, Ali H. Musculoskeletal problems in frequent computer and internet users. *J Family Med Prim Care.* 2018;7(2):337-339.
31. Rottermund J, Knapik A, Saulicz E, et al. Back and neck pain among school teachers in Poland and its correlations with physical activity. *Medycyna Pracy.* 2015;66(6):771-778.
32. Zronek M, Sanker H, Newcomb J, Donaldson M. The influence of home exercise programs for patients with non-specific or specific neck pain: A systematic review of the literature. *Journal of Manual & Manipulative Therapy.* 2016;24(2):62-73.
33. Alpayci M, İlter S. Isometric exercise for the cervical extensors can help restore physiological lordosis and reduce neck pain: A randomized controlled trial. *American Journal of Physical Medicine & Rehabilitation.* 2017;96(9):621-626.
34. Fathollahnejad K, Letafatkar A, Hadadnezhad M. The effect of manual therapy and stabilizing exercises on forward head and rounded shoulder postures: A six-week intervention with a one-month follow-up study. *BMC Musculoskeletal Disorders.* 2019;20:86.
35. Li S, Wu Q, Tang C, Chen Z, Liu L. Exercise-based interventions for internet addiction: Neurobiological and neuropsychological evidence. *Frontiers in Psychology.* 2020;11:1296.
36. Cheng M, Wang S, Wang Y, Zhang R, Qin L. Physical activity reduces internet addiction among “post-00” college students: The mediating role of coping styles. *Frontiers in Psychology.* 2023;13:1052510.
37. Zhang Y, Li G, Liu C, Chen H, Guo J, Shi Z. Mixed comparison of interventions for different exercise types on students with Internet addiction: A network meta-analysis. *Frontiers in Psychology.* 2023;14:1111195.
38. Zhang W, Xu R. Effect of exercise intervention on internet addiction and autonomic nervous function in college students. *Biomed Res Int.* 2022(12):1-7.
39. Guo W, Xing H, Gong X, He L, Zhang Z, Jia C. Effects of Yi Jin Jing on juvenile cervical spondylopathy in China: A parallel, randomized, assessor-blinded clinical trial. *Niger J Clin Pract.* 2023;26(9):1234-1241.
40. Yan Y, Qin X, Liu L, Zhang W, Li B. Effects of exercise interventions on internet addiction among college students: A systematic review and meta-analysis of randomized controlled trials. *Addict Behav.* 2025;160:108159.

Preoperative Corrective Exercise Training in ACL Rupture: Effects on Pain, Stability, and Functional Outcomes: A Single-Blind Randomized Controlled Trial

Emre Serdar ATALAY*, Fatmagül VAROL**, Hasan BOMBACI***

Abstract

Aim: This study aimed to investigate the effect of corrective exercise training in addition to routine exercises on patients with anterior cruciate ligament (ACL) rupture.

Method: 36 ACL ruptured participants were included in the study. Patients were randomly divided into exercise and control groups. The exercise group (n=18) received corrective exercise training 5 days a week for 8 weeks in addition to the routine exercise program. The control group (n=18) received a routine exercise program. Demographic information, Visual Analog Scale for pain and instability feeling, Tegner Activity Scale, Lysholm Knee Scoring System, Kujala Patellofemoral Scoring System, and Functional Movement Screen evaluations were done. Evaluations were repeated before exercise training, at the end of the

Results: The average age of the participants was 26.5 years in the exercise group and 28.3 years in the control group. A statistically significant difference was found between the groups in the feeling of stability and FMS total score parameters. However, no difference was found between the groups in the pain parameters, Lysholm score, and Kujala score after exercise ($p < 0.05$). In intra-group comparisons before and after exercise, a significant difference was observed in the feeling of stability and FMS total score values in both groups, and in the same parameter, a considerable difference was found between the two groups after exercise. A significant difference was observed in pain, Lysholm and Kujala scores only in the corrective exercise group.

Conclusion: Pre-operatively applied FMS-based corrective exercise therapy in patients with ACL injury led to significant improvements in pain, knee stability, function, and range of motion.

Keywords: Anterior cruciate ligament tear, corrective exercise, functional movement screen.

ACL R  pt  r  nde Ameliyat   ncesi D  zeltici Egzersiz Eēitimi: Aērı, Stabilit   ve Fonksiyonel Sonu  lar   zerindeki Etkileri: Tek K  r, Randomize Kontroll   Bir   alı  ma

  z

Ama  : Bu   alı  ma,   n   apraz baē (ACL) yırtıēı olan hastalarda rutin egzersizlere ek olarak verilen d  zeltici egzersiz eēitiminin etkisini ara  tırmayı ama  ladı.

Y  ntem:   alı  maya 36    B r  pt  r   olan katılımcı dahil edilmi  tir. Hastalar rastgele egzersiz ve kontrol gruplarına ayrılmı  tır. Egzersiz grubu (n=18), rutin egzersiz programına ek olarak haftada 5 g  n, 8 hafta boyunca d  zeltici egzersiz eēitimi almı  tır. Kontrol grubu (n = 18) ise yalnızca rutin egzersiz programını uygulamı  tır.   alı  mada demografik bilgiler, aērı ve instabilite hissi i  in G  rsel Analog Skalası, Tegner Aktivite   l  eēēi, Lysholm Diz Skoru Sitemi, Kujala Patellofemoral Skoru Sitemi ve Fonksiyonel

  zg  n Ara  tırma Makalesi (Original Research Article)

Geli   / Received: 26.03.2025 & **Kabul / Accepted:** 07.07.2025

DOI: <https://doi.org/10.38079/igusabder.1666167>

* Asst. Prof., University of Health Sciences, Gulhane Faculty of Physiotherapy and Rehabilitation, Ankara, T  rkiye.

E-mail: emreserdar.atalay@sbu.edu.tr [ORCID https://orcid.org/0000-0002-8249-8628](https://orcid.org/0000-0002-8249-8628)

** Asst. Prof., University of Health Sciences, Gulhane Faculty of Physiotherapy and Rehabilitation, Ankara, T  rkiye.

E-mail: fatmagul.varol@sbu.edu.tr [ORCID https://orcid.org/0000-0003-2808-9732](https://orcid.org/0000-0003-2808-9732)

*** Prof. Dr., Yeditepe University, Department of Orthopedics and Traumatology, Istanbul, T  rkiye.

E-mail: bombacih@hotmail.com [ORCID https://orcid.org/0000-0002-8181-9805](https://orcid.org/0000-0002-8181-9805)

ETHICAL STATEMENT: This study was carried out with the approval of the Ethics Committee of University of Health Sciences Hamidiye Non-Interventional Research Ethics Committee, dated 25/01/2019 and numbered 19/03. A signed subject consent form in accordance with the Declaration of Helsinki was obtained from each participant.

Hareket Tarama deęerlendirmeleri yapılmıřtır. Deęerlendirmeler, egzersiz eęitimi öncesinde ve 8 haftalık program sonunda tekrarlanmıřtır.

Bulgular: Katılımcıların ortalama yařı egzersiz grubunda 26,5 yıl, kontrol grubunda ise 28,3 yıl olarak bulunmuřtur. Gruplar arasında stabilite hissi ve FMS toplam puanı açısından istatistiksel olarak anlamlı bir fark tespit edilmiřtir. Ancak, egzersiz sonrası aęrı parametreleri, Lysholm skoru ve Kujala skoru açısından gruplar arasında anlamlı bir fark bulunmamıřtır ($p < 0.05$). Grup içi karřılařtırmalarda hem egzersiz hem de kontrol grubunda stabilite hissi ve FMS toplam puanı açısından anlamlı gelişmeler gözlemlenmiřtir. Bununla birlikte, egzersiz sonrası aynı parametrelerde gruplar arasında da belirgin bir fark saptanmıřtır. Aęrı, Lysholm ve Kujala skorlarında anlamlı iyileřme yalnızca düzeltici egzersiz grubunda gözlenmiřtir.

Sonuç: Ön çapraz baę yaralanması olan hastalarda, ameliyat öncesi uygulanan FMS tabanlı düzeltici egzersiz tedavisi, aęrı, diz stabilitesi, fonksiyon ve eklem hareket açıklıęında önemli iyileřmelere yol açmıřtır.

Anahtar Sözcükler: Düzeltici egzersiz, fonksiyonel hareket taraması, ön çapraz baę rüptürü.

Introduction

Anterior cruciate ligament (ACL) ruptures are a prevalent injury among athletes and active individuals, often resulting in significant functional impairments and prolonged rehabilitation periods^{1,2}. These injuries can severely affect knee stability, leading to pain, functional limitations, and an increased risk of further damage if not managed properly³. Traditional rehabilitation protocols focus on restoring knee strength and range of motion; however, they may not sufficiently address the underlying biomechanical and neuromuscular deficiencies contributing to poor outcomes^{4,5}. Recent advances in rehabilitation emphasize the integration of corrective exercises targeting the kinetic chain to enhance overall functional recovery and prevent re-injury⁶.

Functional Movement Screening (FMS) has become an effective tool for identifying movement dysfunctions and asymmetries that may predispose individuals to injuries⁷. Research indicates that suboptimal movement patterns contribute to an increased risk of musculoskeletal injuries, particularly in individuals with pre-existing conditions such as ACL ruptures^{8,9}. By incorporating FMS-based corrective exercises into rehabilitation programs, clinicians can address these dysfunctions, potentially improving outcomes for patients with ACL injuries^{10,11}. Previous studies have demonstrated the benefits of functional movement training in enhancing knee function and reducing the risk of secondary injuries post-ACL reconstruction^{12,13}. Additionally, neuromuscular training interventions incorporating FMS principles have been shown to improve balance, proprioception, and knee joint stability in ACL-injured individuals^{14,15}.

However, there is limited evidence on the efficacy of combining traditional rehabilitation approaches with corrective exercises in patients with primary ACL ruptures who have not yet undergone surgical intervention¹⁶. Addressing neuromuscular deficits through FMS-based exercises may provide a comprehensive approach to optimizing functional recovery. This study aims to evaluate the effects of a combined traditional and corrective exercise program on pain, knee insecurity, and functional movement in patients with primary ACL ruptures. We hypothesize that adding FMS-based corrective exercises will result in superior outcomes compared to a traditional exercise program alone. The findings of this study may provide valuable insights into optimizing rehabilitation protocols for ACL injuries, ultimately improving patient outcomes and reducing the burden of knee injuries in the active population.

Material and Methods

Design

This is a single-blind randomized controlled clinical study.

Participants

Patients with anterior cruciate ligament rupture and who have not yet been operated on will be included.

Inclusion criteria: Primary ACL Rupture, a maximum of 12 months have passed after the rupture, being between the ages of 18-35, not indicating emergency surgery.

Exclusion criteria: Accompanying multiple ligament injuries, accompanying Grade 3 Meniscus tear, presence of more than grade II chondromalacia according to the Outerbridge classification, having a history of operation/instability on the same knee¹.

Procedures

The patients who met the inclusion criteria were referred to the investigator by the orthopedic surgeon for rehabilitation. Participants were randomly allocated to groups using a computer-generated random number sequence in a 1:1 ratio. The allocation was concealed in sequentially numbered, sealed opaque envelopes. The outcome assessor was blinded to group assignment to minimize bias. After the initial evaluation, the traditional exercise approach, which will last for 8 weeks, was given to the control group, and the corrective exercise program, which was applied in addition to the traditional approach for the same period, was given to the corrective exercise group. The exercise program was carried out by the responsible researcher in the Physiotherapy and Rehabilitation Department three times a week. The first evaluation was taken before starting the exercises, and the second evaluation was taken at the end of the eight-week exercise program.

Evaluations were made by the other investigator, without knowing which group they belonged to.

Pain and knee instability feeling was measured with the visual analog scale (VAS).

Functional Movement Screen (FMS): FMS is a test consisting of 7 sub-parameters that reveal the functional inadequacies of individuals. These tests are deep squat, hurdle step, in-line lunge, shoulder mobility, active leg raise, trunk stability push up, and rotary stability. Scoring between 0-3 is given in the scoring of the test, and 0 points are given in the presence of pain, even if the movement is performed successfully^{7,10}.

Functional Evaluation and Classification: Tegner Activity Level Scale, Lysholm Knee Scoring Scale, and Kujala Patellofemoral Scoring Scale were used. The Tegner Activity Scale was utilized solely to ensure group homogeneity in terms of participants' pre-injury activity levels and was not used as an outcome measure.

Exercise Program: The weight was adjusted according to the muscle strength of the patient, in painful cases, the exercise was started without weight, and weight was added according to tolerance.

Standard Program:

- 1- Concentric knee extension exercise with free weight in the sitting position.
- 2- Concentric knee flexion exercise with a free weight in the prone position.
- 3- Prone knee flexion exercise, with the help of the other leg at the end of the range.
- 4- Exercise to increase the range of motion of extension by placing a roll under the heel in a sitting position.
- 5- The exercise of pulling a resistance band with one end attached to a place and the other end on the ankle in four directions.

Corrective Exercises:

- 1- Dorsi flexion mobility exercise with a stick in a half-kneel position. In this exercise, the patient moves forward without raising the front heel, holding the stick so that it remains on the outside of the front foot and the inside of the knee.
- 2- Half-knee position hip flexor stretching exercise
- 3- Rotation exercise to the left and right in the half-kneel position while holding the stick on the neck with both hands.
- 4- Prone to supine, supine to prone progressions
- 5- Side plank with knees flexed, and after that legs straight
- 6- Rolling from the supine position to the side by squeezing the roll between the knee and the elbow

Quadriceps and hamstring strengthening, knee flexion-extension range of motion, and knee stabilization exercises will be applied to the control group. In addition to these exercises, corrective exercises based on FMS will be applied to the application group. These exercises include the upper and lower joints and trunk in addition to the knee, addressing the integrity of the kinetic chain^{7,10}.

The exercises were done in three sessions a week under the control of a physical therapist for eight weeks. After the exercise program, measurements were repeated.

Ethical Statement

This study was carried out with the approval of the Ethics Committee of University of Health Sciences Hamidiye Non-Interventional Research Ethics Committee, dated 25/01/2019 and numbered 19/03. A signed subject consent form in accordance with the Declaration of Helsinki was obtained from each participant.

Statistical Analysis

Statistical analyses were performed using SPSS version 21.0 (IBM Inc., Armonk, NY, USA) software. The normality of the data was investigated by the One-Sample Kolmogorov-Smirnov test. Assessing the differences between the two measurements before and after the same group was done with the Wilcoxon test. The Mann-Whitney-U test was used for numerical comparisons between independent groups of the study. The significance level was set to $p < 0.05$. Cohen's d was calculated for the clinical effect size.

Results

The demographic information of the participants is shown in Table 1.

Table 1. Demographic characteristics of the participants

	Group 1 (Corrective Exercise Group) (n=18) (Mean $\pm$ SD)	Group 2 (Control Group) (n=18) (Mean $\pm$ SD)	Significance level* (p-value)
Age	26.5 $\pm$ 8,42	28.38 $\pm$ 7.93	0.514
Body Mass Index	24.46 $\pm$ 2.40	25.25 $\pm$ 3.40	0.580
	n (%)	n (%)	
Gender	5 female (27.77%) 13 male (72.23%)	6 female (33.33%) 12 male (66.66%)	
Tegner Activity Score Before Injury	4.66 $\pm$ 1.64	4.16 $\pm$ 1.29	0.687

SD: Standard Deviation, * Mann-Whitney U Test

Pain and stability feel comparisons in-group and between-group pre-exercise and post-exercise shown at Table 2.

Table 2. Pain and stability feel comparisons in-group and between-group pre-exercise and post-exercise

Pain and Stability Feel (Visual Analog Scale)	Pre-exercise				Post-exercise				Differences between pre- and post-exercise
	Pain		Stability Feel		Pain		Stability Feel		
	Mean	SD*	Mean	SD*	Mean	SD*	Mean	SD*	
Corrective Exercise Group	2.16	2.20	5.5	2.25	0.89	1.19	2.31	1.45	Pain p= 0.006 ^{β*}
									Stability Feel p= 0.001 ^{β*}
Control Group	3.22	2.28	6.66	2.65	2.05	2.09	5	2.14	Pain p= 0.119 ^{β*}
									Stability Feel p= 0.014 ^{β*}
Differences between groups	p= 0.164 ^{α*} Cohen's d: 0.47		p= 0.038 ^{α*} Cohen's d: 0.47		p= 0.109 ^{α*} Cohen's d: 0.63		p= 0.001 ^{α*} Cohen's d: 1.53		

α = Mann Whitney U test, β = Wilcoxon test, SD: Standard Deviation

Functional movement screen total score comparisons in-group and between-group pre-exercise and post-exercise shown at Table 3.

Table 3. Functional movement screen total score comparisons in-group and between-group pre-exercise and post-exercise

FMS TOTAL SCORE	Pre-exercise		Post-exercise		Differences between pre and post-exercise
	Mean	SD	Mean	SD	
Corrective Exercise Group	10.83	1.88	13.83	1.54	p= 0.001 ^β *
Control Group	10.44	2.09	12.22	1.73	p= 0.006 ^β *
Differences between groups	p= 0.550 ^α * Cohen's d: 0.19		p= 0.004 ^α * Cohen's d: 0.98		

α= Mann Whitney U test, β= Wilcoxon test, FMS=Functional Movement Screen, SD: Standard Deviation

Lysholm and Kujala score comparisons in-group and between-group pre-exercise and post-exercise shown at Table 4.

Table 4. Lysholm and Kujala score comparisons in-group and between-group pre-exercise and post-exercise

Lysholm and Kujala Scores	Pre-exercise				Post-exercise				Differences between pre and post-exercise
	Lysholm		Kujala		Lysholm		Kujala		
	Mean	SD*	Mean	SD*	Mean	SD*	Mean	SD*	
Corrective Exercise Group	68.16	15.12	70.55	14.99	80.83	13.12	80.33	14.59	Lysholm p= 0.001 ^{β*}
									Kujala p= 0.001 ^{β*}
Control Group	70.5	14.43	70.5	14.81	76.27	13.39	76.22	12.71	Lysholm p= 0.246 ^{β*}
									Kujala p= 0.191 ^{β*}
Differences between groups	p= 0.486 ^{α*} Cohen's d: 0.15		p= 0.912 ^{α*} Cohen's d: 0.003		p= 0.288 ^{α*} Cohen's d: 0.34		p= 0.235 ^{α*} Cohen's d: 0.30		

α= Mann-Whitney U test, β= Wilcoxon test

Discussion

In the present study, the effects of corrective exercises, in addition to traditional exercises, on pain, stability perception, and Functional Movement Screen (FMS) scores were examined in two groups who participated in an 8-week rehabilitation program before undergoing Anterior Cruciate Ligament Reconstruction (ACLR). It was observed that corrective exercises significantly reduced pain severity, which is a key concern in

ACL injuries^{2,15}. Although both groups showed significant improvement in stability perception, the corrective exercise group demonstrated superior results compared to the control group. Similarly, the FMS total score improved significantly in both groups; however, the corrective exercise group exhibited a greater improvement in between-group comparisons^{3,5}.

Pain and proprioceptive deficits, commonly observed in ACL injuries, contribute to joint instability and impaired neuromuscular control^{6,17}. The FMS protocol emphasizes the activation of proprioceptors throughout the kinetic chain, facilitating improved movement coordination and stabilization⁷. Deficiencies in proprioceptive function can negatively impact the kinetic coupling system, leading to altered mobility, compromised stability, and movement asymmetries that are difficult to compensate for^{12,14}. Therefore, rehabilitation should not only focus on isolated knee strengthening but should also incorporate strategies targeting global movement quality and neuromuscular efficiency⁵.

Traditional rehabilitation programs often prioritize agility, strength, and power while overlooking fundamental movement patterns and neuromuscular efficiency^{13,15}. FMS-based corrective exercises, however, address movement deficiencies and provide a structured approach to enhancing dynamic stability and injury prevention^{8,9}. The clinical significance of preoperative rehabilitation lies in its potential to reduce postoperative complications and optimize functional recovery¹⁶. Research has suggested that individuals scoring below 14 on the FMS are at a heightened risk for injury, emphasizing the importance of preoperative movement screening and correction^{3,8}.

Our findings align with previous studies demonstrating the effectiveness of corrective exercises in improving FMS scores and overall knee function¹¹. However, comparative studies in this domain remain limited, making it challenging to benchmark our results against a robust body of literature. Bodden et al.¹⁸ (2015) investigated the effects of an FMS-based corrective exercise program on mixed martial arts (MMA) athletes and found significant improvements in movement quality after just four weeks of training. Similarly, a six-week FMS-integrated rehabilitation program for military personnel successfully bridged the gap between clinical rehabilitation and return-to-duty readiness¹⁹.

In ACL rehabilitation, neuromuscular training incorporating FMS principles has been associated with superior functional outcomes and reduced reinjury rates^{6,14}. Chao et al.¹¹ (2018) reported improved Lysholm Knee Scores and FMS scores in patients undergoing ACLR when corrective exercises were added to routine rehabilitation. While most studies have focused on postoperative interventions, our study uniquely evaluates the impact of FMS-based exercises in the preoperative phase, highlighting its potential for optimizing recovery trajectories before surgery. To our knowledge, no other studies have assessed FMS-based corrective exercises in preoperative ACL rehabilitation, making our findings a valuable contribution to this field.

Many FMS-related studies have centered on athletic populations and injury prevention strategies. Future research should explore whether correcting movement deficiencies leads to long-term reductions in injury risk and improved functional outcomes across diverse populations, including non-athletes and sedentary individuals^{15,16}. Additionally, further investigation is required to determine the most effective exercise prescription

and duration for sustaining functional improvements beyond the rehabilitation period. To our knowledge, few studies have specifically investigated FMS-based interventions in the preoperative setting. Most existing research focuses on using FMS for injury risk screening or athletic season comparison—for example, Suzuki et al.²⁰ compared FMS scores between preparative and competitive periods in high school baseball players.

This study has some limitations. Firstly, this was a single-center study with a relatively small sample size, which may limit the generalizability of our findings. Secondly, while our results demonstrate the short-term benefits of preoperative FMS-based training, we were unable to assess postoperative effects and long-term treatment outcomes. More randomized controlled trials are needed to establish the clinical efficacy of integrating FMS-based corrective exercises into preoperative ACL rehabilitation programs.

Conclusion

FMS-based corrective exercise therapy in the pre-operative period for patients after ACL injury provided significant improvement in pain, sense of stability, knee function, and knee movements. We recommend integrating FMS-based assessment and exercise into pre-operative period routine rehabilitation practices.

Funding Information

This study has not received any funding.

REFERENCES

1. Murray MM. Current status and potential therapies to stimulate repair of the anterior cruciate ligament. *J Orthop Res.* 2009;27(4):515-521.
2. Arden CL, Webster KE, Taylor NF, Feller JA. Return to sport following anterior cruciate ligament reconstruction surgery: A systematic review and meta-analysis of the state of play. *Br J Sports Med.* 2011;45(7):596-606.
3. Myer GD, Ford KR, Paterno MV, Nick TG, Hewett TE. The effects of generalized joint laxity on dynamic knee motion in ACL-injured girls. *Clin J Sport Med.* 2008;18(1):2-9.
4. Risberg MA, Lewek M, Snyder-Mackler L. A systematic review of evidence for anterior cruciate ligament rehabilitation: How much and what type? *Phys Ther Sport.* 2004;5(3):125-145.
5. Hewett TE, Myer GD, Ford KR. Anterior cruciate ligament injuries in female athletes: Part 1, mechanisms and risk factors. *Am J Sports Med.* 2013;34(2):299-311.
6. Paterno MV, Rauh MJ, Schmitt LC, Ford KR, Hewett TE. Incidence of second ACL injuries 2 years after primary ACL reconstruction and return to sport. *Am J Sports Med.* 2010;38(7):1276-1283.
7. Cook G, Burton L, Hoogenboom BJ, Voight M. Functional movement screening: The use of fundamental movements as an assessment of function-Part 1. *Int J Sports Phys Ther.* 2014;9(3):396-409.
8. Kiesel K, Plisky PJ, Voight ML. Can serious injury in professional football be predicted by a preseason functional movement screen? *N Am J Sports Phys Ther.* 2007;2(3):147-158.

9. Chorba RS, Chorba DJ, Bouillon LE, Overmyer CA, Landis JA. Use of a functional movement screening tool to determine injury risk in female collegiate athletes. *N Am J Sports Phys Ther.* 2010;5(2):47-54.
10. Cook G, Burton L, Hoogenboom BJ, Voight M. Functional movement screening: The use of fundamental movements as an assessment of function-part 2. *Int J Sports Phys Ther.* 2014;9(4):549-63.
11. Chao WC, Shih JC, Chen KC, Wu CL, Wu NY, Lo CS. The effect of functional movement training after anterior cruciate ligament reconstruction: A randomized controlled trial. *J Sport Rehabil.* 2018;27(6):541-545.
12. Padua DA, Marshall SW, Boling MC, Thigpen CA, Garrett WE, Beutler AI. The landing error scoring system (LESS) is a valid and reliable clinical assessment tool of jump-landing biomechanics: The JUMP-ACL study. *Am J Sports Med.* 2012;37(10):1996-2002.
13. Grooms DR, Myer GD, Paterno MV, Ford KR, Hewett TE. Neuroplasticity mechanisms associated with ACL injury prevention and rehabilitation. *J Orthop Res.* 2017;35(10):2266-2274.
14. Sugimoto D, Myer GD, Barber Foss KD, Hewett TE. Specific exercise effects of preventive neuromuscular training intervention on anterior cruciate ligament injury risk reduction in young females: Meta-analysis and subgroup analysis. *Br J Sports Med.* 2015;49(5):282-289.
15. Dingenen B, Gokeler A. Optimization of the return-to-sport paradigm after anterior cruciate ligament reconstruction: A critical review of the literature. *Br J Sports Med.* 2017;51(22):1323-1328.
16. Chaudhari AM, Briant PL, Bevill SL, Koo S, Andriacchi TP. Knee kinematics change due to age and walking speed, but not gender. *Gait Posture.* 2011;31(1):17-22.
17. Riemann BL, Lephart SM. The sensorimotor system, part I: The physiologic basis of functional joint stability. *J Athl Train.* 2002;37(1):71-79.
18. Bodden JG, Needham RA, Chockalingam N. The effect of an intervention program on functional movement screen test scores in mixed martial arts athletes. *J Strength Cond Res.* 2015;29(1):219-225.
19. Gross DL, Christopher GE, Faulk RT. Functional training program bridges rehabilitation and return to duty. *J Spec Oper Med.* 2009;9(2):29-48.
20. Suzuki K, Akasaka K, Otsudo T, et al. Effects of functional movement screen training in high-school baseball players: A randomized controlled clinical trial. *Medicine (Baltimore).* 2021;100(14):e25423.

The Effect of Midwife-Led Practices on Birth Expectancy and Experience Outcomes: Systematic Review and Meta-Analysis

Fatma Şule BİLGİÇ*, Aysu YILDIZ KARAAHMET**, Fatma AZİZOĞLU***

Abstract

Aim: The objective of this study was to conduct a systematic review of the birth expectations and experiences associated with midwife-led interventions, and to perform a meta-analysis of the existing evidence.

Method: The literature review was carried out between November and December 2024 across four electronic databases: PubMed, Cochrane Library, Web of Science, and ULAKBIM. Articles were identified using MeSH-based keywords. Only Randomized Controlled Trials (RCTs) were included in this unrestricted search. The data were analyzed using the Review Manager software.

Results: A total of seven studies, involving 936 women, were included in the analysis. According to the results of the random effects model, significant differences in birth expectations were observed between the groups in the post-test (MD: -15.58, 95% CI: -30.74 to -0.42, Z = 2.01, p = 0.04). Additionally, the results showed significant differences in childbirth self-efficacy values between the groups in the post-test (MD: 43.60, 95% CI: 24.53 to 62.67, Z = 4.48, p < 0.00001).

Conclusions: Consistent with the findings of the studies included in the review, midwife-led interventions were shown to reduce childbirth-related fear and stress in pregnant women and during the puerperium, while also enhancing their perception of self-efficacy for childbirth. These interventions contribute to low-quality evidence.

Keywords: Midwife-led, birth expectancy, experience, childbirth self-efficacy.

Ebe Liderliğindeki Uygulamaların Doğum Beklentisi ve Deneyimi Üzerine Etkisi: Sistematik İnceleme ve Meta-Analiz

Öz

Amaç: Bu çalışmanın amacı, ebe liderliğindeki uygulamaların doğum beklentileri ve deneyimleri üzerindeki etkilerini sistematik bir şekilde incelemek ve mevcut kanıtları meta-analiz yöntemiyle değerlendirmektir.

Yöntem: Literatür taraması, Kasım ve Aralık 2024 tarihlerinde PubMed, Cochrane Library, Web of Science ve ULAKBIM gibi dört elektronik veri tabanında yapılmıştır. Yayımlanan makaleler, MeSH terimleri kullanılarak belirlenmiştir. Aramada yalnızca Randomize Kontrollü Çalışmalar (RCT) dahil edilmiştir. Veriler, Review Manager yazılımı ile analiz edilmiştir.

Bulgular: Meta-analize toplamda 936 kadını içeren yedi çalışma dahil edilmiştir. Random etkiler modeline göre, gruplar arasında doğum beklentileri açısından post-test sonuçlarında anlamlı farklar bulunmuştur (MD: -15,58, 95% CI: -30,74 ile -0,42, Z = 2,01, p = 0,04). Ayrıca, post-testte doğum öz-yeterlilik değerlerinde de gruplar arasında anlamlı farklar gözlemlenmiştir (MD: 43,60, 95% CI: 24,53 ile 62,67, Z = 4,48, p < 0,00001).

Sonuç: İncelenen çalışmaların bulgularına göre, ebe tarafından yönlendirilen müdahaleler, hamile kadınların doğum korkusu ve stresini azalttığı, lohusalık döneminde de bu etkinin devam ettiği ve kadınların

Özgün Araştırma Makalesi (Original Research Article)

Geliş / Received: 31.12.2024 & **Kabul / Accepted:** 28.07.2025

DOI: <https://doi.org/10.38079/igusabder.1610921>

* Asst. Prof., Çanakkale Onsekiz Mart University, Faculty of Health Sciences, Department of Midwifery, Çanakkale, Türkiye. E-mail: sulebilgic@outlook.com [ORCID https://orcid.org/0000-0002-5950-2553](https://orcid.org/0000-0002-5950-2553)

** Asst. Prof., Biruni University, Faculty of Health Sciences, Department of Midwifery, Istanbul, Türkiye. E-mail: aysuyildiz@hotmail.com [ORCID https://orcid.org/0000-0003-1134-9016](https://orcid.org/0000-0003-1134-9016)

*** Asst. Prof., Haliç University, Faculty of Health Sciences, Department of Nursing, Istanbul, Türkiye. E-mail: fatmaazizoglu@halic.edu.tr [ORCID https://orcid.org/0000-0002-7102-9797](https://orcid.org/0000-0002-7102-9797)

doğumla ilgili öz-yeterlilik algılarını artırdığı görülmüştür. Ancak, bu müdahaleler düşük kaliteli kanıtlara dayanmaktadır.

Anahtar Sözcükler: Ebe liderliğinde doğum, doğum beklentisi, deneyim, doğum öz yeterliliği.

Introduction

Pregnancy and childbirth represent major physiological milestones in a woman's life. Throughout this process, a woman's emotional well-being may vary, which can increase her vulnerability to psychological stress and lead to various mental health concerns. Although pregnancy is commonly associated with excitement and positive emotions, research indicates that around 14% of expectant women experience significant fear regarding childbirth^{1,2}.

The fear of childbirth, which can lead to a range of psychological and physiological challenges, may develop either before or during pregnancy, or it can be triggered following a traumatic or distressing birth experience. Pregnancy-related stress poses considerable health risks during the perinatal period and can have a negative effect on the childbirth process, its outcomes, and the overall satisfaction with the experience³⁻⁵. Complications during pregnancy caused by stress can lead to issues such as hypertension, preterm birth, and intrauterine growth restriction, all of which are significant contributors to perinatal morbidity and mortality. Furthermore, when a pregnant woman experiences stress, it increases the likelihood of the baby facing long-term emotional, behavioral, and cognitive challenges^{3,4}.

In perinatal care, midwives play a vital role through continuous interaction with the woman. From pregnancy through the postpartum period, personalized midwifery care tailored to the specific needs and cultural context of each woman aims to enhance both maternal and infant health. In midwife-led care models, a familiar and trusted midwife provides support throughout the prenatal, labor, and postpartum stages, promoting a healthy pregnancy, safe delivery, and effective parenting practices^{6,7}. In the studies conducted, it is reported that midwife-led care will reduce negative emotions such as fear, and anxiety while increasing birth outcomes and women's experiences^{8,9}, and meta-analysis studies that will constitute evidence are very limited. The aim of this study was to systematically review the birth expectancy and experience outcomes of midwife-led interventions and to meta-analysis.

Material and Methods

In this study, a systematic review and meta-analysis were conducted following the guidelines outlined in the PRISMA 2020 statement¹⁰.

Eligibility criteria

The PICOS (Population, Intervention, Comparator, Outcome, Study design) criteria outlined below were applied to select studies for inclusion in this systematic review and meta-analysis.

Population (P): Pregnant women, with the following inclusion criteria: (1) Healthy pregnancy and fetus.

Intervention (I): Midwife-led practices added to routine care, (1): Mindfulness, (2): Psychoeducation and education (4): Model of continuing midwifery care (5) Cognitive Behavioral therapy (6) Yoga.

Comparison (C): (1) Routine care.

Outcome (O): (1): Birth anticipation and experience, (2) Childbirth self-efficacy 3) Stress.

Study design (S): Only RCTs were included in the review. Studies addressing risks or health issues in mothers and infants, as well as those focusing on pregnant women with psychological disorders, were excluded. Furthermore, articles that used invalid measurement tools, along with traditional and systematic reviews, were not included.

Search strategy

The systematic review and meta-analysis literature search was conducted between November and December 2024 across four electronic platforms: PubMed, CINAHL, Scopus, and ULAKBİM. Midwife-led practices were identified through the use of specific medical terms and keywords. These included "midwife-led" AND "education" OR "mindfulness" OR "consulting" AND "pregnant" AND "delivery" OR "birth" AND "pain" OR "labor" AND "fear of birth" AND "psychological parameters" OR "stress." To minimize bias, the articles identified during the screening process were independently evaluated by the same researchers to ensure they met the inclusion and exclusion criteria. Full texts of studies not defined by the summaries were also assessed.

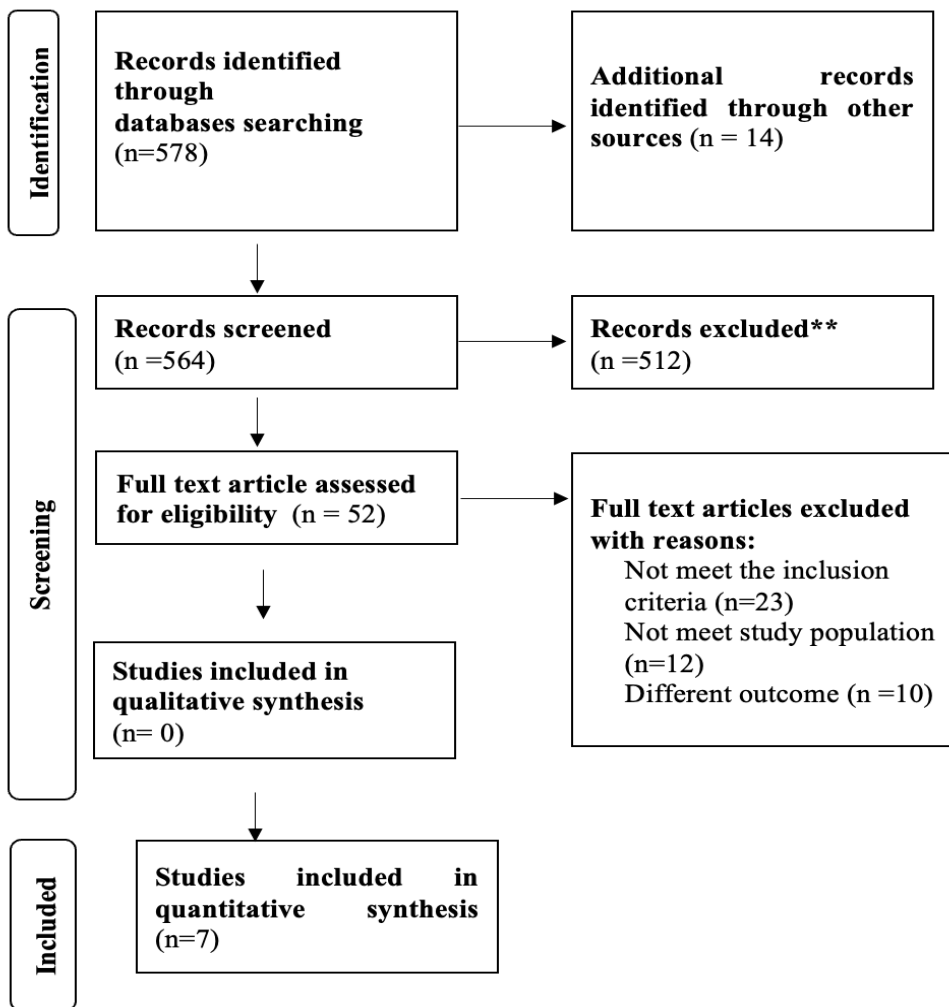
The data analysis

The data for the meta-analysis were processed with Review Manager 5.4. Statistical analyses employed two-tailed tests, with a p-value lower than 0.05 considered statistically significant. The quality of the randomized controlled trials included was assessed using the Cochrane Risk-of-Bias tool, Version 2 (RoB-2). An independent risk-of-bias assessment for the included studies was conducted by one of the authors (FŞB, AYK) using this tool.

Results

Literature review

Through electronic database searches and manual reviews, a total of 578 studies were initially identified. Among these, 512 articles with full-text access were evaluated. After screening the titles and abstracts for relevance, 512 articles were excluded for failing to meet the inclusion criteria. These excluded studies included review articles, protocols, duplicates, studies involving different populations, and those not adhering to the inclusion standards. The remaining 52 full-text articles underwent further eligibility assessment. Ultimately, seven RCTs were included in the quantitative synthesis, as they fulfilled the necessary criteria (Figure 1).

Figure 1. PRISMA flow diagram. PRISMA

Study characteristics

This systematic review and meta-analysis include seven studies involving a total of 936 women. It aims to systematically evaluate the effect of midwife-led practices on birth expectations and experiences, as well as to assess the available evidence^{8,11-16}. In the applications for pregnant women in the articles included in the analysis, mindfulness was applied in two studies^{14,15}, psychoeducation or training in four studies^{8,11-13}. Yilmaz Esencan and Rathfisch¹⁶ applied a midwife-led yoga intervention. All the studies included in the study were healthy women. Birth experience/expectancy, birth self-efficacy and stress were evaluated in the studies (Table 1).

Table 1. General characteristics of the included studies

Reference\ Country	Study design	Population	The inclusion criteria	Intervention Duration	Comparisons	Drop out	Primary Outcome	Other Outcomes	Results
Van der Meulen, et al. ¹⁴ Holland	RCT*	141 Pregnant (EG:75; CG:66)	Women with 16-26 GW were included. -Participation in another hypno-birth in the last year,	Intervention: Mindfulness Duration: 9-week session of 3 hours	CG: Routine protocol	None	W-DEQ*	Perceived Stress Scale, EPDS*, Pregnancy Experience Scale	No significant differences were found between MBCP and ECAU overall, but MBCP participants who labored reported a more positive birth experience.
Yilmaz Esencan and Rathfisch, ¹⁶ Turkey	RCT*	103 Pregnant (EG:34 CG:69)	Primiparous pregnant women, aged 20-36 weeks of gestation, expecting a single fetus with no complications or systemic disease, who were expected to have a spontaneous, normal birth, and could speak Turkish.	Intervention: Yoga Duration: 60 minutes for 10 weeks, twice a week	CG: routine protocol	EG:4, CG:9	W-DEQ*	Childbirth Self-Efficacy Inventory	The intervention group demonstrated significantly higher rates of vaginal delivery, lower intervention and episiotomy rates, reduced pain levels, and WIJMA B scores, along with higher CBSEI scores when compared to the control group.
Veringa-Skiba et al. ¹⁵ Holland	Single Blind RCT*	141 Pregnant (EG:75 CG:66)	Pregnant women who had no prior restrictions on giving birth without medication and who had a W-DEQ-A $\geq$ of 66 and a W-DEQ-A $\geq$ of 66 were included.	Intervention: Mindful Birthing (MBCP) Duration: 9 sessions of interventions, each lasting three hours	CG: Routine protocol	EG:19, CG:11	W-DEQ*	Catastrophizing Labor Pain, Willingness to Accept Obstetric Interventions, The Perinatal Disaster Scenario Scale	MBCP was more effective than enhanced care as usual in reducing childbirth fear and pain catastrophizing, while also lowering the likelihood of epidural analgesia and cesarean section, and increasing the chances of unmedicated childbirth.
Çankaya and Şimşek, ⁸ Turkey	Single Blind RCT*	120 Pregnant (EG:60, CG:60)	Women over 18 years of age, primiparous, with a healthy single pregnancy between 20-32 weeks of gestation, expecting a term birth (38-42 weeks), and with healthy infants were included.	Intervention: Educational intervention based on the philosophy Duration: 2 weeks	CG: routine protocol	EG:5, CG:3	W-DEQ*	Childbirth Self-Efficacy Inventory	Women in the antenatal education group had lower birth fear, stress, and depression, higher childbirth self-efficacy, and fewer postnatal symptoms compared to the control group.
Isbir and Serçekuş, ¹¹ Turkey	Single Blind RCT*	72 Pregnant (EG:36, CG:36)	$\geq$ 18 years old and literate, at least primary school graduate; Gestational age $\geq$ 37 days No contraindications to spontaneous vaginal delivery; $\leq$ 3 cm cervical dilatation; Being conscious and being able to communicate in Turkish were included.	Intervention: Intrapartum continuous midwifery care model Duration: During the period of labor	CG: routine protocol	EG:3, CG:6	W-DEQ*	N/A	The intervention group experienced less delivery fear, higher perceived support and control, lower pain scores during the transient phase of labor, and a shorter delivery duration compared to the control group ($p < 0.05$).

Turkstra et al.¹³ Australia	RCT*	339 Pregnant (EG:170, CG:169)	The study included second-trimester women who were admitted to the hospital's prenatal clinics, could speak English profusely, and were 16 years of age or older.	Intervention: Psychoeducation by telephone Duration: At a time, convenient for them at weeks 24 and 34.	CG: Routine protocol	EG:81, CG:74	W-DEQ*	N/A	The intervention did not increase costs, but a post hoc analysis indicated it could be cost-effective for women with high levels of childbirth fear.
Rouhe et al.¹² Finland	RCT*	371 Pregnant (EG:131, CG:240)	WDEQ-A ≥ 100 recipient and primiparous women were included.	Intervention: Psychoeducation Duration: 6 times for the pregnant	CG: Orientation to first step	EG:54, CG:116	WDEQ*	N/A	Social support, intervention participation, and a less fearful childbirth experience predicted better maternal adjustment and lower postnatal depressive symptoms.

RCT: Randomized Control Trials, EG: Experimental group, CG: Control Group, W-DEQ-A: Wijma Delivery Expectancy/ Experience Questionnaire

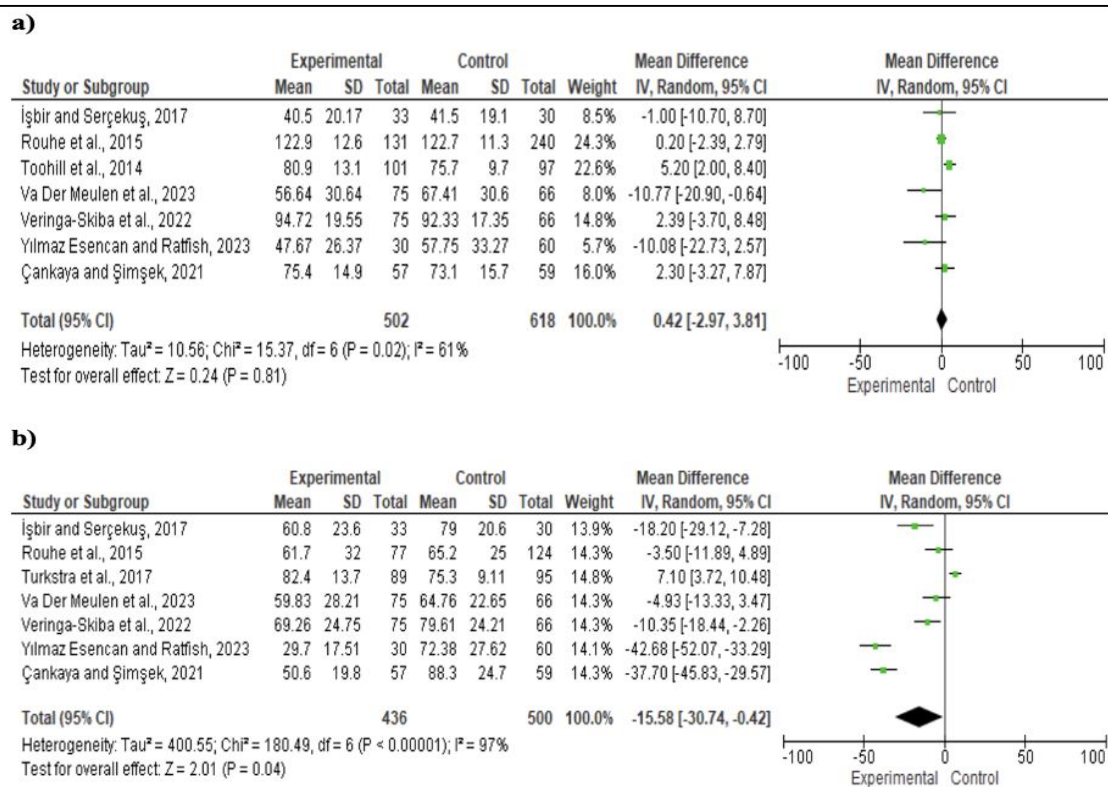
Outcomes

The meta-analysis results were visualized using a forest plot. Among the seven studies included in the analysis^{8,11-16}, birth expectancy and experience were assessed, with these outcomes being prioritized as primary measures. In addition, two studies that focused on childbirth self-efficacy^{8,16}, as well as two studies investigating the impact of practices on stress levels^{8,14}, were considered secondary outcomes in the meta-analysis.

Primary outcomes

Birth expectancy/ experience

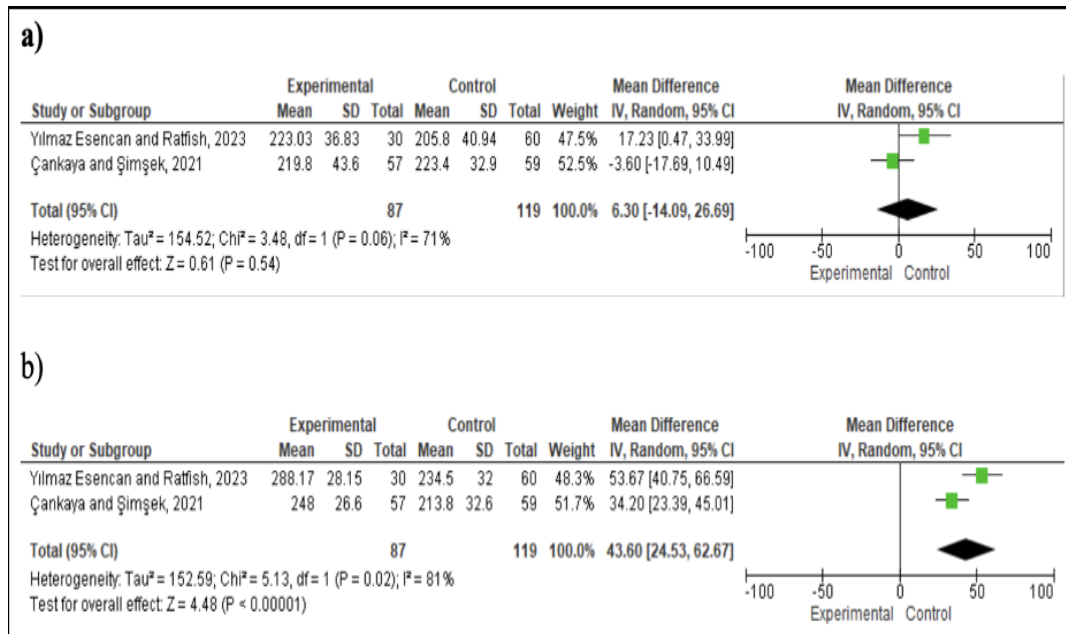
In the studies reviewed, seven studies reported birth expectancy/ experience outcomes at pretest, while eight studies reported these outcomes at posttest. When the data from the studies were pooled, a high level of heterogeneity was observed ($I^2=61\%$, $p=0.02$). As a result, the random effects model revealed no significant difference in birth expectancy between the groups at pretest (MD: 0.42, 95% CI: -2.97 to 3.81, $Z=0.24$, $p=0.81$). However, upon analyzing the post-intervention data, very high heterogeneity was found ($I^2=97\%$, $p<0.00001$). In this instance, the random effects model indicated a significant difference in birth expectancy between the groups at posttest (MD: -15.58, 95% CI: -30.74 to -0.42, $Z=2.01$, $p=0.04$) (Figure 2 a-b).

Figure 2 (a, b). Forest plot of comparison: Meta-analysis results on the effect of midwife-led on the (a) Delivery Expectancy (b) Delivery Experience

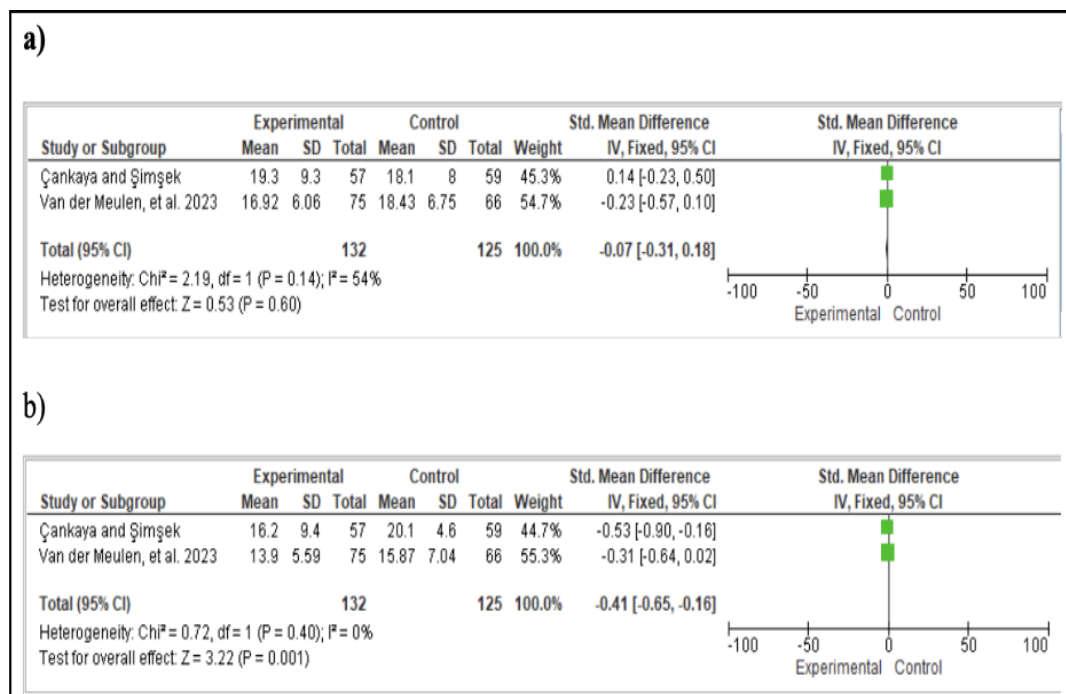
Secondary outcomes

Childbirth self-efficacy

Two studies evaluated childbirth self-efficacy outcomes. When the data from these studies were combined, a high degree of heterogeneity was observed ($I^2=71\%$, $p=0.06$). As a result, the random effects model indicated no significant difference in childbirth self-efficacy between the groups at pretest (MD: 6.30, 95% CI: -14.09 to 26.69, $Z=0.61$, $p=0.54$). However, when analyzing the post-intervention data, heterogeneity remained high ($I^2=81\%$, $p=0.02$). The random effects model revealed significant differences in childbirth self-efficacy between the groups at the posttest (MD: 43.60, 95% CI: 24.53 to 62.67, $Z = 4.48$, $p < 0.00001$) (Figure 3 a-b).

Figure 3 (a, b). Forest plot of comparison: Meta-analysis results on the effect of midwife-led on the Childbirth self-efficacy: (a) Pre-intervention (b) post-intervention**Stress**

Two studies evaluated stress levels in the participants. The pooled data indicated no significant difference in stress levels between the groups at the pretest (SMD: -0.07, 95% CI: -0.31 to 0.18, $Z = 0.53$, $p = 0.60$). However, a significant difference was observed at the posttest (SMD: -0.41, 95% CI: -0.65 to -0.16, $Z = 3.22$, $p = 0.001$) (Figure 4a-b).

Figure 4 (a, b). Forest plot of comparison: Meta-analysis results on the effect of midwife-led on the Stress: (a) Pre-intervention (b) post-intervention

Risk of bias

All studies utilized appropriate methods for the random allocation of pregnant women into groups^{8,11-16}, resulting in a low risk of bias assessment. One study ensured allocation concealment by using sequentially numbered, sealed opaque envelopes, which contributed to its low risk of bias¹⁶. In contrast, the remaining studies were deemed to have a low risk of attrition bias, as the dropouts were either equally distributed between the intervention and control groups or were minimal enough to have no significant effect on the study outcomes^{8,11,14-16}.

Regarding reporting bias, all studies included in the meta-analysis were deemed to have a low risk, as they provided balanced discussions of both positive and negative outcomes and ensured consistent reporting throughout. Furthermore, each study was assessed for other potential sources of bias that had not been previously addressed. Specifically, we examined whether any conflicts of interest or funding sources were disclosed. None of the included studies reported any other significant sources of bias^{8,11-16} (Figure 5 a, b).

Figure 5 a,b. Risk of Bias, RoBs

	Random sequence generation (selection bias)	Allocation concealment (selection bias)	Blinding of participants and personnel (performance bias)	Blinding of outcome assessment (detection bias)	Incomplete outcome data (attrition bias)	Selective reporting (reporting bias)	Other bias
Çankaya and Şimşek, 2021	+	+	+	-	+	+	+
İşbir and Serçekuş, 2017	+	+	+	-	+	+	+
Rouhe et al., 2015	+	+	-	-	-	+	+
Turkstra et al., 2017	+	+	-	-	-	+	+
Va Der Meulen et al., 2023	+	+	-	-	+	+	+
Veringa-Skiba et al., 2022	+	+	+	-	-	+	+
Yılmaz Esencan and Ratfish, 2023	+	-	-	-	+	+	+

Discussion

This study aimed to reveal the evidence regarding the impact of midwife-led practices on birth experiences and psychological outcomes. In the study, it was found that midwife-led practices met the expectations of birth in pregnant and puerperal, reduced fear of childbirth, and stress, increased the perception of self-efficacy, and constituted moderate quality evidence.

Meeting expectations during childbirth is essential for women, as achieving these expectations is closely associated with higher birth satisfaction. The findings from the

meta-analysis revealed that midwife-led practices contributed to reducing the expectations of pregnant women, ultimately leading to those expectations being fulfilled. A recent meta-synthesis underscored that key factors for a positive birth experience include the alignment of birth expectations with personal values. The study further highlighted that having a healthy baby in a safe environment, emotional and practical support from a companion, and care from skilled and compassionate staff are crucial elements for a positive birth outcome¹⁷.

Although childbirth is a natural physiological process, it can elicit a wide range of both positive and negative emotions. In this meta-analysis, midwife-led practices were found to reduce fear of childbirth and stress. Similar studies in the literature have shown that midwife-led practices positively influence women's birth experiences by alleviating negative emotions such as fear, anxiety, and stress. The findings of this study align with the existing literature in this regard^{8,9,11}. It is thought that midwife-led practices can be effective in reducing fear, stress, by strengthening coping mechanisms.

The process of childbirth is closely tied to the concept of self-efficacy, which refers to a woman's confidence and belief in her ability to give birth in a safe and healthy manner. The study found that midwife-led practices increased women's perception of self-efficacy. The fact that the woman sees and accepts the birth as a normal process and that she is confident in this regard can be explained by the concept of self-efficacy. In pregnant women with low self-efficacy perception, the birth process may be adversely affected. It is reported that increased self-efficacy in childbirth reduces the fear of childbirth in pregnant women^{18,19}. The ability of pregnant women to act with maturity when they experience a stressful experience, such as childbirth, depends on the individual's ability to separate thoughts from the more reactive emotion process²⁰. In the literature, it is shown that midwife-led practices enable pregnant women to have a more positive birth experience in which they reduce the level of stress, anxiety, and fear²¹⁻²⁴. The study findings are similar to the studies in literature.

Overall, the findings of this study align with and contribute to the growing body of evidence supporting midwife-led practices as a beneficial model of care. These practices not only respond to women's emotional and psychological needs during childbirth but also promote a more personalized, respectful, and empowering birth environment. As childbirth experiences have long-term effects on maternal well-being, enhancing midwife-led care may offer a sustainable approach to improving both clinical outcomes and women's satisfaction. Continued emphasis on evidence-based, woman-centered care models will be essential in shaping future maternity services.

Conclusion

In line with the analyzed studies, midwife-led practices reduce the fear of childbirth, and stress in pregnant women and puerperal, while increasing the perception of self-efficacy about birth. In addition, it has been revealed that midwife-led practices affect birth experiences and more examples of practices with midwives are needed in this regard. The results are valuable in that they provide an overview of the planned studies in this field.

REFERENCES

1. O'Connell MA, Leahy-Warren P, Khashan AS, Kenny LC, O'Neill SM. Worldwide prevalence of tocophobia in pregnant women: systematic review and meta-analysis. *Acta Obstetrica et Gynecologica Scandinavica*. 2017;96(8):907-920.
2. Jomeen J, Martin CR, Jones C, et al. Tokophobia and fear of birth: a workshop consensus statement on current issues and recommendations for future research. *Journal of Reproductive and Infant Psychology*. 2021;39(1):2-15.
3. Akın B, Çankaya S. A sense of consistency, perceived stress and fear of childbirth in pregnant women. *Turkish Journal of Family Medicine and Primary Care*. 2022;16(4):772-778.
4. Arslantaş H, Çoban A, Dereboy F, Sarı E, Şahbaz M, Kurnaz D. Factors affecting the fear of childbirth in the last trimester pregnant women and the relationship between the fear of childbirth and postpartum depression and maternal attachment. *Cukurova Medical Journal*. 2020;45(1):239-250.
5. Yaylaoğlu Ö, Zengin N. Examining the relationship between fear of childbirth and spiritual well-being in pregnant women: a descriptive study. *Turkiye Klinikleri J Health Sci*. 2023;8(1):57-64.
6. World Health Organization. (2018). WHO recommendations Intrapartum care for a positive childbirth experience. <https://www.who.int/reproductivehealth/publications/intrapartum-care-guidelines/en>
7. Çevik A, Avcıbay Vurgeç B. Midwife-led care in postpartum. *Journal of Midwifery and Health Sciences*. 2022;5(1):37-45
8. Çankaya S, Şimşek B. Effects of antenatal education on fear of birth, depression, anxiety, childbirth self-efficacy, and mode of delivery in primiparous pregnant women: a prospective randomized controlled study. *Clin Nurs Res*. 2021;30(6):818-829.
9. Asadzadeh L, Jafari E, Kharaghani R, Taremian F. Effectiveness of midwife-led brief counseling intervention on post-traumatic stress disorder, depression, and anxiety symptoms of women experiencing a traumatic childbirth: a randomized controlled trial. *BMC Pregnancy and Childbirth*. 2020;20(1):1-9. doi: 10.1186/s12884-020-2826-1.
10. Tugwell P, Tovey D. PRISMA 2020. *Journal of Clinical Epidemiology*, 2021;134:A5-A6.
11. İsbir GG, Serçekuş P. The effects of intrapartum supportive care on fear of delivery and labor outcomes: a single-blind randomized controlled trial. *Journal of Nursing Research*. 2017;25(2):112-119. doi: 10.1097/JNR.000000000000129
12. Rouhe H, Salmela-Aro K, Toivanen R, et al. Group psychoeducation with relaxation for severe fear of childbirth improves maternal adjustment and childbirth experience—a randomised controlled trial. *Journal of Psychosomatic Obstetrics & Gynecology*, 2015;36(1):1-9. doi: 10.3109/0167482X.2014.980722

13. Turkstra E, Mihala G, Scuffham PA, et al. An economic evaluation alongside a randomised controlled trial on psycho-education counselling intervention offered by midwives to address women's fear of childbirth in Australia. *Sexual & Reproductive Healthcare*. 2017;11:1-6. doi: 10.1016/j.srhc.2016.08.003
14. Van der Meulen RT, Veringa-Skiba IK, Van Steensel FJA, Bögels SM, De Bruin EI. Mindfulness-based childbirth and parenting for pregnant women with high fear of childbirth and their partners: outcomes of a randomized controlled trial assessing short-and longer-term effects on psychological well-being, birth and pregnancy experience. *Midwifery*. 2023;116:103545. doi: 10.1016/j.midw.2022.103545
15. Veringa-Skiba IK, De Bruin EI, van Steensel FJ, Bögels SM. Fear of childbirth, nonurgent obstetric interventions, and newborn outcomes: A randomized controlled trial comparing mindfulness-based childbirth and parenting with enhanced care as usual. *Birth*. 2022;49(1):40-51. doi: 10.1111/birt.12571
16. Yilmaz Esencan T, Rathfisch G. Effects of yoga and meditation on the birth process. *Alternative Therapies in Health and Medicine*. 2023;29(1):6-14.
17. Downe S, Finlayson K, Oladapo O, Bonet M, Gülmezoglu AM. What matters to women during childbirth: a systematic qualitative review. *PloS One*. 2018;13(4): e0194906.
18. Barut S, Uçar T. The relationship between birth self-efficacy perception and fear of childbirth in pregnant women. *Mersin University Journal of Health Sciences*. 2018;11(2):107-115.
19. Barut S, Uçar T. Effects of motivational interviews on childbirth perceptions and childbirthself-efficacy in nulliparous pregnant women: a randomised-controlled trial. *Journal of Reproductive and Infant Psychology*. 2022;1-16.
20. Sutcliffe KL, Levett K, Dahlen HG, Newnham E, MacKay LM. How do anxiety and relationship factors influence the application of childbirth education strategies during labor and birth: a bowen family systems perspective. *International Journal of Women's Health*. 2023;455-465. doi: 10.2147/IJWH.S399588.
21. Association of Women's Health, Obstetric and Neonatal Nurses, (AWHONN). Convention. Denver, Colorado, USA. *J Obstet Gynecol Neonatal Nurs*. 2011;40Suppl 1:1-134.
22. Dinç H, Yazıcı S, Yılmaz T, Günaydın S. Pregnant education. pregnancy education. *Journal of Health Sciences and Professions*. 2014;1(1):68-76.
23. Rathfisch G. *The Philosophy of Natural Birth Is an Adventure That Has Taken Place for Millions of Years*. Istanbul: Nobel Medical Bookstores, 2012.
24. Buran G, Olgaç Z, Karaçam Z. The effect of childbirth preparation classes on women's birth style, fear, and experience: a systematic review. *Life Sciences (NWSALS)*. 2020;15(4):41-54. doi: 10.12739/NWSA.2020.15.4.4B00

Comparison of Therapist-Supervised and Home Exercise Calisthenics Exercises in Post-Covid Syndrome: A Single Blind, Randomized Controlled Trial

Alper PERÇİN*, Sena BİLÄZER**, Havva Ezgi ALBAYRAK***, Cansu ÖZDEMİR****,
Cahidenur KOÇAK*****

Abstract

Aim: Post-Covid syndrome (PCS) is a condition that becomes chronic after the acute phase of Covid-19 and affects systems such as respiratory, cardiovascular, nervous, and musculoskeletal, and negatively affects patients' quality of life (QoL). The aim of this study was to investigate the effect of calisthenics exercises on QoL in patients with PCS.

Method: A total of 176 patients (male: 82, female: 94) with PCS were included and randomized to therapist-supervised and home exercise groups in this study. The calisthenics exercise program was carried out for eight weeks in both groups. QoL was assessed by the European Quality of Life 5-Dimensional 3-Level (EQ-5D-3L) questionnaire at baseline and after eight weeks.

Results: Significant improvements were obtained in all parameters of the EQ-5D-3L scale, including mobility, self-care, usual activities, pain/discomfort, anxiety/depression and general health score ($p < 0.05$) in both therapist-supervised and home exercise groups. When therapist-supervised and home exercise groups were compared in terms of EQ-5D-3L, no significant difference was found between these groups ($p > 0.05$).

Conclusion: Calisthenics exercises cause a significant increase in the QoL in patients with Post-Covid syndrome when administered both as a therapist-supervised and home exercise program.

Keywords: Calisthenics, COVID-19, post-acute COVID-19 syndrome, long COVID, quality of life.

Post-Covid Sendromunda Terapist Gözetiminde ve Evde Yapılan Kalistenik Egzersizlerinin Karşılaştırılması: Tek Kör, Randomize Kontrollü Bir Çalışma

Öz

Amaç: Post-Kovid sendromu (PKS), Covid-19'un akut fazından sonra kronikleşen, solunum, kardiyovasküler, sinir ve kas-iskelet sistemlerini etkileyen ve hastaların yaşam kalitesini olumsuz yönde etkileyen bir durumdur. Bu çalışmanın amacı, PKS'li hastalarda kalistenik egzersizlerin yaşam kalitesi üzerindeki etkisini araştırmaktır.

Yöntem: Bu çalışmaya toplam 176 PKS'li hasta (erkek: 82, kadın: 94) dahil edilmiş ve terapist gözetiminde ve evde egzersiz gruplarına randomize edilmiştir. Her iki grupta da sekiz hafta boyunca kalistenik egzersiz

Özgün Araştırma Makalesi (Original Research Article)

Geliş / Received: 09.03.2025 & **Kabul / Accepted:** 28.07.2025

DOI: <https://doi.org/10.38079/igusabder.1654185>

* Asst. Prof., Department of Occupational Therapy, Faculty of Health Sciences, Avrasya University, Trabzon, Türkiye.

E-mail: alperpercin@avrasya.edu.tr ORCID <https://orcid.org/0000-0001-7974-6945>

** Lect., Department of Therapy and Rehabilitation, Vocational School of Health Services, Avrasya University, Trabzon, Türkiye. E-mail: sena.bilazer@avrasya.edu.tr ORCID <https://orcid.org/0009-0002-3103-8362>

*** Lect., Department of Therapy and Rehabilitation, Vocational School of Health Services, Avrasya University, Trabzon, Türkiye. E-mail: ezgi.karas@avrasya.edu.tr ORCID <https://orcid.org/0000-0002-4595-2043>

**** Res. Asst., Department of Occupational Therapy, Faculty of Health Sciences, Avrasya University, Trabzon, Türkiye.

E-mail: cansu.ozdemir@avrasya.edu.tr ORCID <https://orcid.org/0009-0000-8908-5941>

***** Res. Asst., Department of Physiotherapy and Rehabilitation, Faculty of Health Sciences, Avrasya University, Trabzon, Türkiye. E-mail: cahidenur.kocak@avrasya.edu.tr ORCID <https://orcid.org/0000-0003-3362-2415>

ETHICAL STATEMENT: Ethical approval was obtained from Igdr University Non-Interventional Clinical Research Ethics Committee (Date of approval: 25.10.2023, Decision number: 2/3).

programı uygulandı. Yaşam kalitesi, başlangıçta ve sekiz hafta sonra Avrupa Yaşam Kalitesi 5 Boyutlu 3 Seviye (EQ-5D-3L) anketi ile değerlendirilmiştir.

Bulgular: EQ-5D-3L ölçeğinin mobilité, öz bakım, olağan aktiviteler, ağrı/rahatsızlık, anksiyete/depresyon ve genel sağlık skorunu içeren tüm parametrelerinde hem terapist gözetiminde hem de evde egzersiz gruplarında anlamlı iyileşmeler elde edildi ($p < 0.05$). Terapist gözetimindeki ve ev egzersiz grupları EQ-5D-3L açısından karşılaştırıldığında, bu gruplar arasında anlamlı bir fark bulunmamıştır ($p > 0.05$).

Sonuç: Kalistenik egzersizler hem terapist gözetiminde hem de evde egzersiz programı olarak uygulandığında Post-Covid sendromlu hastalarda yaşam kalitesinde anlamlı bir artışa neden olmaktadır.

Anahtar Sözcükler: Kalistenikler, COVID-19, post-akut COVID-19 sendromu, uzamış COVID, yaşam kalitesi.

Introduction

Post-Covid syndrome (PCS) includes some symptoms that persist for twelve weeks or more after the acute phase of Covid-19 and are not associated with other health problems¹. Time classification has been proposed for PCS; sub-acute Covid-19 symptoms refer to symptoms that occur four to twelve weeks after acute Covid-19, while chronic Covid-19 symptoms refer to symptoms that occur after twelve weeks and cannot be associated with any other health problems². It should be emphasized that the findings can be seen not only in Covid-19 patients treated in the hospital but also in patients treated at home.

Previous research showed that long-term results affecting such as respiratory, cardiovascular, central nervous, and musculoskeletal systems may be encountered^{3,4}. Although dyspnea, decreased exercise capacity, and hypoxia are among the most common symptoms, decreased glomerular filtration rate, subacute thyroiditis, palpitation, chest pain, fatigue, myalgia, headache, dystonia, cognitive impairment, anxiety, depression and sleep disorders may also be seen⁵⁻⁷. It investigated the effects of PCS on physical capacity, fatigue and quality of life (QoL) and reported that patients with PCS showed decreased physical capacity and QoL⁸. Similarly, it was suggested that more research is needed into multimodal treatment approaches for individual performance in order to decrease fatigue and thereby increase physical capacity and QoL⁹.

Calisthenics is a type of exercise that uses body weight, usually without equipment. This type of exercise is highly effective in increasing muscle strength, endurance, and flexibility. Calisthenics are dynamic sets of exercises with rhythmic characteristics that can increase aerobic capacity and use agonist-antagonist muscle groups together¹⁰. As well as contributing to health-related physical capacity parameters (endurance, muscle strength, flexibility, posture), calisthenics has a positive effect on parameters such as balance, proprioception, agility, cognitive function and psychomotor skills. In addition, the fact that no special equipment is needed, that it can be done anywhere as a home exercise program, is one of the important advantages of calisthenics. At the same time, the rate of injuries caused by calisthenics is quite low¹¹.

Exercise interventions, which have been used for the decline in physical capacity and QoL, have also started to be used to combat the symptoms that occur after PCS¹². For this purpose, home exercise training, tele-rehabilitation, robotic rehabilitation, and therapist-supervised exercise training have come to the fore¹³⁻¹⁵. The positive effects of

exercise on both the cardiovascular system and the musculoskeletal system have led to studies on which exercise intervention will be more effective after PCS.

In this study, it was hypothesized that calisthenics may be effective on the QoL of patients with PCS. It was aimed to investigate the effect of calisthenics on QoL with therapist-supervised and home exercises in patients with PCS.

Materials and Methods

Study Design

Participants signed an informed consent form prior to enrolment and the details were clearly explained. This randomized controlled trial used a quantitative approach with a pre- and post-test design to compare the effect of calisthenics on QoL in patients with PCS in the form of a therapist-supervised and a home-exercise program.

Participants

Participants who had previously been infected with Covid-19 and had symptoms for twelve weeks or more despite resolution of the infection, and who presented to the clinic and met the eligibility criteria, were invited to participate in this study. Confirmation that participants had previously been diagnosed with Covid-19 and had a positive polymerase chain reaction (PCR) test was verified with patient consent through the national health system. Participants were informed of the content of the study and of their rights to withdraw from the study without giving a reason. Written informed consent was obtained from each patient prior to enrolment.

Inclusion and Exclusion Criteria

Inclusion criteria for the study: Aged between 18 and 65 years, with a history of Covid-19 infection and Post-Covid symptoms for 12 weeks or longer. ***Exclusion criteria:*** Pregnancy, having received physiotherapy within the last six months, having been diagnosed with another acute or chronic disease.

Randomization: Patients who met the study inclusion criteria were asked to choose a number between 1-176 from the numbered papers in a closed box, and the number chosen was recorded and then randomly distributed to both groups using computer software (www.randomizer.org). This process was completed by one of the researchers. This researcher was not involved in the assessment and intervention process. In this trial, the therapist-supervised and the home-based exercises were carried out by physiotherapists, while the assessment was carried out by a different physiotherapist at baseline and at the end of week eight, to ensure single-blinding (assessor blinding).

Assessment

The participants' physical characteristics, such as age, gender, height and weight, were first recorded and then their body mass index (BMI) was calculated. The symptoms experienced by the participants were also recorded. In this study, the EQ-5D-3L (European Quality of Life 5-Dimensional 3-Level) questionnaire was administered to the participants before and after the exercise intervention^{16,17}. This questionnaire consists of five dimensions describing different aspects of health: Mobility, self-care, usual daily activities, pain/discomfort, and anxiety/depression). Each dimension has three levels and is completed by checking one of the boxes: no problems, some problems and extreme

problems. Finally, patients were asked to rate the general health score out of 100. The Turkish validity and reliability study of the questionnaire was conducted by Kahyaoglu and Unsar (2011)¹⁸.

Intervention

The American College of Sports Medicine (ACSM) guidelines for chronic obstructive pulmonary disease and cardiovascular diseases were used to determine type, duration and intensity of exercise intervention¹⁹. The exercise program was initially planned for three days per week, one session per day, with three repetitions of each calisthenics exercise. The number of repetitions was increased by one each week to gradually increase the calisthenics. At week eight, each exercise was performed with 10 repetitions. The exercise program included in both the therapist-supervised and home exercise groups is shown in Table 1.

Table 1. Exercise program for therapist-supervised and home exercise groups

Warm-up	Calisthenic Exercises	Cool-down
Stepping back with raised arms	Jumping Jack	Low pace walking
Chest expansion	Burpee	
Side jack	Mountain climber	
Hip rotations	Squat Thrust	
Arm circles	Squat	
Neck tilt	Jump squat	
	Split jump	
	Plank	

The exercise program consists of three phases: Warm-up period, calisthenics and cool-down period. The warm-up exercises consisted of stepping back and forth with raised arms, side jack, hip rotations, arm circles and neck tilt. Calisthenics consisted of jumping jacks, burpees, mountain climbers, squat thrusts, squats, squat jumps, split jumps, and plank. Cool-down exercises consisted of low-tempo walking for 5 minutes.

Pre-exercise warm-up exercises are performed to achieve optimum performance and maintain muscle temperature without burning energy reserves²⁰. Warm-up exercises consisted of 5-minute dynamic warm-up exercises. The cooling exercise was determined as walking at a low pace for 5 minutes in the corridor. Active cool-down exercise is more effective than the passive cooling method to support recovery after exercise²¹. Therefore, the cool-down exercises were composed of dynamic exercises.

The Borg CR-10 scale was used to determine exercise intensity in the therapist-supervised and home exercise groups²². The Borg CR-10 scale is a numerical scale ranging from 0-10 (nothing to very difficult) and measures the exertional dyspnea experienced by patients during exercise²³. Patients were fully instructed that the intensity of the exercise should be completed at level 5 (difficult) on the Borg CR-10 scale. In accordance with the Borg CR-10 scale, patients were allowed to slow down the pace of their exercise when they reached a level of 5 on this scale, focusing on feelings of exertion

such as shortness of breath and exertion during exercise. The scale is easy to understand and can be maintained by the researcher or the patient.

A training program and booklet on how to do the exercises were produced for the home exercise group. The booklet included visuals of the exercises and detailed explanations of how to perform them. An exercise diary was provided for the participants to follow and they were asked to complete the exercise program. At the end of the study, the exercise diaries were submitted to the researchers by the participants. In order to verify the follow-up of the home exercise program, the participants were interviewed every week via video call on phones.

Ethical Statement

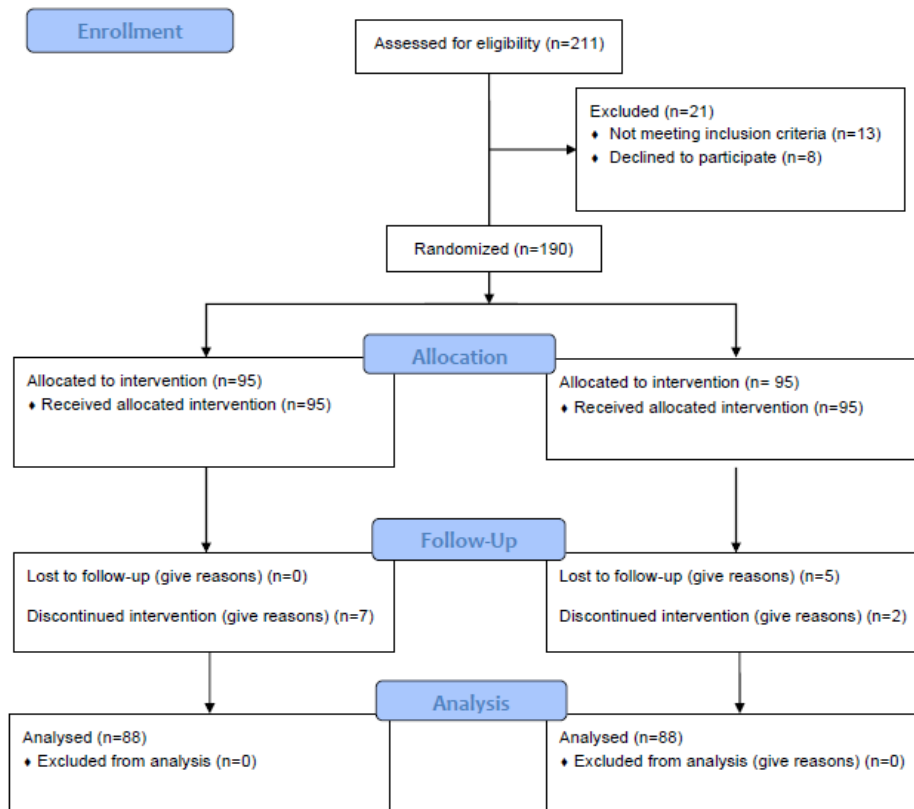
This prospective and randomized controlled trial was completed at the Physical Therapy Laboratory of Avrasya University between January and December 2024 in accordance with the Declaration of Helsinki. Ethical approval was obtained from Iğdır University Non-Interventional Clinical Research Ethics Committee (Date of approval: 25.10.2023, Decision number: 2/3). The clinical trial number was NCT06568393.

Statistical Analysis

Sample size calculations were performed using G*power software (version 3.1.9.6). Effect size $d:0.5$, alpha level 0.05 and power: 95% were selected. At least 176 subjects were considered eligible for statistical analysis. The Statistical Package for the Social Sciences (SPSS) (version 28.0.1 MAC) was used for data analysis. Quantitative variables were expressed as mean $\pm$ standard deviation (SD) and qualitative variables as number (n) and percentage (%). Normality analysis was performed using the Kolmogorov-Smirnov test. When comparing two groups, the independent samples t-test was used if the parametric assumption was met. When comparing intra-group variables, the paired samples t-test was used when the parametric test assumption was met. The level of statistical significance was accepted as $p<0.05$.

Results

The random allocation of enrolled participants to groups, the number of participants who received treatment and were analyzed for the primary outcome, and the number of participants who were excluded and dropped out of the study is shown in Figure 1.

Figure 1. Flow diagram of the study.

The physical characteristics of the patients included in the study were shown in Table 2. The physical characteristics of the participants were similar ($p>0.05$) in this study.

Table 2. Physical characteristics of the participants

	Home exercises	Calisthenic Exercises		
Baseline	n=88	n=88		
Variables	Mean $\pm$SD	Mean $\pm$SD	t	p
Age (year)	33 $\pm$ 6.56	35 $\pm$ 7.04	1.220	.273
Height (cm)	168 $\pm$ 7.95	167 $\pm$ 7.19	.094	.759
Weight (kg)	61 $\pm$ 10.89	60 $\pm$ 8.73	1.178	.281
BMI (kg/m ²)	21 $\pm$ 2.72	21 $\pm$ 7.78	1.193	.662
Gender	n (%)	n (%)	X²	p
Male	42 (52%)	40 (55%)	17.556	.732
Female	46 (48%)	48 (45%)		

¹n: number of participants, X²: chi-square, t: independent samples t test, BMI: Body Mass Index, $p>0.05$

In Table 3, the EQ-5D-3L sub-parameters scores were compared between the therapist-supervised and the home exercise groups at baseline and after eight weeks. At baseline, the therapist-supervised exercise and home exercise groups were similar in terms of mobility, self-care, usual activities, pain/discomfort, anxiety/depression, and general health score ($p>0.05$). After 8 weeks of exercise program, no significant difference was

found between therapist-supervised exercise and home exercise programs in terms of mobility, self-care, usual activities, pain/discomfort, anxiety/depression, and general health score ($p>0.05$).

Table 3. Comparisons of home exercises and calisthenics exercises groups

	EQ-5D-3L	Group 1 Home exercises Mean $\pm$ SD	Group 2 Calisthenics Mean $\pm$ SD	t	p
Before Treatment	Sub-parameters				
	Mobility	2.08 $\pm$ 0.68	2.00 $\pm$ 0.66	8.554	0.120
	Self-care	2.24 $\pm$ 0.64	2.03 $\pm$ 0.72	1.274	0.113
	Usual activities	2.27 $\pm$ 0.5	2.14 $\pm$ 0.63	7.174	0.063
	Pain/Discomfort	2.27 $\pm$ 0.56	2.22 $\pm$ 0.63	4.651	0.054
	Anxiety/Depression	2.22 $\pm$ 0.67	2.27 $\pm$ 0.69	5.052	0.072
	Score	58.54 $\pm$ 18.88	57.97 $\pm$ 22.84	-7.642	0.211
After Treatment	Sub-parameters	Group 1 Home exercises Mean $\pm$SD	Group 2 Calisthenics Mean $\pm$SD	t	p
	Mobility	1.32 $\pm$ 0.58	1.30 $\pm$ 0.46	5.265	0.869
	Self-care	1.16 $\pm$ 0.5	1.19 $\pm$ 0.39	6.159	0.058
	Usual activities	1.24 $\pm$ 0.49	1.35 $\pm$ 0.53	0.927	5.749
	Pain/Discomfort	1.49 $\pm$ 0.6	1.49 $\pm$ 0.5	5.556	0.870
	Anxiety/Depression	1.57 $\pm$ 0.55	1.68 $\pm$ 0.53	4.586	0.89
	Score	75.78 $\pm$ 18.03	68.57 $\pm$ 24.09	-1.959	0.982

P-values are derived from the Independent Samples T-test. Standard deviation (SD), $p>0.05$.

In Table 4, the EQ-5D-3L sub-parameters scores were compared between the therapist-supervised and home exercise groups at baseline and after eight weeks. In the home exercise group, a significant difference was observed in mobility, self-care, usual activities, pain/discomfort, anxiety/depression, and general health score after an 8-week exercise program compared to baseline ($p<0.05$). In the therapist-supervised group, a significant difference was observed in mobility, self-care, usual activities, pain/discomfort, anxiety/depression, and general health score after an 8-week exercise program compared to baseline ($p<0.05$).

Table 4. Comparison of EQ-5D-3L parameters of the groups.

Group 1 Home exercises	Baseline (Mean ±SD)	After treatment (Mean ±SD)	t	p
Mobility	2.08±0.68	1.32±0.58	5.334	0.024*
Self-care	2.24±0.64	1.16±0.5	7.628	0.003*
Usual activities	2.27±0.5	1.24±0.49	9.687	0.012*
Pain/Discomfort	2.27±0.56	1.49±0.6	5.581	0.034*
Anxiety/Depression	2.22±0.67	1.57±0.55	4.998	0.025*
Score	58.54±18.88	75.78±18.03	-3.642	0.001*
Group 2 Calisthenics	Baseline (Mean ±SD)	After treatment (Mean ±SD)	t	p
Mobility	2.00±0.66	1.30±0.46	5.502	0.002*
Self-care	2.03±0.72	1.19±0.39	5.676	0.005*
Usual activities	2.14±0.63	1.35±0.53	6.354	0.001*
Pain/Discomfort	2.22±0.63	1.49±0.50	7.304	0.044*
Anxiety/Depression	2.27±0.69	1.68±0.53	3.782	0.001*
Score	57.97±22.84	68.57±24.09	-3.181	0.003*

P-values are derived from the Paired Samples T-test. Standard deviation (SD), *p<0.05

Discussion

In this study, there were some improvements in the therapist-supervised and home exercise groups after calisthenics compared to the baseline EQ-5D-3L scale. In general, there was no difference between the therapist-supervised and home exercise program in terms of EQ-5D-3L scores. This may be related to the fact that the physiotherapists explained the exercises practically to the home exercise group at the first interview and the exercise follow-up was done successfully with phone calls to the patients.

The decrease in functionality and QoL associated with reduced cardiorespiratory capacity and muscle strength in patients with PCS necessitates exercise intervention. Barbagelata et al. (2021) found that patients with PCS had a lower maximal oxygen volume and lower anaerobic threshold in cardiopulmonary exercise testing (CPET) compared to healthy individuals²⁴. Aparisi et al. (2021) investigated the clinical sequelae of patients with PCS, using CPET, echocardiogram, pulmonary function test, six-minute walking test (6MWT) and QoL questionnaire for the patients. A significant decrease was found in maximal oxygen volume, 6MWT and QoL questionnaire in patients with PCS compared to healthy participants²⁵. Tryfonos et al. (2024) compared the exercise test results of patients with PCS and healthy participants and similarly found decreased aerobic capacity and muscle strength in patients with PCS compared to healthy participants²⁶.

Previous studies have shown some improvements from exercise interventions in people with PCS²⁷⁻²⁹. Jimeno-Almazan et al. (2022) investigated the effects of a supervised resistance exercise program and an unsupervised aerobic exercise program on QoL,

fatigue and depression in thirty-nine patients with PCS. One group received combined resistance training under the supervision of a therapist for eight weeks, while the other group was advised to perform unsupervised aerobic exercise five days a week and ten repetitions of strength exercises three times a week³⁰. As a result of the study, significant improvements were obtained in QoL, fatigue, and perceived depression symptoms parameters in the therapist-supervised exercise training group compared to the unsupervised group. Compagno et al. (2022) found that exercise and psychological support training had positive effects on lower and upper extremity muscle strength, cardiopulmonary parameters, depression, and anxiety, in which exercise and psychological support training were given as a holistic rehabilitation program in patients with PCS in their study³¹. Similarly, significant improvements were obtained in the EQ-5D-3L scale in both the therapist-supervised and home exercise groups in this study.

The chronic inflammation in the formation of the PCS pathogenesis occurs when the post-infectious inflammation is considered as a multisystem inflammatory syndrome and explains the symptoms³². Serum levels of inflammatory cytokines have been found to be higher in patients with PCS, and there was an association between PCS-related chronic fatigue symptoms and an elevated neutrophil count³³. The primary therapeutic effect of calisthenics is a decrease in inflammatory cytokine levels³⁴. Regular exercises could reduce levels of pro-inflammatory cytokines and TNF- α ³⁵. Calisthenics may also increase levels of peroxisome proliferator-activated receptor- γ coactivator 1 α (PGC-1 α), which regulates human homeostasis³⁶. Therefore, calisthenics exercises were chosen as a response to Post-Covid syndrome in this study.

Calisthenics have also been found to be effective on QoL in other diseases. Tıgılı et al. (2020) investigated the effect of calisthenics on QoL after renal transplantation with the general QoL short form (SF-36) and renal disease QoL questionnaires (KDQOL-SF) in patients³⁷. As a result of the eight-week exercise program, an increase was observed in the social function of QoL and patient satisfaction level. Probst et al. (2011) compared the effects of high-intensity endurance and strength programs with calisthenics and respiratory exercises on chronic obstructive pulmonary disease (COPD) and found that both exercise methods showed significant improvement in health-related QoL³⁸. Another study investigated the effectiveness of hospital-based and home-based exercise programs in patients with multiple sclerosis³⁹. It was found that there was a significant improvement in QoL at the end of the twelve-week exercise program in the therapist-supervised and home exercise groups, but no difference was found between the groups. In this study, similarly, significant improvements were observed in therapist-supervised and home exercise groups, but no difference was found between the therapist-supervised and home exercise groups.

Limitations

The strength of this study is that calisthenics exercises were actively practiced in the control group. However, our study has some limitations. The first limitation of the study was that a single scale was used to compare therapist-supervised and home exercise interventions. The second limitation is that blinding was done only during the assessment. The third limitation was the small number of participants.

Conclusions

In this study, the provision of exercise training in the form of either therapist-supervised or home-based exercise training led to an improvement in patients' QoL. This also suggests that the correct delivery of home exercise training can be as effective as the therapist-supervised program. After the Covid-19 pandemic, we are still investigating the effects of PCS, and the use of different exercise methods will lead to selective behaviour in the choice of training in larger populations.

REFERENCES

1. Nalbandian A, Sehgal K, Gupta A, et al. Post-acute COVID-19 syndrome. *Nat Med.* 2021;27(4):601-615. doi: 10.1038/s41591-021-01283-z.
2. Goërtz YMJ, Van Herck M, Delbressine JM, et al. Persistent symptoms 3 months after a SARS-CoV-2 infection: the post-COVID-19 syndrome? *ERJ Open Res.* 2020;6(4):00542-2020. doi: 10.1183/23120541.00542-2020.
3. Khoreva MA. Postcovid syndrome - the new reality. *Neurosci Behav Physiol.* 2022;52(5):619-624. doi: 10.1007/s11055-022-01286-4.
4. Akbarialiabad H, Taghrir MH, Abdollahi A, et al. Long COVID, a comprehensive systematic scoping review. *Infection.* 2021;49(6):1163-1186. doi: 10.1007/s15010-021-01666-x.
5. Scholkmann F, May CA. COVID-19, post-acute COVID-19 syndrome (PACS, "long COVID") and post-COVID-19 vaccination syndrome (PCVS, "post-COVIDvac-syndrome"): Similarities and differences. *Pathol Res Pract.* 2023;246:154497. doi: 10.1016/j.prp.2023.154497.
6. Halpin SJ, McIvor C, Whyatt G, et al. Postdischarge symptoms and rehabilitation needs in survivors of COVID-19 infection: A cross-sectional evaluation. *J Med Virol.* 2021;93(2):1013-1022. doi: 10.1002/jmv.26368.
7. Carvalho-Schneider C, Laurent E, Lemaigen A, et al. Follow-up of adults with noncritical COVID-19 two months after symptom onset. *Clin Microbiol Infect.* 2021;27(2):258-263. doi: 10.1016/j.cmi.2020.09.052.
8. Beyer S, Haufe S, Meike D, et al. Post-COVID-19 syndrome: Physical capacity, fatigue and quality of life. *PLoS One.* 2023;18(10):e0292928. doi: 10.1371/journal.pone.0292928.
9. Jacobs LG, Gourni Paleoudis E, Lesky-Di Bari D, et al. Persistence of symptoms and quality of life at 35 days after hospitalization for COVID-19 infection. *PLoS One.* 2020;15(12):e0243882. doi: 10.1371/journal.pone.0243882.
10. Ozer Kaya D, Duzgun I, Baltaci G, et al. Effects of calisthenics and Pilates exercises on coordination and proprioception in adult women: a randomized controlled trial. *J Sport Rehabil.* 2012;21(3):235-43. doi: 10.1123/jsr.21.3.235.
11. Carter SE, Gladwell VF. Effect of breaking up sedentary time with callisthenics on endothelial function. *J Sports Sci.* 2017;35(15):1508-1514. doi: 10.1080/02640414.2016.1223331.

12. Bai B, Xu M, Zhou H, et al. Effects of aerobic training on cardiopulmonary fitness in patients with long COVID-19: a randomized controlled trial. *Trials*. 2024;25(1):649. doi: 10.1186/s13063-024-08473-3.
13. Trzmiel T, Marchewka R, Pieczyńska A, et al. The effect of using a rehabilitation robot for patients with post-coronavirus disease (COVID-19) fatigue syndrome. *Sensors (Basel)*. 2023;23(19):8120. doi: 10.3390/s23198120.
14. Elyazed TIA, Alsharawy LA, Salem SE, et al. Effect of home-based pulmonary rehabilitation on exercise capacity in post COVID-19 patients: a randomized controlled trail. *J Neuroeng Rehabil*. 2024;21(1):40. doi: 10.1186/s12984-024-01340-x.
15. Palacios-Ceña D, Bautista-Villaécija O, Güeita-Rodríguez J, et al. Supervised telerehabilitation and home-based respiratory muscle training for post-COVID-19 condition symptoms: a nested qualitative study exploring the perspectives of participants in a randomized controlled trial. *Phys Ther*. 2024;104(5):pzae043. doi: 10.1093/ptj/pzae043.
16. Buchholz I, Marten O, Janssen MF. Feasibility and validity of the EQ-5D-3L in the elderly Europeans: a secondary data analysis using SHARE(d) data. *Qual Life Res*. 2022;31(11):3267-3282. doi: 10.1007/s11136-022-03158-3.
17. Rencz F, Lakatos PL, Gulácsi L, et al. Validity of the EQ-5D-5L and EQ-5D-3L in patients with Crohn's disease. *Qual Life Res*. 2019;28(1):141-152.
18. Kahyaoğlu Süt H, Unsar S. Is EQ-5D a valid quality of life instrument in patients with acute coronary syndrome? *Anadolu Kardiyol Derg*. 2011;11(2):156-62.
19. Thompson PD, Arena R, Riebe D, et al. American College of Sports Medicine. ACSM's new preparticipation health screening recommendations from ACSM's guidelines for exercise testing and prescription, ninth edition. *Curr Sports Med Rep*. 2013;12(4):215-7.
20. McGowan CJ, Pyne DB, Thompson KG, et al. Warm-up strategies for sport and exercise: mechanisms and applications. *Sports Med*. 2015;45(11):1523-46.
21. Van Hooren B, Peake JM. Do we need a cool-down after exercise? a narrative review of the psychophysiological effects and the effects on performance, injuries and the long-term adaptive response. *Sports Medicine*. 2018;48(7):1575-1595.
22. Shariat A, Cleland JA, Danaee M, et al. Borg CR-10 scale as a new approach to monitoring office exercise training. *Work*. 2018;60(4):549-554. doi: 10.3233/WOR-182762.
23. Zamunér AR, Moreno MA, Camargo TM, et al. Assessment of subjective perceived exertion at the anaerobic threshold with the Borg CR-10 Scale. *J Sports Sci Med*. 2011;10(1):130-6.
24. Barbagelata L, Masson W, Iglesias D, et al. Cardiopulmonary exercise testing in patients with post-COVID-19 syndrome. *Medicina Clinica (English ed.)*. 2022;159(1):6-11.

25. Aparisi Á, Ybarra-Falcón C, García-Gómez M, et al. Exercise ventilatory inefficiency in post-COVID-19 syndrome: insights from a prospective evaluation. *J Clin Med*. 2021;10(12):2591. doi: 10.3390/jcm10122591.
26. Tryfonos A, Pourhamidi K, Jörnåker G, et al. functional limitations and exercise intolerance in patients with post-COVID condition: a randomized crossover clinical trial. *JAMA Netw Open*. 2024;7(4):e244386. doi: 10.1001/jamanetworkopen.2024.4386.
27. Espinoza-Bravo C, Arnal-Gómez A, Martínez-Arnau FM, et al. Effectiveness of functional or aerobic exercise combined with breathing techniques in telerehabilitation for patients with long COVID: a randomized controlled trial. *Phys Ther*. 2023;103(11):pzad118.
28. McGregor G, Sandhu H, Bruce J, et al. Clinical effectiveness of an online supervised group physical and mental health rehabilitation programme for adults with post-covid-19 condition (REGAIN study): multicentre randomised controlled trial. *BMJ*. 2024;384:e076506. doi: 10.1136/bmj-2023-076506. Erratum in: *BMJ*. 2024;385:q988. doi: 10.1136/bmj.q988.
29. Romanet C, Wormser J, Fels A, et al. Effectiveness of exercise training on the dyspnoea of individuals with long COVID: A randomised controlled multicentre trial. *Ann Phys Rehabil Med*. 2023;66(5):101765. doi: 10.1016/j.rehab.2023.101765.
30. Jimeno-Almazán A, Franco-López F, Buendía-Romero Á, et al. Rehabilitation for post-COVID-19 condition through a supervised exercise intervention: A randomized controlled trial. *Scand J Med Sci Sports*. 2022;32(12):1791-1801. doi: 10.1111/sms.14240.
31. Compagno S, Palermi S, Pescatore V, et al. Physical and psychological reconditioning in long COVID syndrome: Results of an out-of-hospital exercise and psychological - based rehabilitation program. *Int J Cardiol Heart Vasc*. 2022;41:101080.
32. Maltezou HC, Pavli A, Tsakris A. Post-COVID syndrome: an insight on its pathogenesis. *Vaccines (Basel)*. 2021;9(5):497. doi: 10.3390/vaccines9050497.
33. Maamar M, Artime A, Pariente E, et al. Post-COVID-19 syndrome, low-grade inflammation and inflammatory markers: a cross-sectional study. *Curr Med Res Opin*. 2022;38(6):901-909. doi: 10.1080/03007995.2022.2042991.
34. Kadoglou NP, Perrea D, Iliadis F, et al. Exercise reduces resistin and inflammatory cytokines in patients with type 2 diabetes. *Diabetes Care*. 2007;30(3):719-21.
35. Niebauer J, Clark A L, Webb-Peploe K M, et al. Exercise training in chronic heart failure: effects on pro-inflammatory markers. *European Journal of Heart Failure*. 2005;7(2):189-193. doi: 10.1016/j.ejheart.2004.07.012
36. Greulich T, Kehr K, Nell C, et al. A randomized clinical trial to assess the influence of a three months training program (gym-based individualized vs.

calisthenics-based non-individualized) in COPD-patients. *Respir Res.* 2014;15(1):36.

37. Tigli A, Yakut Y. Effect of calisthenic exercise program on inflammatory markers, quality of life and exercise capacity after renal transplantation: a randomized controlled study. *J Exercise Therapy and Rehabilitation.* 2020;7(1):1-10.
38. Probst V S, Kovelis D, Hernandez N A, et al. Effects of 2 exercise training programmes on physical activity in daily life in patients with COPD. *Respiratory care.* 2011;56(11):1799–1807. doi: 10.4187/respcare.01110
39. Aydın T, Akif Sarıyıldız M, Guler M, et al. Evaluation of the effectiveness of home based or hospital based calisthenic exercises in patients with multiple sclerosis. *Eur Rev Med Pharmacol Sci.* 2014;18(8):1189-98.

Reliability and Validity of *Analiz Sistem* in Plantar Pressure Assessment for Unilateral Chronic Ankle Instability

Çağlar SOYLU*, Ceren Şevval KARATAŞ**, Gökem AÇAR***

Abstract

Aim: Pedobarography is a valuable tool for understanding lower limb biomechanics and identifying deviations in plantar pressure distribution, particularly in individuals with chronic ankle instability (CAI). Accurate assessment is essential for tailoring effective rehabilitation programs. This study aims to evaluate the concurrent validity and test-retest reliability of *Analiz Sistem* and Sensor Medica pedobarographic devices in assessing plantar pressure distribution under static postural conditions in individuals with CAI.

Method: A total of 64 participants with unilateral CAI were included, with diagnoses confirmed via a Cumberland Ankle Instability Tool (CAIT) score of ≤ 24 . Static postural assessments focused on surface area and impulse parameters for rearfoot, midfoot, and forefoot regions. Measurements from both systems were analyzed for agreement using Intraclass Correlation Coefficient (ICC), standard error of measurement (SEM), paired t-tests, and Bland-Altman plots.

Results: ICC values ranged from 0.80 to 0.99, demonstrating good to excellent reliability. Rearfoot metrics showed the highest reliability, with ICC values exceeding 0.94. SEM values were consistently low (<1.5 for most metrics), indicating high measurement precision. Paired t-tests revealed no significant differences between the two systems ($p>0.05$). Bland-Altman plots confirmed narrow limits of agreement and minimal mean bias across all metrics.

Conclusion: *Analiz Sistem* and Sensor Medica offer accurate and reliable measurements of plantar pressure distribution under static conditions. Their portability and cost-effectiveness make them suitable for clinical and field-based environments. Future research should focus on integrating advanced technologies like artificial intelligence to enhance their utility further.

Keywords: Pedobarography, chronic ankle instability, plantar pressure, *Analiz Sistem*, Sensor Medica.

Tek Taraflı Kronik Ayak Bileği İnstabilitesinde Plantar Basınç Değerlendirmesinde *Analiz Sistem*'in Güvenilirliği ve Geçerliliği

Öz

Amaç: Pedobarografi, alt ekstremitte biyomekaniğini anlamak ve plantar basınç dağılımındaki sapmaları tespit etmek için değerli bir araçtır, özellikle kronik ayak bileği instabilitesi (CAI) olan bireylerde. Doğru değerlendirme, etkili rehabilitasyon programlarının oluşturulmasında kritik bir öneme sahiptir. Bu çalışma, *Analiz Sistem* ve Sensor Medica pedobarografi cihazlarının statik postüral koşullarda plantar basınç dağılımını değerlendirmedeki eşzamanlı geçerliliğini ve test-tekrar test güvenilirliğini incelemeyi amaçlamaktadır.

Yöntem: Tek taraflı CAI tanısı almış 64 katılımcı çalışmaya dahil edilmiştir ve tanılar Cumberland Ayak Bileği İnstabilite Aracı (CAIT) skorunun ≤ 24 olmasıyla doğrulanmıştır. Statik postüral değerlendirmeler, arka ayak, orta ayak ve ön ayak bölgeleri için yüzey alanı ve impuls parametrelerine odaklanmıştır. Her iki

Özgün Araştırma Makalesi (Original Research Article)

Geliş / Received: 03.01.2025 & **Kabul / Accepted:** 09.05.2025

DOI: <https://doi.org/10.38079/igusabder.1612607>

* PhD. PT., Health Sciences University, Gulhane Faculty of Physiotherapy and Rehabilitation, Ankara, Türkiye.

E-mail: caglar.soylu@sbu.edu.tr ORCID <https://orcid.org/0000-0002-1524-6295>

** PT., Health Sciences University, Gulhane Institute of Health Sciences, Department of Physiotherapy and Rehabilitation, Ankara, Türkiye. E-mail: cerensevval2000@gmail.com ORCID <https://orcid.org/0009-0008-1235-3707>

*** MSc. PT., Manisa Celal Bayar University, Institute of Graduate Education, Department of Sport Science, Manisa, Türkiye. E-mail: gorkemacar2@gmail.com ORCID <https://orcid.org/0000-0002-0970-8625>

ETHICAL STATEMENT: The study adhered to the Declaration of Helsinki and was approved by the Gülhane Scientific Research Ethics Committee of the University of Health Sciences (approval no.: 2024-486; 2024).

sistemden elde edilen ölçümler, Intraclass Correlation Coefficient (ICC), ölçüm hatası standart sapması (SEM), eşleştirilmiş t-testi ve Bland-Altman grafikleri kullanılarak analiz edilmiştir.

Bulgular: ICC değerleri 0,80 ile 0,99 arasında değişmiş ve iyi ile mükemmel güvenilirlik sağlamıştır. Arka ayak metrikleri, 0,94'ün üzerinde ICC değerleri ile en yüksek güvenilirliği göstermiştir. SEM değerleri sürekli olarak düşük bulunmuş (<1,5), bu da ölçümlerin yüksek doğruluğunu göstermiştir. Eşleştirilmiş t-testleri, iki sistem arasında anlamlı bir fark olmadığını göstermiştir ($p > 0,05$). Bland-Altman grafikleri, tüm metriklerde dar uyum sınırları ve minimal ortalama yanlılık doğrulamıştır.

Sonuç: Analiz Sistem ve Sensor Medica, statik koşullarda plantar basınç dağılımını değerlendirmede doğru ve güvenilir ölçümler sunmaktadır. Taşınabilirlikleri ve maliyet etkinlikleri, bu cihazları klinik ve saha ortamları için uygun hale getirmektedir. Gelecekteki araştırmalar, yapay zeka gibi ileri teknolojilerin entegrasyonuna odaklanarak bu cihazların işlevselliğini daha da artırmalıdır.

Anahtar Sözcükler: Pedobarografi, kronik ayak bileği instabilitesi, plantar basınç, Analiz Sistem, Sensor Medica.

Introduction

Pedobarography, which examines pressure distribution between the foot and a supporting surface, is essential for understanding lower limb biomechanics, gait patterns, and postural control. It has significant applications in clinical diagnostics, rehabilitation, and sports science, particularly for conditions like chronic ankle instability (CAI)^{1,2}. CAI, characterized by recurrent ankle "giving way" and persistent instability, alters lower limb biomechanics, affecting plantar pressure distribution and gait mechanics^{3,4}. These changes impact functional mobility, postural stability, and gait efficiency, underscoring the need for precise assessments to optimize rehabilitation strategies⁵.

Plantar pressure systems are crucial for detecting these biomechanical alterations, providing insights into gait parameters and load distribution. The Analiz Sistem, a novel plantar pressure device, holds potential for improving CAI assessments; however, its clinical utility depends on validating its accuracy and reliability^{6,7}. The Sensor Medica, a widely recognized electronic baropodometer, serves as the gold standard due to its proven reliability, with studies reporting ICC values ranging from 0.72 to 0.83 in various biomechanical applications^{8,9}. These findings establish Sensor Medica as a benchmark for validating emerging technologies¹⁰⁻¹².

Research has demonstrated that CAI significantly alters plantar pressure patterns and gait parameters, reinforcing the need for accurate assessment tools^{9,13}. Studies have confirmed the reliability of Sensor Medica in detecting subtle biomechanical changes, making it an ideal reference for evaluating new systems^{8,14}. Advancements in wearable pedobarography have further enhanced the accuracy of gait analysis, broadening its clinical applications^{12,15}.

This study aims to assess the concurrent validity and test-retest reliability of the Analiz Sistem in evaluating plantar pressure distribution and spatiotemporal gait parameters in individuals with CAI. By comparing its measurements with Sensor Medica, this research will determine whether the Analiz Sistem meets the standards for accurate plantar pressure assessment. It is hypothesized that the Analiz Sistem will demonstrate high concurrent validity and test-retest reliability, supporting its applicability in clinical and research settings.

Material and Methods

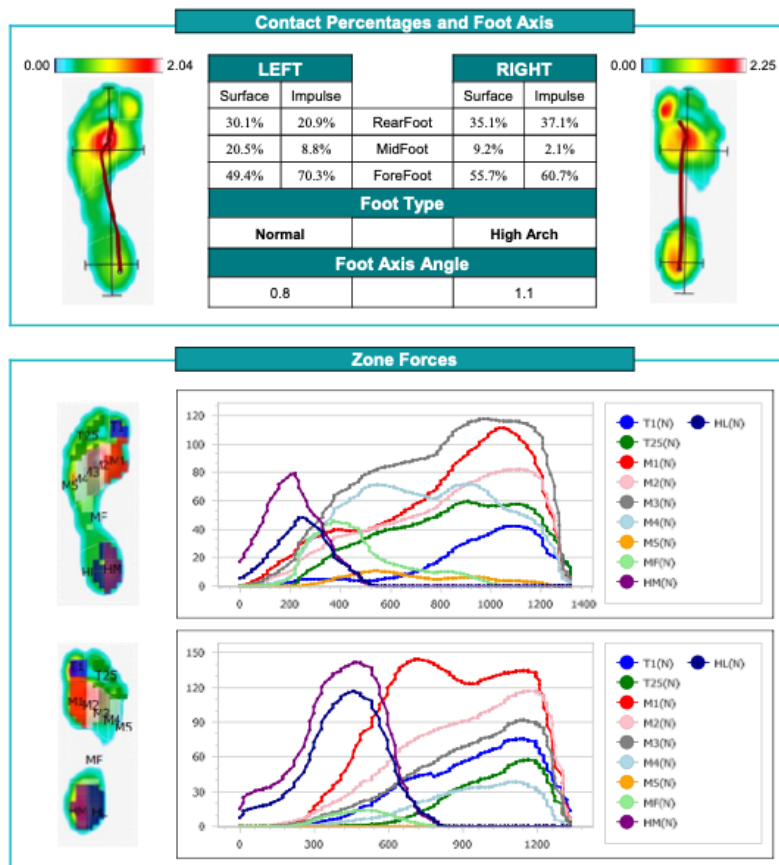
Participations and Experimental Protocol

This study evaluated the concurrent validity and test-retest reliability of the Analiz Sistem for static plantar pressure distribution. Sixty-four participants with unilateral CAI were recruited from rehabilitation centers and university sports clinics according to International Ankle Consortium guidelines, which required a history of at least one significant lateral ankle sprain, recurrent “giving way” episodes, and self-reported instability, with a CAIT score of ≤ 24 confirming the diagnosis¹⁶. Exclusion criteria were recent lower limb surgeries, fractures, systemic neurological conditions, or musculoskeletal injuries affecting balance or gait.

Based on pilot study ICC values (0.880–0.995), sample size calculations determined that at least 60 participants were needed to achieve an ICC of ≥ 0.90 ; a 10% increase for potential dropouts resulted in 64 participants, ensuring statistical robustness and minimizing Type II errors.

Data were collected using the Analiz Sistem - a high-precision pedobarographic device with advanced resistive sensors (sampling frequency up to 300 Hz) for real-time, region-specific pressure mapping (Figure 1.) and the Sensor Medica FreeMed Posturography System, a gold-standard reference featuring a 40 cm $\times$ 40 cm platform with conductive rubber resistive sensors operating at 400 Hz¹⁷.

Figure 1. Example output of plantar pressure analysis from Analiz Sistem



Ethics Committee Approval

The study adhered to the Declaration of Helsinki and was approved by the Gülhane Scientific Research Ethics Committee of the University of Health Sciences (approval no.: 2024-486; 2024). In a controlled laboratory environment ($22 \pm 2^{\circ}\text{C}$, 50–60% humidity), participants performed a 5-second barefoot static postural assessment on a pedobarographic platform (feet shoulder-width apart, arms at sides, gaze forward). To avoid order effects, the Analiz Sistem and Sensor Medica systems were used in a randomized, alternating sequence. Each trial was repeated three times, and the average value was analyzed. To assess test-retest reliability, all measurements were repeated after a 7-day interval under the same environmental conditions and following the identical standardized protocol. This interval was chosen to minimize both short-term adaptation effects and potential fluctuations in postural stability due to daily variability.

The assessment measured surface area (cm^2) and impulse (Ns) for the rearfoot, midfoot, and forefoot. The Sensor Medica FreeMed Posturography System (Guidonia Montecelio, Roma, Italy), equipped with conductive rubber resistive sensors, captured high-resolution plantar pressure data. Both numerical and graphical data were examined, with primary outcomes compared between systems to evaluate agreement and reliability under static conditions.

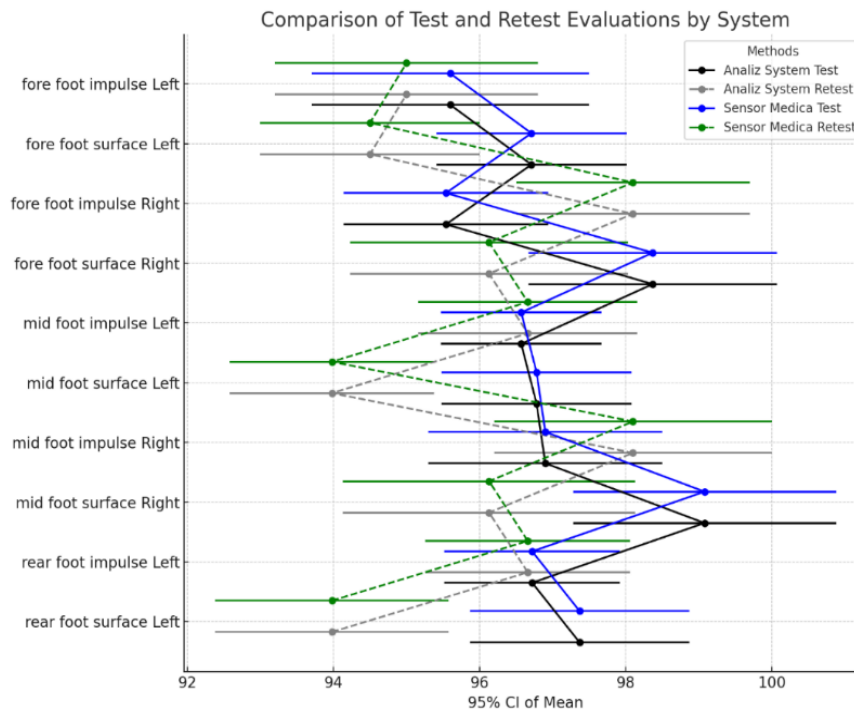
Statistical analysis

Based on pilot results (ICC: 0.880–0.995), a sample size of 60 ($\alpha = 0.05$, power $\geq 90\%$) was deemed sufficient to achieve an ICC ≥ 0.90 ; with an additional 10% for potential dropouts, 64 participants were included to ensure robust statistical power, minimize Type II errors, and improve generalizability. Normality was assessed using histograms and the Shapiro-Wilk test, with numerical variables summarized as means (95% CI) and categorical variables as frequencies. Agreement between Analiz Sistem and Sensor Medica was evaluated using a two-way mixed-effects model ICC (mean measure), where ICC values >0.76 indicated good reliability and >0.90 excellent reliability (Koo & Li, 2016)¹⁸; systematic differences were examined via a paired t-test, and the Spearman rank correlation coefficient (>0.70 indicating strong association) was calculated for ordinal data¹⁹. Test-retest reliability was further assessed using paired t-tests and a single measure ICC (two-way mixed-effects model) with 95% CI, while reproducibility was visually examined through Bland-Altman plots (mean difference ± 1.96 SD). All analyses were performed in R using the "rel", "ggplot2", and "blandr" packages, with a significance level of 0.05.

Results

The study sample had a mean age of 24.00 ± 5.72 years (52.8% male) and a mean BMI of 20.12 ± 3.89 kg/m^2 . Both systems were evaluated using the average of three consecutive measurements (Figure 2), and the findings indicate high reliability for repeated measurements. Specifically, Analiz Sistem and Sensor Medica demonstrated excellent agreement across foot metrics with ICC values exceeding 0.90 (Table 1). Rear foot surface and impulse metrics, with ICCs ranging from 0.88 to 0.94, showed minimal variability, negligible mean differences, and no statistically significant differences ($p > 0.05$), underscoring the consistent performance of both systems.

Figure 2. The mean and 95% confidence interval of the measurements obtained from Analiz system, Sensor medica, and retest evaluation



For mid-foot metrics, ICC values ranged from 0.81 to 0.92 (Table 1), indicating good to excellent reliability. Although overall agreement was robust, the right mid-foot surface showed a mean difference of -4.77 (95% CI: -6.37 to -2.63), which was not statistically significant ($p > 0.05$). Similarly, forefoot metrics demonstrated ICC values between 0.78 and 0.95, with the left forefoot impulse achieving the highest ICC (0.95, 95% CI: 0.933–0.949) and a mean difference of 1.96 (95% CI: 0.54–3.51); paired t-tests confirmed these differences were non-significant ($p > 0.05$), indicating strong overall agreement between the systems.

Table 1. Comparisons of differences between Analiz Sistem and Sensor medica

		Analiz Sistem and Sensor Medica				
		Correlation ^{&} (95% CI)	ICC (95% CI)	SEM	Mean difference (95% CI)	Paired t- test p-value*
First evaluation (test)	rear foot surface left	0.88 (0.96-0.98)	0.99 (0.96-0.98)	1.05	-0.22 (-1.82-1.87)	0.795
	rear foot impulse left	0.94 (0.92-0.97)	0.98 (0.92-0.97)	0.75	-0.53 (-2.06-1.83)	0.061
	mid foot surface right	0.82 (0.96-0.98)	0.99 (0.96-0.98)	1.84	-4.77 (-6.37-2.63)	0.307
	mid foot impulse right	0.81 (0.95-0.97)	0.97 (0.95-0.97)	1.32	-1.63 (-4.62-0.08)	0.467
	mid foot surface left	0.92 (0.94-0.98)	0.98 (0.94-0.98)	0.91	-0.13 (-2.12-1.09)	0.619

	mid foot impulse left	0.9 (0.94-0.95)	0.98 (0.94-0.95)	1.39	0.55 (-0.97-2.20)	0.739
	fore foot surface right	0.84 (0.96-0.97)	0.98 (0.96-0.97)	1.08	-4.46 (-6.67-3.37)	0.796
	fore foot impulse right	0.78 (0.94-0.98)	0.98 (0.94-0.98)	1.45	4.10 (2.24-5.73)	0.467
	fore foot surface left	0.82 (0.94-0.96)	0.98 (0.94-0.96)	1.89	2.22 (-0.12-3.32)	0.157
	fore foot impulse left	0.95 (0.93-0.95)	0.98 (0.93-0.95)	1.22	1.96 (0.54-3.51)	0.758
Second evaluation (retest)	rear foot surface left	0.88 (0.96-0.98)	0.97 (0.91-0.95)	1.05	-0.13 (-2.36-1.78)	0.409
	rear foot impulse left	0.94 (0.92-0.97)	0.81 (0.92-0.97)	0.75	3.97 (-4.38-1.3)	0.661
	mid foot surface right	0.82 (0.96-0.98)	0.93 (0.94-0.95)	1.84	3.28 (-5.49-3.99)	0.768
	mid foot impulse right	0.81 (0.95-0.97)	0.97 (0.92-0.97)	1.32	0.03 (-3.74-1.88)	0.355
	mid foot surface left	0.92 (0.94-0.98)	0.91 (0.93-0.95)	0.91	-3.39 (-1.9-3.69)	0.244
	mid foot impulse left	0.9 (0.94-0.954)	0.97 (0.92-0.96)	1.39	-0.04 (-2.88-4.35)	0.158
	fore foot surface right	0.84 (0.96-0.97)	0.86 (0.92-0.98)	1.08	2.29 (-2.64-3.03)	0.494
	fore foot impulse right	0.78 (0.94-0.98)	0.82 (0.94-0.98)	1.45	-3.97 (-2.54-4.44)	0.690
	fore foot surface left	0.82 (0.94-0.97)	0.99 (0.92-0.98)	1.89	-0.89 (-1.71-3.74)	0.463
	fore foot impulse left	0.95 (0.93-0.95)	0.87 (0.94-0.96)	1.22	-3.8 (-5.26-1.18)	0.356

ICC: Intra-class correlation coefficient (ICC, single measure, two-way mixed-effects model where people effects are random and measures effects are fixed, consistency agreement, higher than 0.76 was considered good and 0.90 was excellent reliability), CI: Confidence interval, SEM: Standard error of measurement.

*There was no statistically significant difference between the Analiz Sistem and Sensor Medica measurements (Paired t test p values > 0.05)

&The obtained correlation coefficient was significant ($p < 0.05$).

Test-retest reliability was high for both systems (Table 2). For Analiz Sistem, ICC values ranged from 0.80 to 0.94, with the left rear foot surface achieving an ICC of 0.94 (95% CI: 0.948–0.981); SEM values ranged from 0.53 to 1.39, and paired t-tests showed no significant differences ($p > 0.05$). Similarly, Sensor Medica exhibited ICC values from 0.88 to 0.99, with the right mid-foot impulse reaching an ICC of 0.96 (95% CI: 0.931–0.976), and paired t-tests confirmed reproducibility ($p > 0.05$).

Table 2. Test-retest reliability values of Analiz Sistem and Sensor medica

		Test - Retest			
		ICC (95% CI)	SEM	Mean difference (95% CI)	Paired t-test p-value*
Analiz Sistem	rear foot surface left	0.94 (0.94- 0.98)	0.53	-4.88 (-3.64- 4.8)	0.188
	rear foot impulse left	0.91 (0.90- 0.96)	1.62	-3.53 (-3.7- 1.49)	0.215
	mid foot surface right	0.9 (0.93- 0.97)	0.67	-3.37 (-5.88- 3.58)	0.115
	mid foot impulse right	0.83 (0.93- 0.98)	1.39	-1.39 (-5.62- 5.27)	0.227
	mid foot surface left	0.91 (0.95- 0.96)	0.99	-3.67 (-4.4- 4.97)	0.087
	mid foot impulse left	0.85 (0.93- 0.97)	1.36	3.18 (-2.48- 1.86)	0.698
	fore foot surface right	0.94 (0.93- 0.96)	1.16	-0.9 (-1.96- 3.15)	0.117
	fore foot impulse right	0.83 (0.94- 0.95)	0.82	4.87 (-5.96- 2.23)	0.679
	fore foot surface left	0.89 (0.94- 0.99)	2.0	1.03 (-2.26- 5.73)	0.131
	fore foot impulse left	0.8 (0.93- 0.95)	0.57	-0.42 (-4.71- 3.85)	0.213
Sensor medica	rear foot surface left	0.89 (0.93- 0.96)	1.31	3.95 (-1.4- 4.96)	0.419
	rear foot impulse left	0.88 (0.91- 0.98)	0.62	0.95 (-2.36- 2.96)	0.303
	mid foot surface right	0.94 (0.93- 0.96)	0.77	-1.12 (-2.91- 3.22)	0.469
	mid foot impulse right	0.96 (0.93- 0.97)	1.39	-1.23 (-4.47- 1.41)	0.767
	mid foot surface left	0.95 (0.92- 0.97)	1.04	-2.4 (-5.85- 5.09)	0.190
	mid foot impulse left	0.9 (0.92- 0.98)	1.74	1.8 (-5.76- 5.81)	0.499
	fore foot surface right	0.91 (0.93- 0.97)	1.5	0.05 (-2.69- 3.19)	0.525
	fore foot impulse right	0.9 (0.93- 0.95)	1.9	3.45 (-4.83- 5.23)	0.124
	fore foot surface left	0.99 (0.93- 0.97)	1.95	1.51 (-2.29- 5.0)	0.105
	fore foot impulse left	0.93 (0.91- 0.97)	1.86	-4.35 (-1.25- 1.06)	0.367

ICC: Intra-class correlation coefficient (ICC, single measure, two-way mixed-effects model where people effects are random and measures effects are fixed, absolute agreement, higher than 0.76 was considered good and 0.90 was excellent reliability), CI: Confidence interval, SEM: Standard error of measurement.

*There was no statistically significant difference between the test and re-test measurements (Paired t-test p-values>0.05).

The Bland-Altman plots (Figure 3a-d) further supported the test-retest reliability of Analiz Sistem. These plots demonstrated narrow limits of agreement, indicating consistent measurements over time. Mean differences were close to zero, suggesting minimal systematic bias. For example, the rear foot impulse (left) exhibited a mean difference within the 95% CI range of -2.36 to 1.78. The data points were evenly distributed around the center line, further confirming the absence of systematic errors.

Discussion

To our knowledge, the present study is among the first to comprehensively evaluate the reliability and agreement of Analiz Sistem and Sensor Medica in assessing foot metrics across static and dynamic conditions. Using robust statistical methods, including intra-class correlation coefficients (ICCs), standard error of measurement (SEM), and Bland-Altman plots, this study demonstrates that both systems provide accurate and consistent

measurements. These findings align with existing literature and underscore the utility of these systems in clinical and sports contexts.

Concurrent Validity of Analiz Sistem and Sensor Medica

The high ICC values (0.80–0.99) indicate good to excellent agreement across all foot metrics, with rearfoot metrics demonstrating ICC values exceeding 0.94. These findings are consistent with Orlin and McPoil's (2000) benchmark, which considers ICC values above 0.75 as indicative of excellent agreement²⁰. Moreover, the results corroborate the observations of Burns et al. (2006), who reported that reliable plantar pressure data can facilitate effective orthotic interventions, particularly for individuals with cavus feet²¹. Consequently, the strong agreement observed between Analiz Sistem and Sensor Medica supports their application in clinical settings for the customization and evaluation of orthotic devices.

Figure 3 (a-b). The Bland-Altman plots for the test–retest reliability of Analiz Sistem right and left surface measurements (The dashed lines represent the limits of agreement and mean of differences. The dotted lines represent 95% CI upper and lower limits.)

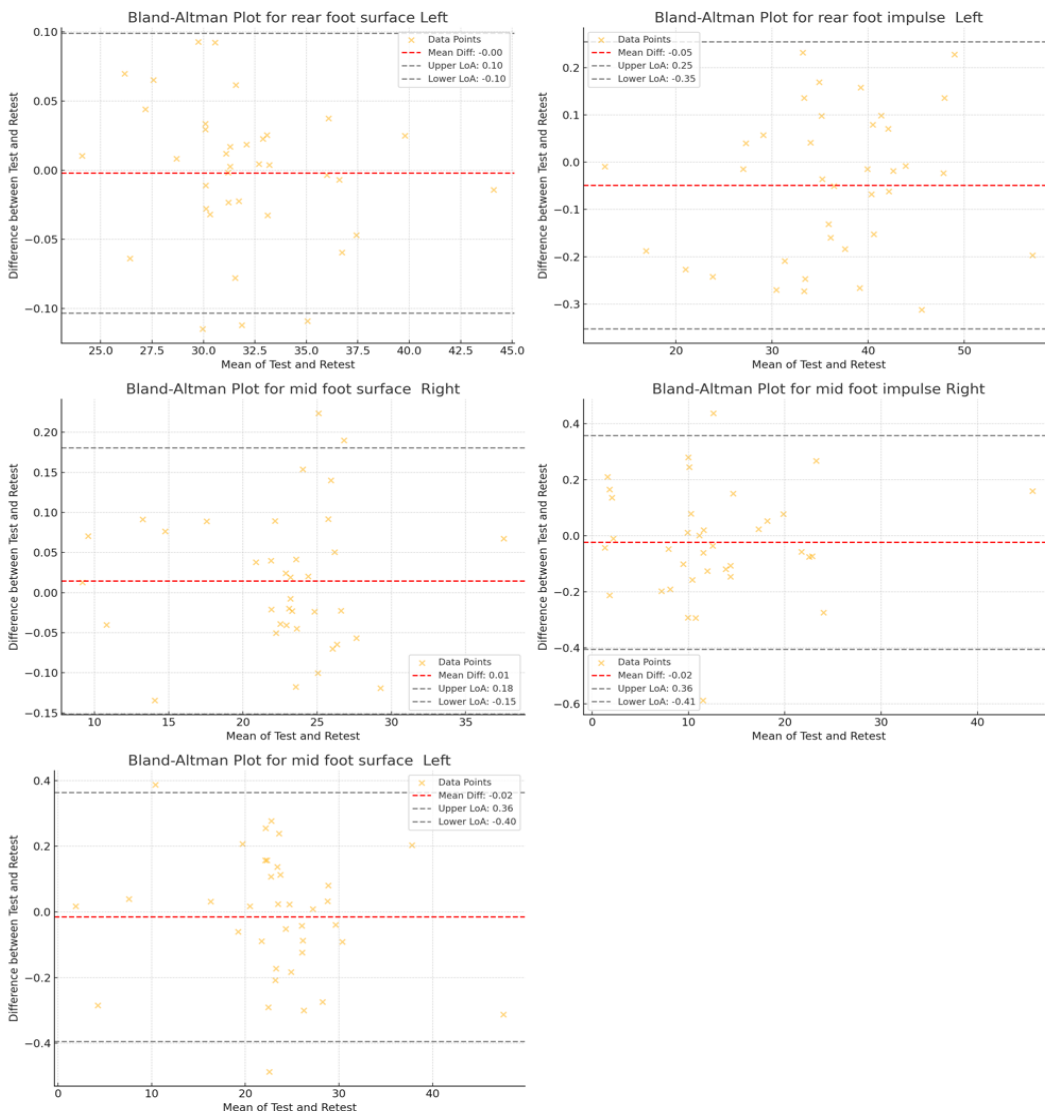
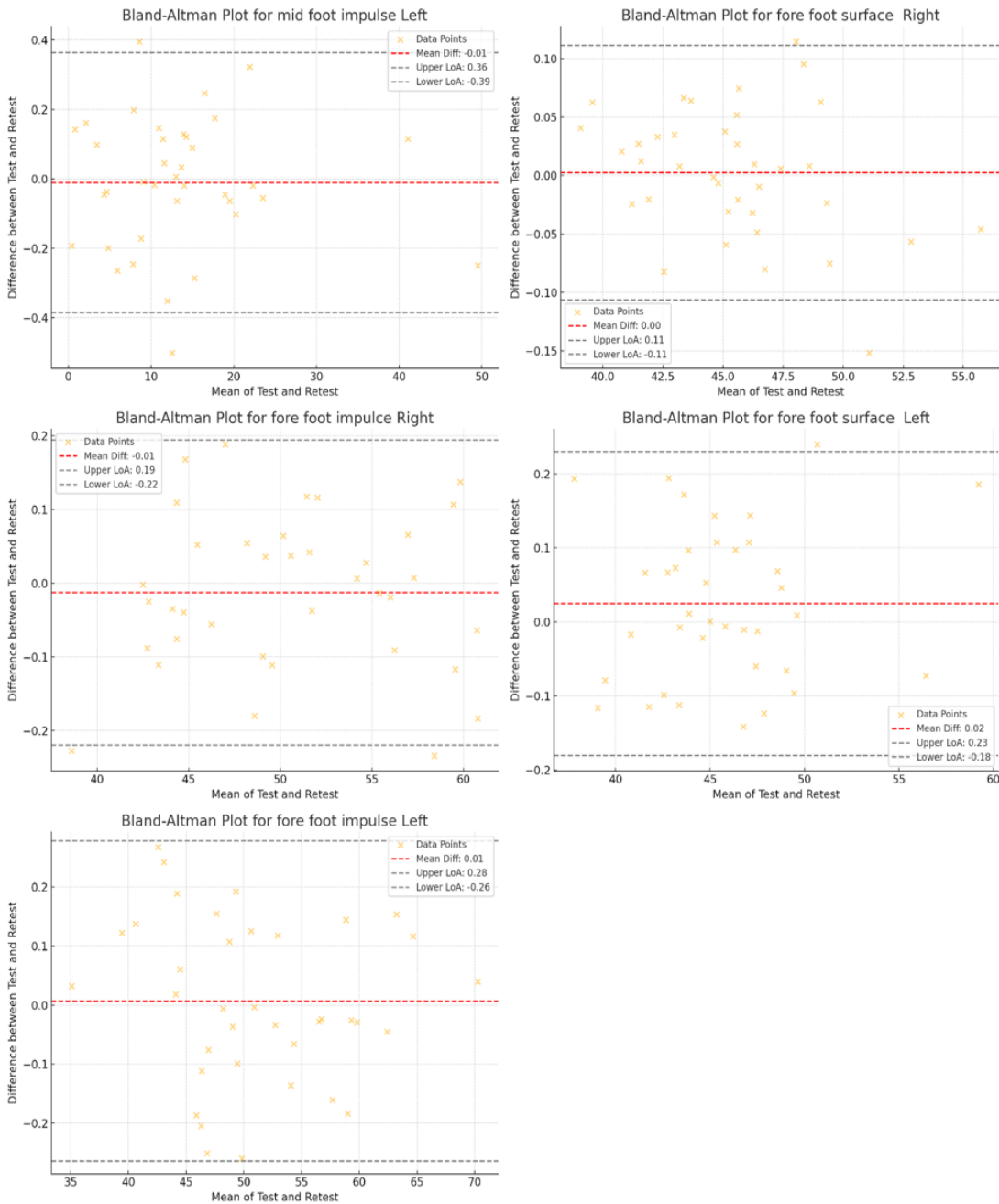


Figure 3 (c-d). The Bland-Altman plots for the test–retest reliability of Analiz Sistem right and left impulse measurements (The dashed lines represent the limits of agreement and mean of differences. The dotted lines represent 95% CI upper and lower limits.)



For midfoot metrics, while ICC values were strong (0.81 to 0.92), minor discrepancies were noted, such as the right midfoot surface (mean difference = -4.77, 95% CI: -6.37 to -2.63). These variations are consistent with findings by Rao et al. (2012) and Guiotto et al. (2013), who highlighted the challenges of capturing midfoot mechanics due to anatomical complexity and load distribution^{22,23}. Despite these discrepancies, the narrow

limits of agreement in the Bland-Altman plots confirm the systems' reliability across repeated measurements.

Test-retest reliability of both Analiz Sistem and Sensor Medica was excellent, with ICCs ranging from 0.88 to 0.99. Notably, Analiz Sistem's left rearfoot surface (ICC = 0.94, 95% CI: 0.948–0.981) and Sensor Medica's right midfoot impulse (ICC = 0.96, 95% CI: 0.931–0.976) demonstrated the highest reliability, corroborating findings by Lambrich et al.²⁴. Low SEM values (<1.5 for most metrics) further confirm measurement precision, consistent with Burnie et al.²⁵. Bland-Altman analyses revealed narrow limits of agreement and minimal bias (e.g., left rearfoot impulse mean difference of -0.13, 95% CI: -2.36 to 1.78), aligning with Hafer et al.²⁶, though slightly greater variability was noted for the Sensor Medica midfoot impulse, as observed by Razak et al.²⁷. These robust reliability metrics support the application of both systems in clinical settings for diagnosing and managing conditions such as plantar fasciitis and diabetic neuropathy^{21,23}, as well as in sports for optimizing load distribution and performance^{28,29}. Future integration of AI and wearable technologies, as suggested by Molavian et al.³⁰, may further enhance their utility in dynamic assessments. Limitations of this study include a relatively homogeneous sample composed solely of young adults, which may limit the generalizability of the findings to older populations or individuals with varying physical activity levels. The use of a strictly controlled laboratory environment (temperature, humidity, and standardized posture) enhances internal validity but may not fully reflect real-world variability. Additionally, the analysis was confined to static plantar pressure assessment; therefore, dynamic conditions such as walking or running were not evaluated, which could offer further insights into functional performance. Minor discrepancies in midfoot measurements also highlight the need for further system calibration and refinement in sensor sensitivity.

Conclusion

In conclusion, Analiz Sistem and Sensor Medica have demonstrated excellent reliability and agreement for assessing foot metrics across static and dynamic conditions. The high ICC values, low SEM, and minimal systematic bias validate their use as accurate and consistent tools for both clinical and sports applications. These systems offer a cost-effective and portable alternative to traditional force-plate systems, making them suitable for diverse environments, including rehabilitation clinics and athletic training settings. The Analiz Sistem, in particular, can be effectively utilized during rehabilitation processes to monitor plantar pressure changes, guide individualized treatment, and track patient progress. Future research should explore their integration with advanced technologies, such as AI-driven analytics, to further enhance precision and expand applicability to diverse populations, including individuals with foot pathologies and older adults. These advancements will solidify their role in improving patient outcomes and advancing the field of biomechanics.

REFERENCES

1. Saito M, Nakajima K, Takano C, et al. An in-shoe device to measure plantar pressure during daily human activity. *Med Eng Phys.* 2011;33(5):638-645. doi: 10.1016/j.medengphys.2011.01.001.
2. McKeon PO, Hertel J. Systematic review of postural control and lateral ankle instability, part I: Can deficits be detected with instrumented testing. *J Athl Train.* 2008;43(3):293-304. doi: 10.4085/1062-6050-43.3.293.
3. Herb CC, Hertel J. Current concepts on the pathophysiology and management of recurrent ankle sprains and chronic ankle instability. *Current Physical Medicine and Rehabilitation Reports.* 2014;2:25-34.
4. Doherty C, Delahunt E, Caulfield B, Hertel J, Ryan J, Bleakley C. The incidence and prevalence of ankle sprain injury: A systematic review and meta-analysis of prospective epidemiological studies. *Sports Med.* 2014;44(1):123-140.
5. Gribble PA, Delahunt E, Bleakley CM, et al. Selection criteria for patients with chronic ankle instability in controlled research: A position statement of the International Ankle Consortium. *J Athl Train.* 2014;49(1):121-127. doi: 10.4085/1062-6050-49.1.14.
6. Morrison KE, Hudson DJ, Davis IS, et al. Plantar pressure during running in subjects with chronic ankle instability. *Foot Ankle Int.* 2010;31(11):994-1000. doi: 10.3113/FAI.2010.0994.
7. Rosário JL. A review of the utilization of baropodometry in postural assessment. *J Bodyw Mov Ther.* 2014;18(2):215-219. doi: 10.1016/j.jbmt.2013.05.016.
8. Kernozek TW, LaMott EE. Comparisons of plantar pressures between the elderly and young adults. *Gait & Posture* 1995;3(3):143-148.
9. Schmidt H, Sauer LD, Lee SY, Saliba S, Hertel J. Increased in-shoe lateral plantar pressures with chronic ankle instability. *Foot Ankle Int.* 2011;32(11):1075-1080. doi: 10.3113/FAI.2011.1075.
10. Hessert MJ, Vyas M, Leach J, Hu K, Lipsitz LA, Novak V. Foot pressure distribution during walking in young and old adults. *BMC Geriatr.* 2005;5:8. doi: 10.1186/1471-2318-5-8.
11. Graf PM. The EMED System of foot pressure analysis. *Clin Podiatr Med Surg.* 1993;10(3):445-454.
12. Jacobs D, Farid L, Ferré S, Herraes K, Gracies JM, Hutin E. Evaluation of the validity and reliability of connected insoles to measure gait parameters in healthy adults. *Sensors (Basel).* 2021;21(19):6543. doi: 10.3390/s21196543.
13. Molinaro L, Russo L, Cubelli F, et al. Reliability analysis of an innovative technology for the assessment of spinal abnormalities. *2022 IEEE International Symposium on Medical Measurements and Applications (MeMeA).* IEEE, 2022.

14. Sgrò F, Monteleone G, Pavone M, et al. Validity analysis of Wii Balance Board versus baropodometer platform using an open custom integrated application. *AASRI Procedia*. 2014;8:22-29.
15. Canavese G, Stassi S, Fallauto C, et al. Real-time pedobarography analysis by piezoresistive wearable insole. *Sensor Letters*. 2014;12(9):1427-1432.
16. Wright CJ, Arnold BL, Ross SE, Linens SW. Recalibration and validation of the Cumberland Ankle Instability Tool cutoff score for individuals with chronic ankle instability. *Arch Phys Med Rehabil*. 2014;95(10):1853-1859. doi: 10.1016/j.apmr.2014.04.017.
17. Messina G, Amato A, Rizzo F, et al. The association between masticatory muscles activation and foot pressure distribution in older female adults: A cross-sectional study. *Int J Environ Res Public Health*. 2023;20(6):5137. doi: 10.3390/ijerph20065137.
18. Koo TK, Li MY. A guideline of selecting and reporting intraclass correlation coefficients for reliability research [published correction appears in *J Chiropr Med*. 2017;16(4):346. doi: 10.1016/j.jcm.2017.10.001]. *J Chiropr Med*. 2016;15(2):155-163. doi: 10.1016/j.jcm.2016.02.012.
19. Mukaka MM. Statistics corner: A guide to appropriate use of correlation coefficient in medical research. *Malawi Med J*. 2012;24(3):69-71.
20. Orlin MN, McPoil TG. Plantar pressure assessment. *Phys Ther*. 2000;80(4):399-409. doi: 10.1093/ptj/80.4.399.
21. Burns J, Crosbie J, Ouvrier R, Hunt A. Effective orthotic therapy for the painful cavus foot: A randomized controlled trial. *J Am Podiatr Med Assoc*. 2006;96(3):205-211. doi: 10.7547/0960205.
22. Rao S, Riskowski JL, Hannan MT. Musculoskeletal conditions of the foot and ankle: Assessments and treatment options. *Best Pract Res Clin Rheumatol*. 2012;26(3):345-368. doi: 10.1016/j.berh.2012.05.009.
23. Guiotto A, Sawacha Z, Guarneri G, Cristoferi G, Avogaro A, Cobelli C. The role of foot morphology on foot function in diabetic subjects with or without neuropathy. *Gait Posture*. 2013;37(4):603-610. doi: 10.1016/j.gaitpost.2012.09.024.
24. Lambrich J, Hagen M, Schwiertz G, Muehlbauer T. Concurrent validity and test-retest reliability of pressure-detecting insoles for static and dynamic movements in healthy young adults. *Sensors (Basel)*. 2023;23(10):4913. doi: 10.3390/s23104913.
25. Burnie L, Chockalingam N, Holder A, Claypole T, Kilduff L, Bezodis N. Testing protocols and measurement techniques when using pressure sensors for sport and health applications: A comparative review. *Foot (Edinb)*. 2024;59:102094. doi: 10.1016/j.foot.2024.102094.
26. Hafer JF, Lenhoff MW, Song J, Jordan JM, Hannan MT, Hillstrom HJ. Reliability of plantar pressure platforms. *Gait Posture*. 2013;38(3):544-548. doi: 10.1016/j.gaitpost.2013.01.028.

- 27.** Razak AH, Zayegh A, Begg RK, Wahab Y. Foot plantar pressure measurement system: A review. *Sensors (Basel)*. 2012;12(7):9884-9912. doi: 10.3390/s120709884.
- 28.** Nigg BM, Stergiou P, Cole G, Stefanyshyn D, Mündermann A, Humble N. Effect of shoe inserts on kinematics, center of pressure, and leg joint moments during running. *Med Sci Sports Exerc*. 2003;35(2):314-319. doi: 10.1249/01.MSS.0000048828.02268.79.
- 29.** Willems TM, Witvrouw E, Delbaere K, Mahieu N, De Bourdeaudhuij I, De Clercq D. Intrinsic risk factors for inversion ankle sprains in male subjects: A prospective study. *Am J Sports Med*. 2005;33(3):415-423. doi: 10.1177/0363546504268137.
- 30.** Molavian R, Fatahi A, Abbasi H, Khezri D. Artificial intelligence approach in biomechanics of gait and sport: A systematic literature review. *J Biomed Phys Eng*. 2023;13(5):383-402. doi: 10.31661/jbpe.voio.2305-1621.

The Relationship between Core Endurance, Hand Grip Strength, and Reaction Time in Young Adults*

Anıl TEKEOĞLU TOSUN**, Ezgi ERYILDIZ***, Çağdaş IŞIKLAR****,
Demet TEKİN DE LAS PEÑAS*****

Abstract

Aim: The aim of the study was to examine the relationship between core endurance, hand grip strength, and reaction time in young adults.

Method: Fifty-two undergraduate students with an average age of 21.07 (1.46) were included in this cross-sectional, observational study. Core endurance (McGill's Core Endurance Tests), hand grip strength (Jamar Hydraulic Hand Dynamometer), and the lower extremity reaction time (OptoGait device) were assessed.

Results: There was a moderate, positive correlation between the left-right trunk lateral endurance test and the right (respectively; $r=0.51$, $r=0.47$, $p<0.001$) and left-hand grip strength (respectively; $r=0.52$, $r=0.51$, $p<0.001$). A weak, negative correlation was found between the left-right trunk lateral endurance test and right lower extremity reaction time (respectively; $r=-0.38$, $p=0.005$; $r=-0.39$, $p=0.004$). There was a weak, negative correlation between left- and right-hand grip strength and right lower extremity reaction time (respectively; $r=-0.32$, $p=0.02$; $r=-0.37$, $p=0.006$). Additionally, in participants with the right dominant leg, a moderate, negative correlation was found between the right lower extremity reaction time and right-hand grip strength ($r=-0.40$, $p=0.01$) and a weak, negative correlation with left and right trunk lateral endurance test (respectively; $r=-0.35$, $p=0.03$; $r=-0.33$, $p=0.04$).

Conclusion: The findings of this study, which demonstrate that there was a relationship between core endurance, hand grip strength, and reaction time, can provide a valuable resource for professionals working in this field. The association between these parameters may be helpful in guiding exercise planning in subjects such as injury, rehabilitation process, and increasing performance in sports.

Keywords: Core, muscle strength, physical fitness, reaction time.

Genç Erişkinlerde Kor Endurans, El Kavrama Kuvveti ve Reaksiyon Süresi Arasındaki İlişki Öz

Amaç: Çalışmanın amacı, genç erişkinlerde kor endurans, el kavrama kuvveti ve reaksiyon süresi arasındaki ilişkiyi incelemektir.

Özgün Araştırma Makalesi (Original Research Article)

Geliş / Received: 22.07.2024 & **Kabul / Accepted:** 21.07.2025

DOI: <https://doi.org/10.38079/igusabder.1520250>

* This study was presented as a poster abstract at the 18th Advances in Physiotherapy Congress (September 8-11, 2022, Ankara, Türkiye).

** PhD, PT, Asst. Prof., Fenerbahçe University, Faculty of Health Sciences, Division of Physiotherapy and Rehabilitation, İstanbul, Türkiye. E-mail: anil19@gmail.com [ORCID https://orcid.org/0000-0003-1815-385X](https://orcid.org/0000-0003-1815-385X)

*** MSc, PT, Res. Asst. (Corresponding author), Marmara University, Faculty of Health Sciences, Division of Physiotherapy and Rehabilitation, İstanbul, Türkiye ; Marmara University, Institute of Health Sciences, Department of Physiotherapy and Rehabilitation, İstanbul, Türkiye. E-mail: fzt.ezgigul@gmail.com [ORCID https://orcid.org/0000-0002-7508-104X](https://orcid.org/0000-0002-7508-104X)

**** MSc, PT, Lecturer, Fenerbahçe University, Vocational School of Health Services, Division of Physiotherapy and Rehabilitation, İstanbul, Türkiye ; Hacettepe University, Institute of Health Sciences, Department of Physiotherapy and Rehabilitation, Ankara, Türkiye. E-mail: cagdas.isiklar@fbu.edu.tr [ORCID https://orcid.org/0000-0003-0287-3238](https://orcid.org/0000-0003-0287-3238)

***** PhD, PT, Assoc. Prof., Rumeli University, Faculty of Health Sciences, Department of Physiotherapy and Rehabilitation, İstanbul, Türkiye. E-mail: tekindemett@gmail.com [ORCID https://orcid.org/0000-0002-7508-104X](https://orcid.org/0000-0002-7508-104X)

ETHICAL STATEMENT: This study was carried out with the approval of the Ethics Committee of Fenerbahçe University, dated 20/07/2022 and numbered 20.2022fbu. A signed subject consent form in accordance with the Declaration of Helsinki was obtained from each participant.

Yöntem: Bu kesitsel ve gözlemsel çalışmaya yaş ortalaması 21,07 (1,46) olan 52 lisans öğrencisi dahil edilmiştir. Kor enduransı (McGill'in Kor Endurans Testleri), el kavrama kuvveti (Jamar Hidrolik El Dinamometresi) ve alt ekstremité reaksiyon süresi (OptoGait cihazı) değerlendirilmiştir.

Bulgular: Sol-sağ gövde lateral kor enduransı testi ile sağ (sırasıyla; $r=0,51$; $r=0,47$; $p<0,001$) ve sol el kavrama kuvveti (sırasıyla; $r=0,52$; $r=0,51$; $p<0,001$) arasında orta düzeyde, pozitif bir korelasyon bulundu. Sol-sağ gövde lateral kor enduransı testi ile sağ alt ekstremité reaksiyon süresi (sırasıyla; $r=-0,38$; $p=0,005$; $r=-0,39$; $p=0,004$) arasında zayıf, negatif bir korelasyon bulundu. Sol ve sağ el kavrama kuvveti ile sağ alt ekstremité reaksiyon süresi arasında da zayıf, negatif bir korelasyon vardı (sırasıyla; $r=-0,32$; $p=0,02$; $r=-0,37$; $p=0,006$). Ayrıca, sağ dominant bacağa sahip katılımcılarda, sağ alt ekstremité reaksiyon süresi ile sağ el kavrama kuvveti arasında orta düzeyde, negatif bir korelasyon ($r=-0,40$; $p=0,01$) ve sol ve sağ gövde lateral kor enduransı testi ile zayıf, negatif bir korelasyon (sırasıyla; $r=-0,35$; $p=0,03$; $r=-0,33$; $p=0,04$) bulundu.

Sonuç: Bu çalışmanın bulguları, kor enduransı, el kavrama kuvveti ve reaksiyon süresi arasında bir ilişki olduğunu göstermektedir ve bu alanda çalışan profesyoneller için değerli bir kaynak sağlayabilir. Bu parametreler arasındaki ilişki, yaralanma, rehabilitasyon süreci ve sporda performans artışı gibi konularda gerekli egzersizlerin planlanmasında faydalı olabilir.

Anahtar Sözcükler: Kor, kas kuvveti, fiziksel uygunluk, reaksiyon süresi.

Introduction

Physical fitness is the ability to perform occupational, recreational and daily activities successfully without experiencing fatigue¹. It includes both health-related and performance-related components². Improving health-related physical fitness, involving cardiovascular endurance, muscular strength and endurance, flexibility, and body composition, is encouraging to improve health. Additionally, the ability to perform physical activity concerning agility, power, speed, balance, coordination, and reaction time is defined by skill-related physical fitness³, which is crucial for performance⁴. The role of these physical fitness parameters in dropping the fall risk in the elderly was detailedly reported by a review which recommended that lower extremity flexibility, reaction time, and strength should be considered when creating fall intervention exercise programs⁵. Considering its effect on health, injury prevention and improvement in performance, it is essential to examine core parameters of physical fitness⁶.

The core can be defined as the muscle groups that support the spine, which play an effective role in the transfer of force in the lower and upper extremities, surrounded by the abdominals anteriorly, the paraspinal and gluteal posteriorly, the diaphragm as the roof, and the pelvic floor and hip girdle muscles below^{7,8}. There are also anatomical definitions that express the core is a structure surrounded by muscles that function synergistically to generate and reduce power and provide dynamic stabilization⁹. Core stability has no clear definition; it may vary according to researchers and authors¹⁰. It is called the "powerhouse" which is the basis of all extremity movements and is important for maximizing force generation and minimizing joint loads in each activity¹¹. It is thought that the strength of the core region, which is known to be connected through the kinetic chain with the lower and upper extremities, will improve upper and lower extremity function¹². Core strength is an important performance indicator; thus, core muscles help transfer energy to the extremities while doing activities. Functional movements are highly dependent on the core region; thus, low strength and endurance of the core muscles may predispose to injury¹³.

Another important performance indicator is upper extremity strength. Hand grip strength, which is one of the determinants of upper extremity strength, is the result of strong flexion of all finger joints with the maximum force that the person can apply under normal biokinetic conditions¹⁴. Grip strength is considered to offer an objective index of the practical integrity of the upper extremity. It is the widely established, reliable and valid instrument for determining the value of treatment approaches^{15,16}. Many activities performed in daily life require the controlled use of the trunk and abdominal muscles, that is, effective core muscle strength and endurance when working with the upper extremities. However, there are many studies conducted separately about hand grip strength and core muscle stimulation in the literature, there are very limited studies on the association between the two parameters^{12,17}.

The relationship between the core region and the upper extremity, as well as its relationship with the lower extremity, has been extensively studied in the literature. The importance of the core area has been reported in terms of general performance improvement or protection from injuries^{18,19}. Available evidence has also shown a strong association between improved reaction time and reduced risk of lower extremity injury²⁰. Although there are many studies conducted separately for reaction time and core muscle activation, there are very limited studies on the correlation between the two parameters²¹. Reaction time measures how quickly an organism responds to a stimulus, defined as the interval between the stimulus application and the subsequent response. This physical skill is based on human performance and is considered a key parameter of physical fitness. While the significance of reaction time is well-documented, and research has explored the relationship between upper extremity reaction times and hand grip strength across various populations^{21,22}, no studies have specifically examined the link between lower extremity reaction time and hand grip strength in young adults. Consequently, this study was designed to investigate the association between core muscle endurance, hand grip strength, and reaction time in young adults.

Material and Methods

Participants

The study consisted of 52 volunteer undergraduate students (22 males and 30 females) in the 1st, 2nd, and 3rd classes in the Physiotherapy and Rehabilitation Department, considering the specified inclusion and exclusion criteria. To agree to participate in the study after being informed, to be between the ages of 18-25 were the inclusion criteria. The exclusion criteria of the study were as follows: To have an orthopaedic and neurological dysfunction that may prevent the evaluation, a history of low back pain, recent surgery and/or trauma, systemic diseases, and to refuse to participate in the study after being informed.

Outcome Measures

Demographic information such as age, weight, height, and gender, as well as self-reported information, was collected during the enrolment of the participants. McGill's Core Endurance tests²³ were used to evaluate core endurance. The Jamar Hydraulic hand dynamometer²⁴ was employed to measure hand grip strength, and the OptoGait device was utilized to assess lower extremity reaction time²⁵. The measurements started with a

reaction time measurement, then, hand grip strength was assessed, and finally, core endurance tests were conducted. A 10-minute break was given between the tests. The tests began in the morning, at least 2 hours after the meal, with participants having a low level of fatigue. All tests for a participant were conducted on the same day by an experienced physiotherapist. Participants were familiarized with the tests before it starts, and verbal support was provided throughout.

Evaluation Form

Demographic data of individuals (age, gender, marital status), whether they have metabolic disorders, presence of pain, drugs used, exercise status, anthropometric measurement values [height, weight, body mass index (body weight (kg)/ height (m²)], dominant hand/leg and a detailed data collection form in which data obtained as a result of core muscle endurance, right and left-hand grip strength, and reaction time measurements are recorded.

Anthropometric Measurements

The “Tanita BC 730 Body Analysis Scale”²⁶ was used to measure participants' weight and body mass index (BMI). Participants removed their shoes and socks and stood on the scale with their heels touching the electrodes and knees fully extended. Height was measured using a tape measure attached to a flat wall.

McGill’s Core Endurance Tests: McGill determined a valid and reliable set of tests [trunk flexors endurance test, trunk extensors endurance test (Biering-Sorensen) and lateral bridge tests]] to demonstrate trunk muscle endurance, and these tests have been shown to have reliability coefficients between 0.97 and 0.99. The purpose of endurance tests is to keep the person in a static position for as long as possible²³.

Trunk Flexors Endurance Test: The Trunk Flexors Endurance Test begins with the participant in a seated position, with the trunk supported at a 60° flexion angle. To minimize hip flexor involvement, the knees are bent to approximately 90°, and the feet must remain in contact with the ground without external fixation. The arms are crossed over the chest. Once the trunk support is removed, the participant attempts to maintain the position for as long as possible. The test is concluded when the participant can no longer hold the position. Time is manually recorded using chronograph stopwatches (Technos, YP2151/8P, BR) to the nearest 0.01 second²³.

Trunk Extensors Endurance Test (Biering-Sorensen): The Trunk Extensors Endurance Test, also known as the Biering-Sorensen test, assesses the isometric endurance of the trunk extensor muscles. During the test, the participant lies prone on a treatment table with their lower body, from the superior border of the iliac crest downward, secured to the table by a physiotherapist. The pelvis, hips, and knees are stabilized, while the trunk and upper extremities are supported by a chair at the same height as the table surface. Once the chair is removed, the participant maintains a prone position, holding their upper body horizontally without support. Hands are placed on the ears, elbows are extended outward and aligned with the trunk, and the head is kept in a neutral position. The participant holds this position until they can no longer resist the force of gravity due to fatigue. The test concludes when the participant's horizontal

position deteriorates and the trunk begins to flex. The duration is recorded in seconds using chronograph stopwatches (Technos, YP2151/8P, BR)^{23,27}.

Lateral Bridge Test: This test is used to evaluate the endurance of the oblique muscle groups in the trunk. To begin, the participant lies on their right side with legs extended and stacked on top of each other. The right elbow is positioned directly under the right shoulder, and the right forearm is placed on the ground with the palm facing down to provide support. The left arm is either placed along the side of the body or across the chest. From this starting position, the participant lifts their hips off the ground into a side bridge position, forming a straight line from head to feet. The test is terminated when the pelvis drops to the bed or when the participant is unable to maintain proper posture^{23,28}.

Evaluation of Hand Grip Strength: Hand grip strengths were measured with the "Jamar Hydraulic Hand Dynamometer". Several studies have stated the high reliability and/or validity of the Jamar dynamometer and thus it is the gold standard for measurement of hand grip strength^{29,30}. Participants were requested to indicate the hand with which they write in order to determine their dominant hand prior to the test. The standard test position suggested by the American Association of Hand Therapists were used³¹. Participants were positioned on a flat surface, sitting upright, knees and hips flexed to 90°, elbows flexed to 90°, forearm in a neutral position, wrist 0-30° flexed, and 0-5° ulnar deviation. The grip handle of the dynamometer is adjusted to the hand length of each participant to achieve an optimum grip position. During the measurement, it was asked to squeeze the handle of the dynamometer strongly and then to hold the position for 3 seconds. The measurement was made alternately and 3 times for both hands. The average values were taken for the right and left hands after the measurements, and the force was recorded in 'kg'²⁴. A 1-minute break was taken between measurements to prevent fatigue³².

Evaluation of Reaction Time: The reaction time was measured with the OptoGait (Microgate Italia, Bolzano-Bozen, Italy) device. OptoGait is a motion analysis technology that is portable and uses high-density photoelectric cells between the transmitter and receiver rods when measuring²⁵. In this study, the visual reaction test in the device was used. As soon as the red circle on the device screen turned green, the participant was asked to perform the one-leg raising and lowering movement that we determined to measure the reaction time of the lower extremity, with both feet fixed on the floor, knees in full extension, hips in neutral position, and arms at the side, and the reaction time was measured in seconds by the device. The test was performed three times for each of the legs, and the average of the reaction times obtained was recorded. A 1-minute break was taken between measurements to prevent fatigue. Before the start, the test was shown to the participants³³.

Before the test, low amplitude pushes were applied from the front and back to determine the dominant leg while talking to the participant constantly, and it was observed which leg the participant put forward or back in order not to fall. The leg used by the participant was recorded as the dominant leg³³.

Ethical Statement

This study was an observational, cross-sectional study that was approved by the local Ethics Committee (20.07.2022, Project no: 20.2022fbu) and conducted according to the Helsinki Declaration. Written informed consent for the use of the participants' data for research projects was completed by all participants at the time of enrolment.

Statistical Analysis

The GPower software package (GPower, Version 3.1.9.4, Franz Faul, Universität Kiel, Germany) was employed to determine the required sample size. The sample size calculation was based on the "correlation bivariate normal model" to assess the relational dynamics between the variables. It was determined that a minimum sample size of 46 subjects was necessary to achieve 95% power, with an effect size of $d = 0.50$, a significance level of $\alpha = 0.05$ for Type I error, and $\beta = 0.05$ for Type II error. For the statistical analysis of the study data, the "Statistical Package for Social Sciences" (SPSS) Version 20.0 (SPSS Inc., Chicago, IL, USA) was utilized. Variables were described using their mean, standard deviation, and percentage values. Pearson correlation analysis was conducted to examine the relationships between the scales. Correlation coefficients were interpreted as follows: 0.00–0.10: negligible, 0.10–0.39: weak, 0.40–0.69: moderate, 0.70–0.89: strong, and 0.90–1.00: very strong correlation³⁴. A p-value of <0.05 was considered statistically significant in all analyses.

Results

Sixty undergraduates, ranging from 1st to 4th year, were invited to participate, but 8 did not meet the eligibility criteria. Consequently, a total of 52 participants were included. No unexpected effects were observed during the assessments.

The demographic and clinical characteristics of the participants are summarized in Table 1. The sample of this study included 22 males (42.3%) and 30 females (57.7%) with a mean age of 21.18 ± 0.85 years. The average body mass index (BMI) was 22.12 ± 2.84 kg/m². In all participants, the right hand was dominant, while 37 participants (71.2%) had a dominant right leg, and 15 participants (28.8%) had a dominant left leg.

Table 1. Sociodemographic characteristics of the participants.

Characteristics	n (52)
Sex (F/M), n (%)	30 (57.7) / 22 (42.3)
Age (year), mean (SD)	21.18 (0.85)
Height (meter), mean (SD)	1.70 (0.09)
Weight (kg), mean (SD)	65.15 (13.62)
BMI (kg/m ²), mean (SD)	22.12 (2.84)
Dominant leg	
Right	37 (71.16)
Left	15 (28.84)

SD: standard deviation, F: female, M: male, BMI: body mass index

The correlation between core endurance, hand grip strength, and reaction time parameters is shown in Table 2. Left-right trunk lateral endurance test was moderately

and positively correlated with the right-hand grip strength (respectively, $r=0.51$, $r=0.47$, $p<0.001$). A moderate, positive correlation was found between left-right trunk lateral endurance tests and left-hand grip strength (respectively, $r=0.52$, $r=0.51$, $p<0.001$). A weak, negative correlation was found between the left-right trunk lateral endurance test and right lower extremity reaction time (respectively, $r=-0.38$, $p=0.005$; $r=-0.39$, $p=0.004$). There was no relationship between the core endurance parameters and the left lower extremity reaction time of these participants ($p>0.05$). Left- and right-hand grip strength was weakly and negatively correlated with right lower extremity reaction time (respectively; $r=-0.32$, $p=0.02$; $r=-0.37$, $p=0.006$). There was no correlation between left- and right-hand grip strengths and left lower extremity reaction time ($p>0.05$).

Table 2. Correlation between core endurance, hand grip strength and reaction time parameters.

Variables		LLERT	RLERT	LHGS	RHGS	TFET	LTLET	RTLET	TEET
LLERT (sn)	r	1	.447**	-.230	-.205	-.059	-.078	-.224	-.029
	p		.001	.102	.145	.680	.585	.111	.838
RLERT (sn)	r	.447**	1	-.325*	-.379**	-.221	-.384**	-.395**	-.090
	p	.001		.019	.006	.115	.005	.004	.527
LHGS (kg)	r	-.230	-.325*	1	.925**	.267	.522**	.511**	.191
	p	.102	.019		.000	.056	.000	.000	.176
RHGS (kg)	r	-.205	-.379**	.925**	1	.151	.512**	.470**	.135
	p	.145	.006	.000		.286	.000	.000	.342
TFET (sn)	r	-.059	-.221	.267	.151	1	.406**	.367**	.442**
	p	.680	.115	.056	.286		.003	.007	.001
LTLET (sn)	r	-.078	-.384**	.522**	.512**	.406**	1	.828**	.316*
	p	.585	.005	.000	.000	.003		.000	.022
RTLET (sn)	r	-.224	-.395**	.511**	.470**	.367**	.828**	1	.363**
	p	.111	.004	.000	.000	.007	.000		.008
TEET (sn)	r	-.029	-.090	.191	.135	.442**	.316*	.363**	1
	p	.838	.527	.176	.342	.001	.022	.008	

** Correlation is significant at the 0.01 level (2-tailed), *Correlation is significant at the 0.05 level (2-tailed), LLERT: left lower extremity reaction time, RLERT: right lower extremity reaction time, LHGS: left-hand grip strength, RHGS: right-hand grip strength, TFET: trunk flexor endurance test, LTLET: left trunk lateral endurance test, RTLET: right trunk lateral endurance test, TEET: trunk extensor endurance test

The correlation between lower extremity reaction time and other parameters in participants with right and left-dominant legs are shown in Table 3. In participants with right right-dominant leg, a moderate, negative correlation was found between the right lower extremity reaction time and right-hand grip strength ($r=-0.40$, $p=0.01$). Additionally, there was a weak, negative correlation between right lower extremity reaction time and left and right trunk lateral endurance test (respectively; $r=-0.35$,

$p=0.03$; $r=-0.33$, $p=0.04$). In participants with left dominant leg, no correlation was found between left lower extremity reaction time and other parameters.

Table 3. Correlation between lower extremity reaction time and other parameters in participants with right and left dominant legs.

Variables		LLERT	RLERT	LHGS	RHGS	TFET	LTLET	RTLET	TEET
Participants with right dominant leg (n=37)									
RLERT (sn)	r	,423**	1	-,264	-,402*	-,190	-,356*	-,331*	-,111
	p	,009		,114	,014	,260	,030	,045	,512
Participants with left dominant leg (n=15)									
LLERT (sn)	r	1	,523*	-,175	-,088	-,033	,127	-,248	-,137
	p		,046	,532	,754	,906	,652	,373	,627

** Correlation is significant at the 0.01 level (2-tailed), *Correlation is significant at the 0.05 level (2-tailed), LLERT: left lower extremity reaction time, RLERT: right lower extremity reaction time, LHGS: left-hand grip strength, RHGS: right-hand grip strength, TFET: trunk flexor endurance test, LTLET: left trunk lateral endurance test, RTLET: right trunk lateral endurance test, TEET: trunk extensor endurance test

Discussion

The aim of this study was to explore the relationship between core muscle endurance, hand grip strength, and reaction time in young adults. The result of this study revealed that core endurance, measured by the trunk lateral endurance test, demonstrated moderate and positive correlations with left- and right-hand grip strength. Additionally, it was weakly and negatively correlated with right lower extremity reaction time. The left- and right-hand grip strength was weakly and negatively correlated with right lower extremity reaction time. According to these findings, a higher trunk strength is associated with upper extremity strength and reaction time.

Core endurance affects functional movements, and improper core endurance is highly associated with injuries. The core region is connected through the kinetic chain with the body parts and is very important for the function of the upper and lower extremities³⁵. Thus, it is important to evaluate the relationship between core endurance and the performance parameters of the extremities. Solanki et al. whose purpose was to find out the correlation between hand grip strength and core muscle activation of the age group 18 to 25 reported a weak correlation between hand grip strength with core muscle activation¹². Another study showed that strengths of back and abdominal muscles were connected with hand grip strength in the female participants, and back strength was related with lower extremity function in females and males¹⁷. Our study showed a moderate, positive relation between core endurance and hand grip strength that is consistent with the results of these studies. This finding may be explained by the fact that the core region exhibits an anatomical and biomechanical interconnection with the extremities, characterized by a prominent muscular linkage³⁶.

Reaction time, an important parameter for performance, is strongly associated with the risk of injuries. Especially in the process of preventing injuries to the lower extremities,

it is of great importance that the person can adapt to sudden reactions and react quickly³⁷. Bıyıklı et al. aimed at investigating the relationship between reaction time performances and core muscle strength and durability of the swimmers of an average age of 21. They concluded that there was a relation between right-hand visual reactions and plank measurement values²¹. Our study demonstrated a weak and negative correlation between core endurance and lower extremity reaction time. These findings may be explained by the fact that the lower extremity moves through core stabilization and power transfer, which are encouraged by the activation of the core muscles. In addition, the activation of the kinetic chain between the lower extremity and core area may affect the reaction time.

Choudhary et al. discovered that hand grip strength, a measure of muscle strength, was linked to better reaction time and noted that non-cognitive indicators like hand grip strength have a closer association with reaction time³⁸. Also, a recent study showed how to hand grip strength increased as lower extremity reaction time decreased in older adults, consistent with the results of this study³⁹. Additionally, our research has revealed that there was a correlation between right lower extremity reaction time and core endurance and hand grip strength, while the absence of correlation on the left side are similar to the results from previous studies. Bıyıklı et al. found a relation between right-hand reaction time and the core²¹ and Choudhary et al. showed a negative correlation between at dominant hand grip strength and visual reaction time³⁸.

The main limitation of our study is the small number of participants. Secondly, the fact that the results are not categorized and evaluated according to gender can be considered as a limitation. Additionally, due to the cross-sectional design of the study, causality cannot be inferred, which should also be acknowledged as a limitation.

Conclusion

The research highlighted the relationship between core endurance, hand grip strength, and reaction time, noting these as significant markers of physical fitness. Given our results, considering the previously documented benefits of the analysed parameters in terms of injury prevention, performance enhancement, and effectiveness in treatment, we believe that the knowledge of the identified relationship will serve as a valuable guide for individuals working in this field. Future research could further examine different age groups and design various exercise programs based on these relationships

Conflicts of interest: The authors have no conflicts of interest relevant to this article.

Funding: This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Data availability: The data that support the findings of this study are available from the corresponding author upon reasonable request.

Ethics Committee Approval: This study was approved by the Fenerbahçe University Ethics Committee (20.07.2022, Project no: 20.2022fbu). Written informed consent for the use of the participants' data for research projects was completed by all participants at the time of enrolment.

REFERENCES

1. Ortega FB, Ruiz JR, Castillo MJ, Sjöström M. Physical fitness in childhood and adolescence: A powerful marker of health. *Int J Obes*. 2008;32(1):1-11. doi: 10.1038/sj.ijo.0803774.
2. Singh K, Malik I. Comparison of selected physical fitness components and playing ability of rural and urban basketball players. *Hum Mov Sport Sci*. 2017;2(2):427-429.
3. Hoeger W, Hoeger S. *Principles and labs for fitness and wellness*. 3th ed. New Jersey: American Society of Hand Therapists; 2015.
4. Kariyawasam A, Ariyasinghe A, Rajaratnam A, Subasinghe P. Comparative study on skill and health related physical fitness characteristics between national basketball and football players in Sri Lanka. *BMC Res Notes*. 2019;12(1). doi: 10.1186/s13104-019-4434-6.
5. Hsiao-Weeksler ET. Biomechanical and age-related differences in balance recovery using the tether-release method. *J Electromyogr Kinesiol*. 2008;18(2):179-187. doi: 10.1016/j.jelekin.2007.06.007.
6. Cabarkapa D, Whetstone JM, Patterson AM, Mosier EM, Cabarkapa DV, Fry AC. Relationship between health-related physical fitness parameters and functional movement screening scores acquired from a three-dimensional markerless motion capture system. *Int J Environ Res Public Health*. 2022;19(8):4551. doi: 10.3390/ijerph19084551.
7. Akuthota V, Ferreiro A, Moore T, Fredericson M. Core stability exercise principles. *Curr Sports Med Rep*. 2008;7(1):39-44. doi: 10.1097/01.CSMR.0000308663.13278.69.
8. Richardson CA, Snijders CJ, Hides JA, Damen L, Pas MS, Storm J. The relation between the transversus abdominis muscles, sacroiliac joint mechanics, and low back pain. *Spine*. 2002;27(4):399-405. doi: 10.1097/00007632-200202150-00015.
9. Samson KM, Sandrey MA, Hetrick A. A core stabilization training program for tennis athletes. *Athl Ther Today*. 2007;12(3):41-46. doi: 10.1123/att.12.3.41.
10. Clark DR, Lambert MI, Hunter AM. Contemporary perspectives of core stability training for dynamic athletic performance: A survey of athletes, coaches, sports science and sports medicine practitioners. *Sport Med - Open*. 2018;4(1):32. doi: 10.1186/s40798-018-0150-3.
11. Sung DJ, Park SJ, Kim S, Kwon MS, Lim YT. Effects of core and non-dominant arm strength training on drive distance in elite golfers. *J Sport Heal Sci*. 2016;5(2):219-225. doi: 10.1016/J.JSHS.2014.12.006.
12. Solanki DV, Soni N. Correlation between hand grip strength and core muscle activation in physical therapists of Gujarat. *International Journal of Health Sciences and Research*. 2021;11(5):82. doi: 10.52403/ijhsr.20210512.
13. Warren L, Baker R, Nasypany A, Seegmiller J. Core concepts: Understanding the

complexity of the spinal stabilizing systems in local and global injury prevention and treatment. *International Journal of Athletic Therapy and Training*. 2014;19(6):28-33.

14. Bohannon RW. Reference values for extremity muscle strength obtained by hand-held dynamometry from adults aged 20 to 79 years. *Arch Phys Med Rehabil*. 1997;78(1):26-32.
15. Foo LH, Zhang Q, Zhu K, Ma G, Greenfield H, Fraser DR. Influence of body composition, muscle strength, diet and physical activity on total body and forearm bone mass in Chinese adolescent girls. *Br J Nutr*. 2007;98(6):1281-1287.
16. Massy-Westropp N, Rankin W, Ahern M, Krishnan J, Hearn TC. Measuring grip strength in normal adults: Reference ranges and a comparison of electronic and hydraulic instruments. *J Hand Surg Am*. 2004;29(3):514-519. doi: 10.1016/j.jhsa.2004.01.012.
17. Ishak NA, Zahari Z, Justine M. Kinesiophobia, pain, muscle functions, and functional performances among older persons with low back pain. *Pain Res Treat*. 2017;2017.
18. Ferri-Carwana A, Prades-Insa B, Serra-AÑÓ P. Effects of pelvic and core strength training on biomechanical risk factors for anterior cruciate ligament injuries. *J Sports Med Phys Fitness*. 2020;60(8):1128-1136. doi: 10.23736/S0022-4707.20.10552-8.
19. Green CM, Petrou MJ, Fogarty-Hover MLS, Rolf CG. Injuries among judokas during competition. *Scand J Med Sci Sport*. 2007;17(3):205-210.
20. Engeroff T, Giesche F, Niederer D, et al. Explaining upper or lower extremity crossover effects of visuomotor choice reaction time training. *Percept Mot Skills*. 2019;126(4):675-693. doi: 10.1177/0031512519841755.
21. Bıyıklı T. Investigation of the relation between core muscle strength, durability and reaction performance for swimmers. *J Educ Train Stud*. 2018;6(11):254. Tekin D, Agopyan A. Comparison of motorcyclists' hand grip strength and reaction time. *J Sport Heal Res*. 2022;14(1):97-112.
22. McGill SM, Childs A, Liebenson C. Endurance times for low back stabilization exercises: Clinical targets for testing and training from a normal database. *Arch Phys Med Rehabil*. 1999;80(8):941-944. doi: 10.1016/S0003-9993(99)90087-4.
23. Roberts HC, Denison HJ, Martin HJ, et al. A review of the measurement of grip strength in clinical and epidemiological studies: Towards a standardised approach. *Age Ageing*. 2011;40(4):423-429. doi: 10.1093/ageing/afro51.
24. Weart AN, Miller EM, Freisinger GM, Johnson MR, Goss DL. Agreement between the optogait and instrumented treadmill system for the quantification of spatiotemporal treadmill running parameters. *Front Sport Act Living*. 2020;2.
25. Barcin Güzeldere HK, Aksoy M. Anthropometric measurements and food consumption analysis of older people according to place of residence and gender: A cross-sectional study. *Clin Nutr ESPEN*. 2021;45:236-244. doi: 10.1016/j.clnesp.2021.08.018.

26. Petrič M, Zaletel-Kragelj L, Vauhnik R. Characteristics and usefulness of trunk muscle endurance tests on the Roman chair in healthy adults. *Peer J*. 2022;10.
27. Abdelraouf OR, Abdel-Aziem AA. The relationship between core endurance and back dysfunction in collegiate male athletes with and without nonspecific low back pain. *Int J Sports Phys Ther*. 2016;11(3):337-344.
28. Mathiowetz V, Weber K, Volland G, Kashman N. Reliability and validity of grip and pinch strength evaluations. *J Hand Surg Am*. 1984;9(2):222-226.
29. Shechtman O, Gestewitz L, Kimble C. Reliability and validity of the DynEx dynamometer. *J Hand Ther*. 2005;18(3):339-347. doi: 10.1197/j.jht.2005.04.002.
30. MacDermid J, Solomon G, Valdes K. *Clinical Assessment Recommendations*. WorldCat.org; 2015. Accessed July 23, 2023. <https://cir.nii.ac.jp/crid/1570572701254788096>.
31. Franchini E, Schwartz J, Takito MY. Maximal isometric handgrip strength: Comparison between weight categories and classificatory table for adult judo athletes. *J Exerc Rehabil*. 2018;14(6):968-973. doi: 10.12965/jer.1836396.198.
32. Teo I, Thompson J, Neo YN, Lundie S, Munnoch DA. Lower limb dominance and volume in healthy individuals. *Lymphology*. 2017;50(4):197-202.
33. Schober P, Schwarte LA. Correlation coefficients: Appropriate use and interpretation. *Anesth Analg*. 2018;126(5):1763-1768. doi: 10.1213/ANE.0000000000002864.
34. Kim J, Lee DY, Yu J, Kim J, Hong J. The influence of abdominal muscles on shoulder isometric muscular strength. *Indian J Sci Technol*. 2015;8(25).
35. Aly S, ElMohsen A, Hafez S. Effect of six weeks of core stability exercises on trunk and hip muscles' strength in college students. *Int J Ther Rehabil Res*. 2017;6(2):9.
36. Wilkerson GB, Simpson KA, Clark RA. Assessment and training of visuomotor reaction time for football injury prevention. *J Sport Rehabil*. 2017;26(1):26-34.
37. Choudhary AK, Jiwane R, Alam T, Kishanrao SS. Grip strength and impact on cognitive function in healthy kitchen workers. *Achiev Life Sci*. 2016;10(2):168-174.
38. Jiménez-García JD, Martínez-Amat A, Hita-Contreras F, Fábrega-Cuadros R, Álvarez-Salvago F, Aibar-Almazán A. Muscle strength and physical performance are associated with reaction time performance in older people. *Int J Environ Res Public Health*. 2021;18(11). doi: 10.3390/ijerph18115893.

Factors Related to Quality of Life in the Older Adults: Urinary Incontinence, Comorbidity and Polypharmacy

Özge ÖZ YILDIRIM*, İlknur AYDIN AVCI**

Abstract

Aim: Urinary incontinence (UI) is a health problem that has a significant impact on the quality of life of older adults, especially in the presence of comorbidity and polypharmacy, which tend to increase with age. This study aims to investigate the influence of UI, comorbidity and polypharmacy on quality of life in older adults.

Method: This descriptive and correlational study was conducted with 328 older adults between November 2020-June 2021. The data collection tools consisted of a "Personal Information Form" and Quality of Life Scale in older adults. Descriptive statistics, two-way analysis of variance and binary logistic analysis were used to evaluate the data. The significance level was accepted as $p < 0.05$.

Results: The prevalence of urinary incontinence in older adults was 46.6%. Female gender (OR: 0.54) and accepting urinary incontinence as a health problem (OR: 3.11) were found to be risk factors for urinary incontinence in older adults ($p < 0.05$). For quality of life, the main effect of the urinary incontinence variable ($p < 0.001$) and the main effect of the polypharmacy variable ($p < 0.05$) were found to be statistically significant. The comorbidity*polypharmacy variable also has an effect on quality of life ($p < 0.05$).

Conclusions: According to the findings of this study, approximately one in two older adults experiences urinary incontinence. This condition is more prevalent among older women and among individuals who perceive urinary incontinence as a significant health issue. Both urinary incontinence and polypharmacy have a negative impact on quality of life, with urinary incontinence exerting a greater detrimental effect. Furthermore, the coexistence of comorbidities and polypharmacy is also associated with a decline in quality of life.

Keywords: Urinary incontinence, older adults, comorbidity, polypharmacy, quality of life.

Yaşlılarda Yaşam Kalitesi ile İlişkili Faktörler: Üriner İnkontinans, Komorbidite, Polifarmasi

Öz

Amaç: Üriner inkontinans (UI), özellikle yaşla birlikte artma eğiliminde olan komorbidite ve polifarmasi varlığında yaşlı yetişkinlerin yaşam kalitesi üzerinde önemli bir etkiye sahip olan bir sağlık sorunudur. Bu çalışmada, üriner inkontinans, komorbidite ve polifarmasinin yaşlılarda yaşam kalitesi üzerindeki etkisini araştırmayı amaçlamaktadır.

Yöntem: Bu çalışma tanımlayıcı ve ilişki arayıcı araştırma türünde 328 yaşlı ile yapılmıştır. Veri toplama formu olarak, "Kişisel Soru Formu" ve "Yaşlı Yaşam Kalitesi Ölçeği" kullanılmıştır. Verilerin değerlendirilmesinde tanımlayıcı istatistikler, iki yönlü varyans analizi ve binary logistic regresyon analizi kullanılmıştır. Anlamlılık düzeyi $p < 0,05$ olarak kabul edilmiştir.

Bulgular: Yaşlılarda üriner inkontinans sıklığı %46,6'dır. Yaşlılarda üriner inkontinans risk faktörü olarak kadın cinsiyeti (OR:0,54) ve üriner inkontinansı sağlık sorunu olarak kabul etme (OR:3,11)

Özgün Araştırma Makalesi (Original Research Article)

Geliş / Received: 10.09.2024 & **Kabul / Accepted:** 28.07.2025

DOI: <https://doi.org/10.38079/igusabder.1546274>

* (Corresponding Author) Asst. Prof., Ondokuz Mayıs University, Faculty of Health Sciences, Public Health Nursing

Department, Samsun, Türkiye. E-mail: ozge.oz@omu.edu.tr [ORCID](https://orcid.org/0000-0003-4810-563X) <https://orcid.org/0000-0003-4810-563X>

** Prof. Dr., Ondokuz Mayıs University, Faculty of Health Sciences, Public Health Nursing Department, Samsun, Türkiye. E-mail: ilknura@omu.edu.tr [ORCID](https://orcid.org/0000-0002-5379-3038) <https://orcid.org/0000-0002-5379-3038>

ETHICAL STATEMENT: To conduct the research, ethics committee approval was obtained from Ondokuz Mayıs University Social and Humanities Ethics Committee (no: 2020-793, date of acceptance: 27.11.2020).

bulunmuştur($p<0,05$). Yaşam kalitesi üzerine, üriner inkontinans değişkenine ilişkin ana etki ($p<0,001$) ve polifarmasi değişkenine ait ana etki ($p<0,05$) istatistiksel olarak anlamlı bulunmuştur. Komorbidite* polifarmasi değişkeni de yaşam kalitesi üzerinde etki oluşturmaktadır ($p<0,05$).

Sonuç: Bu çalışma sonuçlarına göre yaklaşık her iki yaşlıdan biri üriner inkontinans yaşamaktadır. Kadın yaşlılarda ve üriner inkontinansı sağlık sorunu olarak kabul eden yaşlılarda üriner inkontinans daha fazladır. Üriner inkontinans ve polifarmasi yaşam kalitesini olumsuz etkilemektedir. Üriner inkontinansın yaşam kalitesini olumsuz etkileme durumu polifarmsiden daha fazladır. Ayrıca komorbidite ve polifarmasinin bir arada olması da yaşam kalitesini olumsuz etkilemektedir.

Anahtar Sözcükler: Üriner inkontinans, yaşlı, komorbidite, polifarmasi, yaşam kalitesi.

Introduction

The incidence of UI, defined as involuntary urine leakage, increases with age¹⁻³. Prevalence varies by definition and setting, but ranges from an average of 37.1% to 46.8% (56.3% women and 35% men) in rural areas, and may affect up to 80% of frail older adults⁴⁻⁶.

Many risk factors cause UI, such as age, gender, obesity, menopause, smoking, chronic cough, type of birth, etc.^{2,7}. With aging, the weakening of bladder capacity, the ability to delay urination, and bladder contractions cause UI^{6,8}. In addition, one of the risk factors that increases the frequency of UI in old age is comorbidity, which is the coexistence of many chronic diseases^{9,10}. It is stated that comorbidities affecting the neurological and cardiovascular systems are closely related to UI¹⁰.

Comorbidities can lead to polypharmacy¹¹. Comorbidities increase the frequency of UI both with the physiological and neurological effects they cause and with polypharmacy⁹. Polypharmacy, defined as taking more than five medicines a day, is a significant risk factor for UI¹²⁻¹⁴. Various drug classes that affect the central nervous system (benzodiazepines, antidepressants, antipsychotics, and opioids) have important effects on the development of UI¹⁵⁻¹⁸.

UI is a social, emotional, hygienic, and medical problem. UI restricts the physical and social life of older adults and decreases their quality of life (QoL) significantly¹⁹⁻²¹. Comorbidity and polypharmacy increase the frequency of UI, but also reduce QoL. Separate studies of comorbidity²² and polypharmacy^{12,23,24} have found that UI has a negative impact on QoL. It is known that the frequency of chronic diseases, polypharmacy, and UI increases with increasing age. It is also stated that all these variables decrease the QoL. While the older adult population is rising rapidly in the world, studies examining the effects of comorbidity, polypharmacy, and UI on QoL in old age should be conducted in order to plan studies to improve the QoL of these individuals. No study has been found in the literature examining the frequency of UI, comorbidity, and the effects of polypharmacy on QoL^{23,24}. Therefore, this study aims to examine the effects of UI, comorbidity, and polypharmacy on the QoL in older adults.

Material and Methods

This paper follows the reporting guidelines outlined in “STROBE - Cross-Sectional Studies”.

Study design: This research is cross-sectional.

Research Question: HOW do UI, comorbidity, and polypharmacy affect the QoL in older adults?

Setting

This study was conducted with 328 older adults in the central district of a province in the north of Turkey between November 2020 and June 2021. Due to the Covid-19 pandemic, data was collected online using the snowball sampling method. The inclusion criteria for the study include living in these regions, being over 65 years of age, using a smartphone, using the WhatsApp application, knowing how to read and write, and agreeing to participate in the research. In the power analysis made using the G*Power 3.1 program and the average score of the quality-of-life scale in the older adults (15.96 ± 7.73), the sample size of the study was determined as 268 using the data such as 95% power, Type 1 error 0.05, and 0.20 effect level²⁵.

The dependent variable is the QoL, and the independent variables are the socio-demographic characteristics of the older adults with UI, polypharmacy, and comorbidity.

Data Collection

Data were collected using a questionnaire form developed by the researchers based on the literature and the QoL Scale for older adults.

Questionnaire form: The questionnaire includes questions examining age, gender, education, marital status, family income, UI characteristics, disease status, and their use of medication.

Quality of Life Scale in Older People (CASP-19): The CASP-19 scale was developed by Hyde et al. in 2003 to measure the QoL of older adults and was adapted into Turkish by Türkoğlu and Adıbelli in 2014²⁶. Each item of the scale is scored as 0 "never", 1 "not often", 2 "sometimes", and 3 "often". Items 1, 2, and 4 are reverse-coded. An increase in the total score indicates that the quality of life increases. In this study, the mean score of the scale is 21.01 ± 7.79 (0-39), and Cronbach's alpha is 0.88.

Ethical Statement

To conduct the research, ethics committee approval was obtained from Ondokuz Mayıs University Social and Humanities Ethics Committee (no: 2020-793, date of acceptance: 27.11.2020). Participants agreed to participate in the study before starting the study. The study adhered to the Declaration of Helsinki (2013) in all its phases.

Data Analysis

The data were analyzed in the IBM SPSS v23 package program (Chicago, USA). Number of units (n), percentage (%), mean $\pm$ standard deviation (mean (SD) values were used as summary statistics. The normal distribution of the data was evaluated by the Kolmogorov-Smirnov test. In the evaluation of the data, the effect of UI, polypharmacy, and comorbidity variables on QoL was examined by two-way analysis of variance along with descriptive statistics. Multiple comparisons were evaluated with Bonferroni correction. Associations between independent variables and prevalence were analyzed using univariate/multivariate generalized estimating equation (GEE) binary logistic analysis; the odds ratio (OR) and its 95% confidence interval (CI) were also reported. The significance level was accepted as $p < 0.05$.

Research Limitations

This research was conducted online with older adults living in the research area and using smartphones and WhatsApp due to the limitations experienced during the Covid-19 pandemic. Therefore, the research results are limited to the participants who participated in the study.

Results

The average age of participants is 70.14 ± 4.33 . 62.5% are female, 30.5% have completed primary school education, and 13.1% have completed higher education. 76.2% of participants are married, and 68% have a middle-level economic status. The frequency of UI in participants is 46.6%. When looking at the type of UI, it was determined that 41.8% were stress urinary incontinence and 41.8% were urge urinary incontinence. 19.6% of participants applied to a health institution due to UI and 86.9% accept UI as a health problem. 73.2% of participants have chronic diseases, 29.6% have comorbidities, and 30.8% have polypharmacy. 66.2% of them use medications constantly, 89.4% know how to use their medications, and 18.9% use medications other than those recommended by the doctor (Table 1).

Table 1. Factors associated with participants' UI and health problems

	X$\pm$SS(min-max)	
Age	70.14 $\pm$ 4.33(65-79)	
Gender	n	%
Female	205	62.5
Male	123	37.5
Education status		
Illiterate	122	37.2
Primary school	100	30.5
Middle school	29	8.8
High school	34	10.4
Higher education and above	43	13.1
Marital status		
Married	250	76.2
Single	78	23.8
Economic level		
Good	56	17.1
Medium	223	68
Bad	49	14.9
Urinary incontinence		
Yes	153	46.6
No	175	53.4
Urinary incontinence type (n=153)		
Stress	64	41.8

Urge	64	41.8
Mix	25	16.4
Applying to a health institution (n=153)		
Yes	30	19.6
No	123	80.4
Accepting urinary incontinence as a health problem		
Yes	285	86.9
No	43	13.1
Having a chronic disease		
Yes	240	73.2
No	88	26.8
Having a comorbidity		
Yes	97	29.6
No	231	70.4
Polypharmacy		
Yes	101	30.8
No	227	69.2
Continuous medication use		
Yes	217	66.2
No	111	33.8
Knowing how to use medications (n=217)		
Yes	194	89.4
No	23	10.6
Using medication other than the one recommended by the doctor		
Yes	62	18.9
No	266	81.1

Gender and acceptance of UI as a health problem were independent risk factors for UI. In multivariate analysis, UI was 0.54 times more common in female older adults than male older adults ($p = 0.016$). Likewise, the incidence of UI was found to be 3.11 times higher in older adults who considered UI as a health problem ($p=0.004$). Other variables were not found to be significant ($p<0.01$) (Table 2).

Table 2. Risk factors for UI in older adults

	Univariate		Multivariate	
	OR(%95 CI)	p	OR(%95 CI)	p
Gender				
Female	0.52(0.33-0.82)	0.005**	0.54(0.33-0.90)	0.016**
Male	Reference		Reference	
Educational Status				
Illiterate	0.57(0.28-1.17)	0.573	1.05(0.46-2.42)	0.912

Primary school	0.70(0.33-1.45)	0.696	0.96(0.43-2.13)	0.920
Middle school	0.73(0.28-1.90)	0.729	0.84(0.30-2.36)	0.734
High school	0.67(0.27-1.66)	0.667	0.79(0.30-2.10)	0.635
Higher education and above	Reference		Reference	
Marital status				
Married	1.67(1.00-2.80)	0.049	1.39(0.79-2.44)	0.256
Single	Reference		Reference	
Income status				
Good	2.22(1.02-4.86)	0.046	1.54(0.63-3.81)	0.346
Moderate	1.53(0.82-2.85)	0.185	1.16(0.55-2.43)	0.697
Bad	Reference		Reference	
Family Type				
Nuclear	1.75(1.11-2.76)	0.017**	1.49(0.87-2.53)	0.143
Extended	Reference		Reference	
Accepting urinary incontinence as a health problem				
Yes	3.94(1.91-8.13)	0<0.001**	3.11(1.45-6.66)	0.004**
No	Reference		Reference	
Having a chronic disease				
Yes	0.61(0.37-1.00)	0.049	0.97(0.54-1.76)	0.918
No	Reference		Reference	
Having a comorbidity				
Yes	0.44(0.27-0.72)	0.001	0.63(0.34-1.16)	0.139
No	Reference		Reference	
Polypharmacy				
Yes	0.50(0.31-0.81)	0.005	0.77(0.41-1.42)	0.396
No	Reference		Reference	
Constant				
			0.42	0.200

Cox and Snell $R^2=0.108$; Nagelkerke $R^2=0.144$; Hosmer and Lemeshow Chi Square=4.814, $p=0.777$; DS=62%; CI, confidence interval: Ref., reference; UI, urinary incontinence; OR, odds ratio.

The multivariate regression model included variables with $*p < 0.05$ in univariate regression analyses treated as covariates; significance: $**p < 0.05$.

The main effects of experiencing UI, polypharmacy and comorbidity variables on QoL were examined. The main effect regarding the UI variable was found to be statistically significant ($p<0.001$). Similarly, the main effect of the polypharmacy variable was found to be statistically significant ($p<0.05$). The effect of the comorbidity *polypharmacy variable was found to be statistically significant ($p<0.05$). For the UI variable, partial eta squared is 0.045, for the polypharmacy variable in the figure, partial eta squared is 0.029; and for the comorbidity and polypharmacy variable, partial eta squared is 0.022.

The effect of UI on QoL was found to be higher than polypharmacy and comorbidity *polypharmacy ($p<0.05$) (Table 3).

Table 3. Effects of urinary incontinence, comorbidity, and polypharmacy variables on QoL

	F	p	Partial Eta Squared	R ²
Urinary incontinence	14.998	0.000*	0.045	
Comorbidity	0.531	0.467	0.002	
Polypharmacy	9.501	0.002*	0.029	0.185
Urinary incontinence* Comorbidity	0.389	0.533	0.001	
Urinary incontinence* Polypharmacy	1.702	0.193	0.005	
Comorbidity* Polypharmacy	7.121	0.008*	0.022	
Urinary incontinence* Polypharmacy* Comorbidity	0.197	0.657	0.001	

* $p<0.05$

Discussion

In this study, the prevalence of UI among older adults was 46.6%. Approximately half of the older adults have UI. In a study conducted among older adults in China, the prevalence of any type of urinary incontinence (UI) was reported as 46.8%²⁷. Similarly, a study involving elderly individuals with chronic illnesses living in a nursing home in Spain found a UI prevalence of 76.5%²⁸. The literature consistently indicates that the prevalence of UI is higher in populations with chronic conditions, as observed in the present study²⁹. Additionally, it has been noted that age-related physiological changes further contribute to the increased incidence of UI in older adults^{6,8}. The prevalence of both stress- and urge-type UI in older adults is 41.8%. In the study of Alshammari et al. it was determined that UI and SUI were the two most common types of UI in older adults. The prevalence of MUI was 41.03% in female older adults and 13.04% in male older adults, while the prevalence of SUI was 25.64% in female older adults and 23.91% in male older adults²⁰.

Female gender is a risk factor for UI in older adults. Studies have shown that the frequency of UI is higher in women, especially in the post-menopausal period^{20,30}. The effect of changes that occur with aging in women may also cause them to experience UI more frequently than men. However, women's gynecological history, fertility history and intervention in their births, and the fact that genital infections, prolapse, etc., are more common in women may increase the risk of incontinence compared to men^{2,31}. Studies have reported that UI negatively affects the QoL^{20,21}. Therefore, the QoL in older women who experience UI may be more negatively affected than in men.

UI is more common in older adults who consider UI as a health problem. Being aware of a health condition positively affects accepting that health condition as a problem and seeking help for its solution³². Therefore, in this study, the fact that older adults accept UI as a health problem indicates that their awareness of this condition is high. This

situation is thought to be a factor that can positively affect coping with UI. One limitation of this study is that it was conducted with older adults who can use smartphones and can be reached via social media. This group's acceptance of UI as a health problem may have been higher than that of other disadvantaged older adults. There is a need to analyze acceptance and experience of UI as a health problem through further studies.

UI has the most impact on QoL in older adults ($p<0.001$), producing negative effects^{19-21,33}, that include physical, social and psychological limitations in the lives of the older adults. This study found polypharmacy to negatively affect QoL. ($p<0.05$). Purchase et al. (2022) determined that polypharmacy negatively affects the QoL³⁴. Additionally, the coexistence of comorbidity and polypharmacy reduced the QoL ($p<0.05$). In the study by Van Wilder et al. (2022), it was found that the quality of life among older adults with comorbidity and polypharmacy was significantly lower¹⁴. Similarly, other studies have shown that polypharmacy negatively impacts the quality of life in the elderly^{35,36}. The symptoms associated with chronic diseases can affect older adults both physically and psychologically, leading to various limitations in daily life^{37,38}. Furthermore, the increasing number of medications prescribed for managing chronic conditions can make it challenging for older adults to adhere to proper timing and dosage schedules³⁹. Difficulty in managing these medications may lead to poorer disease control, further deteriorating quality of life.

Conclusion and Recommendations

This study found that one in every two older adults has UI, and the incidence of UI is higher in older adults who are women and who accept UI as a health problem. UI and polypharmacy negatively impact QoL, though UI negatively affects QoL more than polypharmacy. The coexistence of comorbidity and polypharmacy also negatively impacts QoL. The study was conducted with the older adults during the pandemic and within online access parameters. Conducting similar studies with older adults of different education levels and residential demographics is recommended. Nurses and physicians who provide healthcare services to older adults should not ignore the problem of UI. Geriatric and public health nurses should assess urinary incontinence (UI) status when evaluating older adult patients and consider quality of life (QoL) in relation to polypharmacy and comorbidities. Nurses are encouraged to educate older individuals on the management of UI through strategies such as Kegel exercises, fluid intake regulation, and bladder training. Additionally, they should provide guidance on the importance of chronic disease management, including appropriate medication timing and dosage. It is also recommended that physicians consider existing medication regimens when prescribing additional medications to older adults to avoid complications related to polypharmacy.

Conflict of interest: No conflict of interest was declared by the authors

REFERENCES

1. D'Ancona C, Haylen B, Oelke M, et al. The International Continence Society (ICS) report on the terminology for adult male lower urinary tract and pelvic floor symptoms and dysfunction. *Neurourol Urodyn*. 2019;38:433–77.

2. Pang H, Lv J, Xu T, et al. Incidence and risk factors of female urinary incontinence: A 4-year longitudinal study among 24 985 adult women in China. *BJOG: An International Journal of Obstetrics & Gynaecology*. 2022;129(4):580-589.
3. Ahmadi B, Alimohammadian M, Golestan B, et al. The hidden epidemic of urinary incontinence in women: A population-based study with emphasis on preventive strategies. *Int Urogynecol J*. 2010;21(4):453-459
4. Batmani S, Jalali R, Mohammadi M. et al. Prevalence and factors related to urinary incontinence in older adults women worldwide: A comprehensive systematic review and meta-analysis of observational studies. *BMC Geriatr*. 2021;21:212.
5. Luo Y, Zou P, Wang K, et al. Prevalence and risk factors of urinary incontinence among elderly adults in rural China: A cross-sectional survey. *Journal of Wound, Ostomy and Continence Nursing*. 2022;49(1):78-86.
6. Aly WW, Sweed HS, Mossad NA, et al. Prevalence and risk factors of urinary incontinence in frail elderly females. *Journal of Aging Research*. 2020;(1):2425945.
7. Daneshpajoo A, Naghibzadeh-Tahami A, Najafipour H, et al. Prevalence and risk factors of urinary incontinence among Iranian women. *Neurourology and Urodynamics*. 2021;40(2):642-652.
8. Gibson W, Johnson T, Kirschner-Hermanns R, et al. Incontinence in frail elderly persons: Report of the 6th International Consultation on Incontinence. *Neurourology and Urodynamics*. 2021;40(1):38-54.
9. Talasz H, Lechleitner M. Polypharmacy and incontinence. *Zeitschrift für Gerontologie und Geriatrie*. 2012;45(6):464-467.
10. Scharp D, Harkins SE, Topaz M. Comorbidities of community-dwelling older adults with urinary incontinence: A scoping review. *Geriatric Nursing*. 2023;53:280-294.
11. Menditto E, Gimeno Miguel A, Moreno Juste A, et al. Patterns of multimorbidity and polypharmacy in young and adult population: Systematic associations among chronic diseases and drugs using factor analysis. *PLoS One*. 2019;14(2):e0210701.
12. Küçükdağlı P. Polypharmacy and related factors in geriatric outpatients. *European Journal of Geriatrics and Gerontology*. 2019;1(2):56-60.
13. Gutiérrez-Valencia M, Herce PA, Lacalle-Fabo E, et al. Prevalence of polypharmacy and associated factors in older adults in Spain: Data from the National Health Survey 2017. *Medicina Clínica*. 2019;153(4):141-150.
14. Van Wilder L, Devleeschauwer B, Clays E, et al. Peer reviewed: polypharmacy and health-related quality of life/psychological distress among patients with chronic disease. *Preventing Chronic Disease*. 2022;19:E50.

15. Landi F, Cesari M, Russo A, et al. Benzodiazepines and the risk of urinary incontinence in frail older persons living in the community. *Clinical Pharmacology & Therapeutics*. 2002;72(6):729-734
16. Fritel X, Tsegean YE, Pierre F, et al. Association of postpartum depressive symptoms and urinary incontinence: A cohort study. *European Journal of Obstetrics & Gynecology and Reproductive Biology*. 2016;198:62-67.
17. Felde G, Engeland A, Hunskaar S. Urinary incontinence associated with anxiety and depression: The impact of psychotropic drugs in a cross-sectional study from the Norwegian HUNT study. *BMC Psychiatry*. 2020;20:1-10.
18. Ruby CM, Hanlon JT, Boudreau RM, et al. The effect of medication use on urinary incontinence in community-dwelling elderly women. *Journal of the American Geriatrics Society*. 2010;58(9):1715-1720.
19. Murukesu RR, Singh DK, Shahar S. Urinary incontinence among urban and rural community dwelling older women: Prevalence, risk factors and quality of life. *BMC Public Health*. 2019;19(4):1-11.
20. Alshammari S, Alyahya MA, Allhidan RS, et al. Effect of urinary incontinence on the quality of life of older adults in Riyadh: Medical and sociocultural perspectives. *Cureus*. 2020;12(11):e11599.
21. Zhang D, Wang S, Gao L, et al. Analysis of characteristics and quality of life of elderly women with mild to moderate urinary incontinence in community dwellings. *International Journal of Environmental Research and Public Health*. 2022;19(9):5609.
22. Ragins AI, Shan J, Thom DH, et al. Effects of urinary incontinence, comorbidity and race on quality of life outcomes in women. *The Journal of Urology*. 2008;179(2):651-655.
23. Prud'homme G, Alexander L, Orme S. Management of urinary incontinence in frail elderly women. *Obstetrics, Gynaecology & Reproductive Medicine*. 2018;28(2):39-45.
24. Schenker Y, Park SY, Jeong K, et al. Associations between polypharmacy, symptom burden, and quality of life in patients with advanced, life-limiting illness. *Journal of General Internal Medicine*. 2019;34:559-566.
25. Bitek DE, Ulukoca N, Helvacı M. Evde bakım hizmetinden yararlanan engelli yaşlı bireylerin sağlık durumları ve yaşam kalitelerinin değerlendirilmesi. In: *3rd International, 21st National Public Health Congress*; November 26–30, 2019; Antalya, Turkey.
26. Türkoğlu N, Adıbelli D. Yaşlılarda yaşam kalitesi ölçeğinin (CASP-19) Türk toplumuna adaptasyonu. *Akad Geriatri*. 2014;6:98-105.
27. Luo Y, Zou P, Wang K, Li X, Wang J. Prevalence and risk factors of urinary incontinence among elderly adults in rural China: A cross-sectional survey. *Journal of Wound Ostomy & Continence Nursing*. 2022;49(1):78-86.

- 28.** Jerez-Roig J, Farrés-Godayol P, Yildirim M, et al. Prevalence of urinary incontinence and associated factors in nursing homes: A multicentre cross-sectional study. *BMC Geriatrics*. 2024;24(1):169.
- 29.** Scime NV, Hetherington E, Metcalfe A, et al. Association between chronic conditions and urinary incontinence in females: A cross-sectional study using national survey data. *Canadian Medical Association Open Access Journal*. 2022;10(2):E296-E303.
- 30.** Huang H, Ding G, Li M, et al. Menopause and stress urinary incontinence: The risk factors of stress urinary incontinence in perimenopausal and postmenopausal women. *Journal of Obstetrics and Gynaecology Research*. 2023;49(10):2509-2518.
- 31.** Liu B, Wang L, Huang SS. et al. Prevalence and risk factors of urinary incontinence among Chinese women in Shanghai. *Int J Clin Exp Med*. 2014;7(3):686-96.
- 32.** Siddiqui NY, Ammarell N, Wu JM, et al. Urinary incontinence and health-seeking behavior among white, black, and Latina women. *Female Pelvic Med Reconstr Surg*. 2016;22(5):340-5.
- 33.** Silay K, Akinci S, Ulas A, et al. Occult urinary incontinence in elderly women and its association with geriatric condition. *Eur Rev Med Pharmacol Sci*. 2016;20(3):447-51
- 34.** Purchase T, Trilloe G, Ahmed H, et al. Polypharmacy and smoking as potentially modifiable risk factors associated with symptom severity in men with lower urinary tract symptoms in primary care: Findings from the PriMUS study. *European Urology Focus*. 2022;8(1):8-10.
- 35.** Tegegn HG, Erku DA, Sebsibe G, et al. Medication-related quality of life among Ethiopian elderly patients with polypharmacy: A cross-sectional study in an Ethiopia university hospital. *PloS One*. 2019;14(3):e0214191.
- 36.** Aljeaidi MS, Haaksma ML, Tan EC. Polypharmacy and trajectories of health-related quality of life in older adults: An Australian cohort study. *Quality of Life Research*. 2022;31(9):2663-2671.
- 37.** Chen HM, Chen CM. Factors associated with quality of life among older adults with chronic disease in Taiwan. *International Journal of Gerontology*. 2017;11(1):12-15.
- 38.** Xiao S, Shi L, Dong F, et al. The impact of chronic diseases on psychological distress among the older adults: The mediating and moderating role of activities of daily living and perceived social support. *Aging & Mental Health*. 2022;26(9):1798-1804.
- 39.** İşli F. Yaşlılarda polifarmasi. *Turkey Health Literacy Journal*. 2022;3(3):171-174.

Quantitative Determination of α -Tocopherol and α -Tocopheryl Acetate in Pharmaceutical and Supplementary Soft Capsules by High Performance Liquid Chromatography

Nükte TOPRAKSEVER*, Gamze ÖZGÜL ARTUÇ**

Abstract

Aim: This study aims to determine the amounts of α -tocopherol (α -toc) and α -tocopheryl acetate (α -tocAc) in soft pharmaceutical capsules and supplements using a chromatographic method. Additionally, method validation parameters for both analytes were evaluated.

Method: Analyses were performed using a chromatographic method. As part of the method validation, recovery (% recovery), repeatability (% RSD), linear regression coefficient (R^2), limit of detection (LOD), and limit of quantification (LOQ) values were determined.

Results: The recovery values were found to be above 95%. Repeatability (%RSD) was calculated as $<3\%$. The linearity (R^2) values were obtained as 0.999. For α -toc: LOD: 0.131 $\mu\text{g/mL}$ and 2.228 $\mu\text{g/mL}$, LOQ: 0.396 $\mu\text{g/mL}$ and 6.752 $\mu\text{g/mL}$. For α -tocAc: LOD: 0.260 $\mu\text{g/mL}$, LOQ: 0.787 $\mu\text{g/mL}$.

Conclusion: The chromatographic method used in this study enabled the determination of α -toc and α -tocAc with high accuracy and repeatability. This method can be considered a reliable alternative for the analysis of these compounds in pharmaceutical products.

Keywords: α -tocopherol, α -tocopheryl acetate, HPLC, soft capsule.

Farmasötik ve Takviye Edici Yumuşak Kapsüllerdeki α -Tokoferol ve α -Tokoferil Asetat'ın Yüksek Performanslı Sıvı Kromatografisi ile Kantitatif Tayini

Öz

Amaç: Bu çalışmada, yumuşak farmasötik kapsüller ve takviyelerde bulunan α -tokoferol (α -tok) ve α -tokoferil asetat (α -tokAs) miktarlarının kromatografik yöntem kullanılarak belirlenmesi amaçlanmıştır. Ayrıca, her iki analit için yöntem doğrulama (validasyon) parametreleri değerlendirilmiştir.

Yöntem: Analizler kromatografik bir yöntemle gerçekleştirilmiştir. Yöntem validasyonu kapsamında geri kazanım, tekrarlanabilirlik, doğrusal regresyon katsayısı, LOD ve LOQ değerleri belirlenmiştir.

Bulgular: Geri kazanım değerleri %95'in üzerinde bulunmuştur. Tekrarlanabilirlik (%RSD) $<3\%$ olarak hesaplanmıştır. Doğrusallık (R^2) değerleri 0.999 olarak elde edilmiştir. α -tok için: LOD: 0.131 $\mu\text{g/mL}$ ve 2.228 $\mu\text{g/mL}$, LOQ: 0.396 $\mu\text{g/mL}$ ve 6.752 $\mu\text{g/mL}$ α -tokAs için: LOD: 0.260 $\mu\text{g/mL}$, LOQ: 0.787 $\mu\text{g/mL}$.

Sonuç: Çalışmada kullanılan kromatografik yöntem, α -tok ve α -tokAs miktarlarının yüksek doğruluk ve tekrarlanabilirlik ile belirlenmesini sağlamıştır. Yöntem, farmasötik ürünlerdeki bu bileşiklerin analizi için güvenilir bir alternatif olarak değerlendirilebilir.

Anahtar Sözcükler: α -tokoferol, α -tokoferil asetat, HPLC, yumuşak kapsül.

Özgün Araştırma Makalesi (Original Research Article)

Geliş / Received: 22.11.2024 & **Kabul / Accepted:** 07.07.2025

DOI: <https://doi.org/10.38079/igusabder.1589685>

* Corresponding Author, Asst. Prof., Istanbul Health and Technology University, Faculty of Engineering and Natural Sciences, Department of Chemical Engineering, Istanbul, Türkiye. E-mail: nukte.topraksever@istun.edu.tr

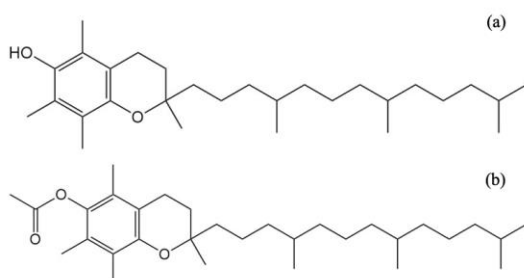
ORCID <https://orcid.org/0000-0001-8982-2219>

** Asst. Prof., Istanbul Health and Technology University, Faculty of Engineering and Natural Sciences, Department of Chemical Engineering, Istanbul, Türkiye. E-mail: gamze.ozgul@istun.edu.tr ORCID <https://orcid.org/0000-0002-7869-1281>

Introduction

Vitamins are organic nutrients that are required in low amounts for biochemical reactions in the body, and their absence in the diet can lead to inadequate growth and development. These organic nutrients differ in their chemical composition, physiological effects and nutritional importance¹. Vitamin E is a fat-soluble vitamin consisting of 4 tocopherols (α , β , γ and δ tocopherols) and 4 tocotrienols (α , β , γ and δ tocotrienols)². The IUPAC name of α -toc was ((2R)-2,5,7,8-Tetramethyl-2-[(4R,8R)-4,8,12-trimethyltridecyl]-3,4-dihydro-2H-1 benzopyran-6-ol)³. The IUPAC name of α -tocAc was (2R)-2,5,7,8-Tetramethyl-2-[(4R,8R)-4,8,12-trimethyltridecyl]-3,4-dihydro-2H-1- benzopyran-6-yl acetate. The chemical structures of α -tocopherol (α -toc) and α -tocopheryl acetate (α -tocAc) are given in Figure 1.

Figure 1. Chemical structure of α -toc (a) and α -tocAc (b)



Alpha tocopherol is the main component of vitamin E and is known to have antioxidant properties. Alpha tocopheryl acetate is the acetylated ester form of alpha tocopherol. Alpha tocopherol acetate acts as an antioxidant by protecting cells from free radical damage^{4,5}. Alpha tocopherol acetate has the same effect by converting from ester form to tocopherol form, but it becomes active more slowly. Since it is in ester form, it is a slightly more stable component than tocopherol. Therefore, this form is more preferred in cosmetic products⁶⁻⁸.

Vitamin E serves as the primary lipophilic antioxidant in the plasma, membranes, and tissues across all mammals. Among its homologues, α -toc is the most prevalent form found in humans⁹. It plays a critical role in preventing lipid peroxidation and is recognized for mitigating stress-induced apoptosis^{10,11}. Numerous studies have demonstrated that α -toc enhances antioxidant defenses within the biological system, making it beneficial for individuals experiencing anxiety and depression. Moreover, vitamin E supplementation is associated with minimal side effects¹². As a potent fat-soluble antioxidant, α -toc effectively interrupts chain reactions in biological membranes, stabilizes cell membranes, and shields cellular components from damage caused by oxygen-free radicals and lipid peroxidation. Additionally, due to its strong antioxidant capacity, vitamin E aids in neutralizing free radicals generated by radiation exposure¹³.

Vitamin E supplements are typically provided in the form of α -tocAc, a derivative of α -toc with antioxidant properties¹⁴. The U.S. Food and Drug Administration classifies tocopherols and α -tocAc as generally recognized as safe substances. Tocopherols, when utilized as antioxidants in food products, are readily absorbed and metabolized by the body. While they exhibit low toxicity, with LD₅₀ values around 2000 mg/kg¹⁵, excessive intake of vitamin E may interfere with the absorption of other fat-soluble vitamins,

including vitamins A, D, and K. Additionally, high doses of vitamin E might exert a pro-oxidant effect under certain conditions¹⁶.

Quantification of lipophilic vitamins in clinical or biological samples is of medical and epidemiological importance. However, there are some difficulties in the simultaneous determination of these compounds, such as their susceptibility to photooxidation, the presence of cis- and trans-isomers, and their varying polarity. Due to the complex matrix of clinical and biological samples, an additional sample pretreatment step is needed before their determination¹⁷. Various techniques such as voltametric¹⁸, spectrophotometric¹⁹ and chromatographic^{20,21} methods, have been reported in the literature for the determination of α -toc in pharmaceutical preparations.

In this study, α -toc and α -tocAc in pharmaceutical preparations and supplements were quantitatively determined by high-performance liquid chromatography (HPLC). The analytical method applied was precise, accurate, linear, selective, and robust.

Material and Methods

Reagents and Chemicals

α -toc (CAS number 10191-41-0) and HPLC-grade methanol (CAS number 67-56-1) were purchased from Sigma Aldrich (Germany). α -tocAc was purchased from Doğa İlaç (Istanbul), Evicap soft capsules (200 IU α -toc per capsule) and Nature's Bounty (400 IU 268 mg⁻¹) were purchased from the pharmacy (Istanbul, Turkey), Doppel herz Omega-3 (20 mg Vitamin E per capsule) was purchased from the pharmacy (Deutschland, Germany).

Analytical Instruments and Conditions

Agilent 1200 instrument with UV/Vis detector was used for the determination of α -toc and α -tocAc in pharmaceutical preparation and supplements by HPLC, and ChemStation software was used for data collection and analysis. HPLC consists of a piston pump, degasser, column oven, UV-DAD detector and autosampler quadruple system. Glass vials of 1.5 mL were used in the autosampler. Chromatographic separation was performed using a C18 column (GL Sciences, Japan) (150 mm x 4.6 mm, 3 μ m). Mobile phase: methanol (100%, v/v), flow rate: 2 mL/min, injection volume; 10 μ L, column temperature: 25 °C, chromatographic detection wavelength; 285 nm. DK SONIC brand (DK-300H) ultrasonic bath, Radwag (AS 220.R2) brand analytical balance for all weighing, and Eppendorf (Research plus) brand pipettes were used for pipetting.

Preparation of Stock and Quality Control Solutions

The stock solution of α -toc and α -tocAc for HPLC determination was prepared in methanol at a concentration of 50 μ g/mL. Standard solutions were prepared by diluting the stock solution with methanol at concentrations of 1, 2, 4, 6, 8 (α -tocAc), 0.5, 1, 2, 4, 6, 8 (α -toc) μ g/mL. Methanol was used as a blank solution. All solutions were stored in the refrigerator at +4 °C until analysis.

Procedure for Pharmaceutical Preparation and Supplements

Pharmaceutical soft capsules and supplements were cut open with a sharp knife, and the capsule contents were transferred to a volumetric flask with methanol. The knife and capsules were carefully washed with methanol, and the remaining α -toc and α -tocAc

were transferred to the flask^{19,22,23}. The final volume was diluted to 50 mL with methanol. The resulting mixture was dissolved in an ultrasonic bath at room temperature (24-25°C) for 30 min and then diluted to 50 mL with methanol. The prepared solutions were filtered through a 45 µm filter into 1 mL HPLC vials and kept refrigerated at +4°C until analysis. The same procedure was performed for the blank solution using solvent only.

Method Validation

Chromatographic method was validated following the protocols specified in ICH guidelines Q2(R1)²⁴. Validation parameters are linearity, accuracy, precision, specificity, LOD, LOQ.

Linearity

Concentration curves of α-toc and α-tocAc solutions prepared in the concentration range of 0.5-8 and 1-8 µg/mL were plotted (peak area versus concentration for chromatographic method). Evaluation of linearity was performed by regression analysis using the least squares method.

Precision

Intraday precision analysis was performed by HPLC method for four tablet samples (n=4) prepared at specific concentrations. For inter-day precision, measurements were performed on five consecutive days, and analyte concentration and relative standard deviation (%RSD) were calculated.

Accuracy

The accuracy of the method was determined by recovery studies. Accuracy study was performed by analyzing the sample at the determined concentration and comparing the values after addition at known concentrations. Recovery percentages were calculated by HPLC methods.

Limit of Detection and Limit of Quantification (LOD, LOQ)

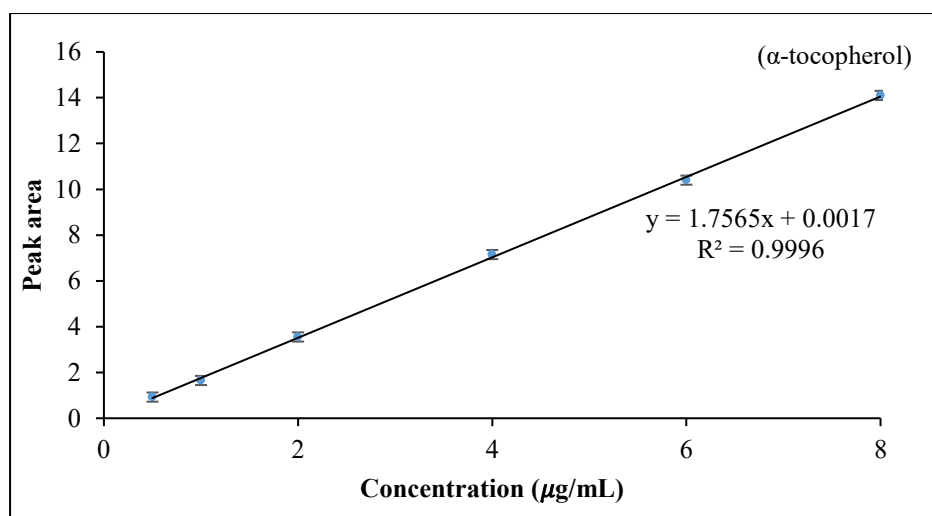
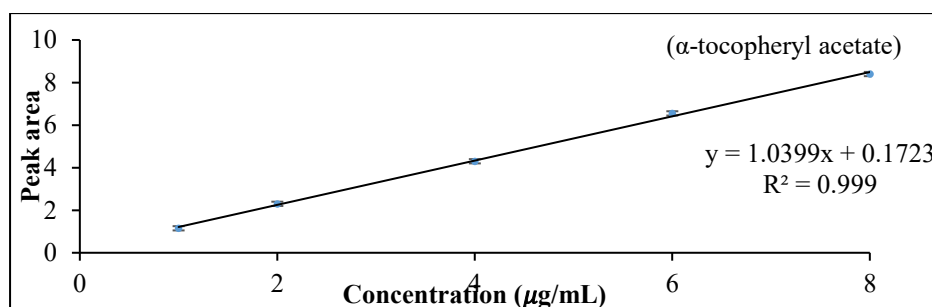
LOD and LOQ values were calculated to evaluate the sensitivity of chromatographic method. LOD; $3.3\sigma/m$, LOQ; $10\sigma/m$ were calculated according to the formulae. σ is the standard deviation (intercept) of the y-axis intercept of the calibration curve, and m is the slope of the calibration curve.

Marketed Formulation Analysis

Soft capsule samples containing α-toc and α-tocAc were prepared as described in the preparation of pharmaceutical preparations section and analyzed by HPLC.

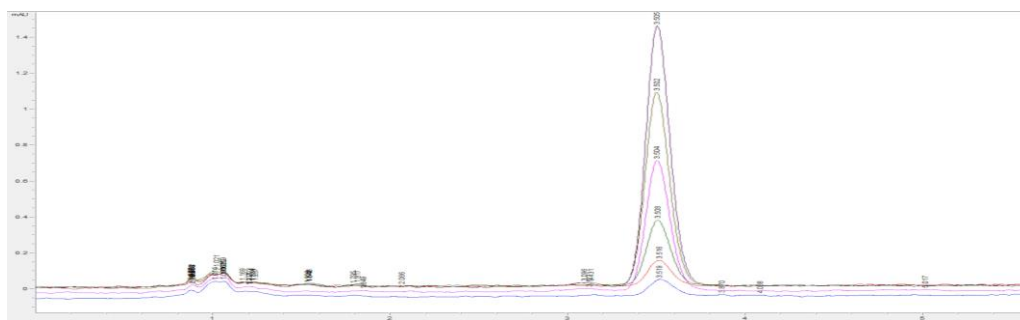
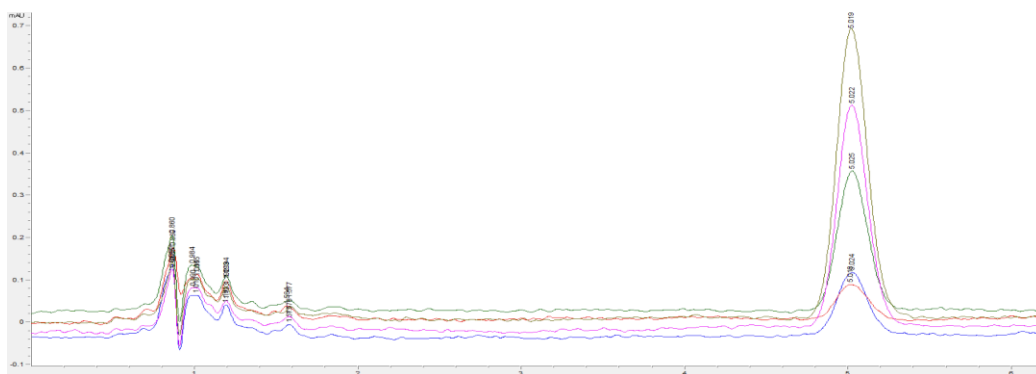
Results

The linearity of the method was established over the analytical range of 0.5-8 µg/mL for α-toc and 1-8 µg/mL for α-tocAc. An excellent correlation between the analyte peak area and the standard concentration was obtained, with $R^2 \geq 0.999$ for all standard curves (Figure 2, Figure 3, Table 1).

Figure 2. Standard graphic of calibration curve of HPLC-UV (α -toc)**Figure 3.** Standard graphic of calibration curve of HPLC-UV (α -tocAc)**Table 1.** Linearity data obtained by HPLC for α -toc and α -tocAc

Regression parameters	α -toc	α -tocAc
Number of points	6	5
Regression coefficient (R^2)	0.9996	0.999
Slope	1.7565	1.0399
Intercept	0.0017	0.1723
Concentration range ($\mu\text{g/mL}$)	0.5-8	1-8

It was observed that the quantification of α -toc and α -tocAc by chromatographic method provided strong theoretical plates (>7.0) and peak tailing factor (<1.0) when methanol was used as the mobile phase. Chromatographic conditions were isocratic mobile phase containing 100% methanol on a GL Sciences C18 column at 25°C and 2 mL/min flow rate. Under these chromatographic conditions, the retention times of α -toc and α -tocAc were 3.5 and 5.0 min, respectively (Figure 4, Figure 5).

Figure 4. HPLC-UV chromatograms of α -toc (0.5-8 $\mu\text{g/mL}$)**Figure 5.** HPLC-UV chromatograms of α -tocAc (1-8 $\mu\text{g/mL}$)

Analytical Validation

The regression coefficient (R^2) in α -toc and α -tocAc determination by the HPLC method was high (>0.999) and no significant difference in linearity was observed in the analyzed range. As a result of the analysis, %RSD values are below three (<3) (Table 2). The %RSD values obtained show that the sensitivity of the method is good.

Table 2. Validation parameters for HPLC methods

Validation parameters	α -toc	α -tocAc
Number of points	6	5
Accuracy, (mean recovery, %, n=5)	94.7	106.2
LOD ($\mu\text{g/mL}$)	0.131	0.260
LOQ ($\mu\text{g/mL}$)	0.396	0.787
Concentration range ($\mu\text{g/mL}$)	0.5-8	1-8
Intra-day precision (RSD %, n=4)	1.66	1.76
Inter-day precision (RSD %, n=20)	2.02	2.39

Method accuracy was examined using the standard addition method. Recovery values were found to be close to 100% (Table 3).

Table 3. Recovery of α -toc and α -tocAc from pharmaceuticals (n=5)

Added	Found		Recovery (%)	
	HPLC*	HPLC	HPLC*	HPLC
-	4.026 $\pm$ 0.221	4.121 $\pm$ 0.164	-	-
0.5 μ g/mL	4.594 $\pm$ 0.124	4.570 $\pm$ 0.057	113.6	89.8
1.0 μ g/mL	5.074 $\pm$ 0.124	5.151 $\pm$ 0.073	104.8	103
1.5 μ g /mL	5.531 $\pm$ 0.092	5.492 $\pm$ 0.074	100.3	91.4

* α -tocAc

In the specificity analysis performed by HPLC, the peak purity of the α -toc chromatograms of the samples was observed to be over 99%. According to the results, other peaks were separated from the main peak.

The LOD values for the HPLC method were 0.131 μ g/mL and 0.260 μ g/mL for α -toc and α -tocAc, respectively, and the LOQ values were 0.396 and 0.787 μ g/mL for α -toc and α -tocAc, respectively.

Soft Capsules Samples Analysis

HPLC method was applied to the pharmaceutical preparations Evicap soft capsules and Nature's Bounty dietary supplement soft capsules (Table 4).

Table 4. Determination of α -toc acetate and α -tocAc in real samples (n=5)

		α -toc		α -tocAc	
Evicap	3 μ g/mL	3.112 $\pm$ 0.341	103.7%	0.885 $\pm$ 0.043	-
	4 μ g/mL	4.029 $\pm$ 0.157	100.7%	1.187 $\pm$ 0.049	-
	5 μ g/mL	4.883 $\pm$ 0.142	97.6%	1.519 $\pm$ 0.035	-
Nature's Bounty	3 μ g/mL	-	-	2.995 $\pm$ 0.061	99.8%
	4 μ g/mL	-	-	4.055 $\pm$ 0.077	101.2%
	5 μ g/mL	-	-	5.160 $\pm$ 103.2	103.2%
Doppel herz	20mg/capsule Total Vitamin E	442.6 $\pm$ 2.75		110.5%	

HPLC determination of α -toc and α -tocAc in pharmaceutical preparation and supplements were found to be a more sensitive and selective method. This method can be applied for α -toc and α -tocAc determination. The Figure 6 and Figure 7 shows the overlaid spectra of real sample and standard α -toc and α -tocAc.

α -toc and α -tocAc are compounds found in many products such as pharmaceuticals, supplements, and cosmetics. Therefore, it is very important to develop and validate simple, rapid, nontoxic, and inexpensive procedures for the determination of these compounds.

Figure 6. Overlay HPLC-UV chromatogram of sample and α -toc standard

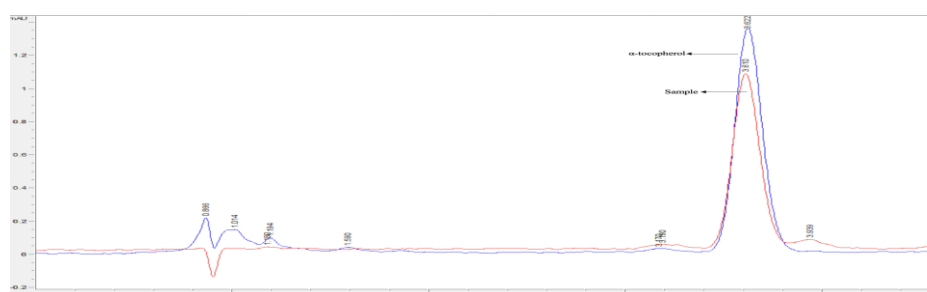


Figure 7. Overlay HPLC-UV chromatogram of sample and α -tocAc standard



Discussion

In this study, α -toc and α -tocAc in pharmaceutical preparations and supplement soft capsules were determined by chromatographic method. In the literature, there are studies in which tocopherol and its derivatives are determined from various samples by various methods¹³. The % recovery, RSD, and LOD values obtained in this study, along with some studies from the literature, are presented in Table 5.

When this study is compared with studies in the literature that applied chromatographic and spectrophotometric methods, the % recovery values were found to be consistent with the literature. When LOD values were compared, similar values were obtained with other chromatographic methods, while lower values were found compared to spectrophotometric methods. The intra-day and inter-day repeatability values obtained in this study were also consistent with the literature for both analytes, demonstrating that reproducible results were achieved.

Table 5. Comparison of the presented study on the determination of α -toc and α -tocAc in pharmaceutical and soft capsules using HPLC with the literature

Study	Analyte	Matrix	Method	Recovery (%)	RSD (%)	LOD
Goudarzi ²⁵	Total Vitamin E	Oil	HPLC	90.2-99.76	1.11-5.12	2.3 ng/mL
Pasias ²⁶	α -toc	Cereal, biscuit	GC-FID	99.5	<10	0.17 mg/L
Kadioglu ²⁷	α -toc	Cow milk Soft capsule Film tablet	GC-FID	98.7-100.7	<20	0.30 μ g/mL
Demirkaya-Miloglu ²⁸	α -toc	Pharmaceutical capsule Human plasma	Spectrofluorimetric method	100.5-108.3	3.79	0.09 μ g/mL
Ashour ²⁹	Total Vitamin E	Pharmaceutical preparations	Spectrophotometric method	101.3	0.71-1.82	0.49 μ g/mL
Méjean ³⁰	Tocopherols tocotrienols	Soybean oil	SFC-MS	87.3-100.3	<15	21.5 μ g/L
Jeelani ³¹	α -tocAc	Multivitamin tablet	UPLC	100.4-101	<3	-
Luhua ²³	α -toc	Capsule	HPLC	95.82	2.3	0.94 μ g/mL
Moreno ²⁰	α -tocAc	Multivitamin capsule	HPLC	100	1.64	3.09 mg/L
Wang ³²	α -tocAc	Vitamin capsule	HPLC	103	6	-
This study	α -toc α -tocAc	Pharmaceutical Supplementary soft capsule	HPLC	89.8-113.6	1.66-2.39	0.131, 0.260 μ g/mL

Conclusion

The method presented in this study is applicable for the determination of α toc and α tocAc in supplementary and pharmaceutical soft capsules using HPLC. The obtained recovery values range from 89.8% to 113.6%. As a fat-soluble vitamin, vitamin E in the forms of α toc and α tocAc has been determined with a low detection limit, high repeatability, good sensitivity, and a short analysis time. The simplicity and speed of the proposed procedure make it an attractive option for the determination and quality control of multivitamins in the dietary supplement and pharmaceutical preparation industries.

Graphical Abstract



REFERENCES

1. Asgher M, Waseem A, Yaqoob M, Nabi A. Flow injection chemiluminescence determination of retinol and α -tocopherol in blood serum and pharmaceuticals. *Anal Lett.* 2011;44(1-3):12-24.
2. Traber MG, Packer L. Vitamin E: Beyond antioxidant function. *Am J Clin.* 1995;62(6):1501-1509.
3. Dongala T, Palakurthi AK. Stability-indicating LC method for the simultaneous determination of methyl paraben, propyl paraben, butylated hydroxytoluene and alpha-tocopherol contents in marijuana capsules. *J Iran Chem Soc.* 2020;17(3):631-638.
4. Jiang Q. Natural forms of vitamin E: Metabolism, antioxidant, and anti-inflammatory activities and their role in disease prevention and therapy. *Free Radic Biol Med.* 2014;72:76-90.
5. Maldonado A, Riquelme N, Muñoz-Fariña O, García O, Arancibia C. Stability and bioaccessibility of α -tocopherol-enriched nanoemulsions containing different edible oils as carriers. *LWT.* 2023;174.
6. Gianeti MD, Gaspar LR, De Camargo FB, Campos PMBGM. Benefits of combinations of vitamin A, C and e derivatives in the stability of cosmetic formulations. *Molecules.* 2012;17(2):2219-2230.
7. Mandelli De Almeida M, Rosana C, De Castro Lima R, et al. Stability evaluation of tocopheryl acetate and ascorbyl tetraisopalmitate in isolation and incorporated in cosmetic formulations using thermal analysis. *Braz J Pharm Sci.* 2010;46:129-134.
8. Ben-Shabat S, Kazdan Y, Beit-Yannai E, Sintov AC. Use of alpha-tocopherol esters for topical vitamin e treatment: Evaluation of their skin permeation and metabolism. *J Pharm Pharmacol.* 2013;65(5):652-658.
9. Anastassakis K. *Androgenetic Alopecia From A to Z*. Springer International Publishing; 2022.

10. Retzlaff D, Dörfler J, Kutschan S, Freuding M, Büntzel J, Hübner J. The vitamin E isoform α -tocopherol is not effective as a complementary treatment in cancer treatment: A systematic review. *Nutr Cancer*. 2022;74(7):2313-2336.
11. Wallert M, Ziegler M, Wang X, et al. α -Tocopherol preserves cardiac function by reducing oxidative stress and inflammation in ischemia/reperfusion injury. *Redox Biol*. 2019;26.
12. Lee ARY Bin, Tariq A, Lau G, Tok NWK, Tam WWS, Ho CSH. Vitamin E, Alpha-tocopherol, and its effects on depression and anxiety: A systematic review and meta-analysis. *Nutrients*. 2022;14(3).
13. Emecen G. Effect of α -tocopherol and ascorbic acid on the genotoxicity by gamma-irradiation in drosophila melanogaster. *Hacettepe J Biol Chem*. 2022;50(1):93-98.
14. Waseem A, Rishi L, Yaqoob M, Nabi A. Flow-injection determination of retinol and tocopherol in pharmaceuticals with acidic potassium permanganate chemiluminescence. *Anal Sci*. 2009;25:407-412.
15. U.S. Food & Drug Administration. *Select Committee on GRAS Substances (SCOGS) Opinion: Alpha-Tocopherol Acetate, Tocopherols*, 2015.
16. Loughrill E, Govinden P, Zand N. Vitamins A and e content of commercial infant foods in the UK: A cause for concern? *Food Chem*. 2016;210:56-62.
17. Karpińska J, Mikołuc B, Motkowski R, Piotrowska-Jastrzebska J. HPLC method for simultaneous determination of retinol, α -tocopherol and coenzyme Q10 in human plasma. *J Pharm Biomed Anal*. 2006;42(2):232-236.
18. Jaiswal P V, Ijeri VS, Srivastava AK. Voltammetric behavior of-tocopherol and its determination using surfactant + ethanol + water and surfactant + acetonitrile + water mixed solvent systems. *Anal Chim Acta*. 2001;441:201-206.
19. Özgül Artuç G. Farmasötik yumuşak kapsülde α -tokoferolün spektrofotometri ile kantitatif tayini. *Experimed*. 2020;10(2):72-76.
20. Moreno P, Salvado VS, Salvadó S. Determination of eight water-and fat-soluble vitamins in multi-vitamin pharmaceutical formulations by high-performance liquid chromatography. *J Chromatogr A*. 2000;870:207-215.
21. Ruperez FJ, Martín D, Herrera E, Barbas C, Barbas B. Chromatographic analysis of α -tocopherol and related compounds in various matrices. *J Chromatogr A*. 2001;935:45-69.
22. Bonifacio FN, Giocanti M, Reynier JP, Lacarelle B, Nicolay A. Development and validation of HPLC method for the determination of cyclosporin a and its impurities in Neoral® capsules and its generic versions. *J Pharm Biomed Anal*. 2009;49(2):540-546.
23. Luhua Z, Ying T, Zhengyu Z, Guangji W. Determination of α -tocopherol in the traditional chinese medicinal preparation sea buckthorn oil capsule by non-aqueous reversed phase-HPLC. *Chem Pharm Bull (Tokyo)*. 2004;52(1):150-152.
24. EMEA. *ICH Topic Q 2 (R1) Validation of Analytical Procedures*.; 1995. <http://www.emea.eu.int>.
25. Goudarzi N, Farsimadan S, Arab Chamjangali M, Bagherian GA. Development of coupled ultrasound-assisted and reversed-phase dispersive liquid-liquid microextraction before high-performance liquid chromatography for the sensitive

- determination of vitamin A and vitamin E in oil samples. *J Sep Sci.* 2015;38(18):3254-3261.
26. Pasiyas IN, Kiriakou IK, Papakonstantinou L, Proestos C. Determination of vitamin E in cereal products and biscuits by GC-FID. *Foods.* 2018;7(1).
 27. Kadioglu Y, Demirkaya F, Kursat Demirkaya A. Quantitative determination of underivatized α -tocopherol in cow milk, vitamin and multivitamin drugs by GC-FID. *Chromatographia.* 2009;70(3-4):665-670.
 28. Demirkaya-Miloglu F, Kadioglu Y, Senol O, Yaman ME. Spectrofluorimetric determination of α -tocopherol in capsules and human plasma. *Indian J Pharm Sci.* 2013;5(75):563-568.
 29. Ashour H, Maher H, Kamel S, El-Yazbi F. Novel, cost-effective, eco-friendly spectrophotometric method for the determination of beta-carotene, vitamin C, and vitamin E in their ternary mixtures: Greenness and whiteness appraisal. *J Adv Pharm Sci.* 2024;1(1):22-28.
 30. Méjean M, Brunelle A, Touboul D. Quantification of tocopherols and tocotrienols in soybean oil by supercritical-fluid chromatography coupled to high-resolution mass spectrometry. *Anal Bioanal Chem.* 2015;407(17):5133-5142.
 31. Jeelani S, Kassymbek Z. Simultaneous determination of ten fat-soluble vitamins by ultra-performance liquid chromatography in multivitamins with mineral capsules. *Journal of Separation Science*, 2025; 48:e70167
 32. Wang LH, Wang JF. Determination of retinoids in human serum, tocopherol and retinyl acetate in pharmaceuticals by RP-LC with electrochemical detection. *J Pharm Biomed Anal.* 2001;25:785-793.

Fieldwork Experiences in Special Education and Rehabilitation Centers: A Qualitative Approach to the Perspective of Child Development Students*

Esra Hazal ÇELEPİ**, Rabia Nazıkar BOZACIOĞLU***, Berk Efe ALTINAL****

Abstract

Aim: This study examines the experiences of child development students who had done fieldwork at various rehabilitation centers through a qualitative approach. The aim of the research was to reveal the experiences and problems encountered by the students in the institutions.

Method: To collect data, a set of questions were prepared and asked using a semi-structured face-to-face interview method. The study was conducted with 15 child development students who interned at special education and rehabilitation centers. The data was later analyzed using MAXQDA.

Results: Five main themes emerged in the data; theory-practice discrepancy, suggestions, insufficiencies, diversity, and experience. It was observed that special education and rehabilitation centers were generally perceived as inadequate by the fieldwork participants, but the fieldwork process itself is deemed valuable due to the opportunity to use theoretical knowledge in practice.

Conclusion: Universities should clarify fieldwork guidelines and create effective feedback mechanisms to align student experiences with learning goals

Keywords: Child development, rehabilitation centers, special education, fieldwork, higher education.

Özel Eğitim ve Rehabilitasyon Merkezlerinde Alan Çalışması Deneyimleri: Çocuk Gelişimi Öğrencilerinin Niteliksel Görüşleri

Öz

Amaç: Bu çalışma, farklı rehabilitasyon merkezlerinde alan çalışması gerçekleştiren çocuk gelişimi öğrencilerinin deneyimlerini nitel bir yaklaşımla incelemektedir. Araştırmanın amacı, alan çalışması gerçekleştirilen kurumlardaki deneyimlerini ve karşılaştıkları sorunları ortaya çıkarmaktır.

Yöntem: Veri toplamak için yarı yapılandırılmış yüz yüze görüşme yöntemi kullanılarak hazırlanan bir dizi soru setiyle 15 çocuk gelişimi öğrencisiyle çalışma yürütülmüştür. Veriler daha sonra MAXQDA kullanılarak analiz edilmiştir.

Bulgular: Verilerde beş ana tema belirlenmiştir: teori-pratik uyumsuzluğu, öneriler, eksiklikler, çeşitlilik ve deneyim. Alan çalışması gerçekleştiren öğrenciler tarafından genel olarak özel eğitim ve rehabilitasyon merkezlerinin yetersiz olarak algılandığı ancak alan çalışması sürecinin teorik bilginin pratiğe dönüştürülme fırsatı nedeniyle değerli bulunduğu gözlemlenmiştir.

Özgün Araştırma Makalesi (Original Research Article)

Geliş / Received: 15.01.2025 & **Kabul / Accepted:** 07.07.2025

DOI: <https://doi.org/10.38079/igusabder.1599776>

* The study has been supported and funded by TUBITAK as a part of the 2209-A Research Project Support Program for Undergraduate Students (2023/2 Term Call) ; This study was presented as an oral presentation at the 9th National Child Development Student Congress on December 13, 2024, with the title 'Özel Eğitim ve Rehabilitasyon Merkezlerinde Staj Deneyimi: Çocuk Gelişimi Öğrencilerinin Bakış Açısına Nitel Bir Yaklaşım'.

** 2023/24 BA Alumni, Istanbul Gelisim University, Faculty of Health Sciences, Child Development (English), Istanbul, Türkiye. E-mail: esrahazal15@gmail.com [ORCID https://orcid.org/0009-0004-4638-4895](https://orcid.org/0009-0004-4638-4895)

*** 2023/24 BA Alumni, Istanbul Gelisim University, Faculty of Health Sciences, Child Development (English), Istanbul, Türkiye. E-mail: bzcoglu Arabia@gmail.com [ORCID https://orcid.org/0009-0007-7801-5631](https://orcid.org/0009-0007-7801-5631)

**** (Corresponding Author) Lecturer, Istanbul Gelisim University, Faculty of Health Sciences, Child Development (English), Istanbul, Türkiye. E-mail: bealtinal@gelisim.edu.tr [ORCID https://orcid.org/0000-0001-6987-8012](https://orcid.org/0000-0001-6987-8012)

ETHICAL STATEMENT: Istanbul Gelisim University Ethical Review Board approved the research protocol (Date: 29.02.2024, Decision Number: 2024-03).

Sonuç: Üniversiteler, alan çalışması deneyimlerini öğrenme hedefleriyle uyumlu hale getirmek için alan çalışması kılavuzlarını netleştirmeli ve etkili geri bildirim mekanizmaları oluşturmaları olmalıdır.

Anahtar Sözcükler: Çocuk gelişimi, rehabilitasyon merkezleri, özel eğitim, alan çalışması, yükseköğrenim.

Introduction

The fieldwork process is a fundamental aspect of health science education as it gives an opportunity for students to experience practical implementation of the theoretical knowledge acquired through bachelor's degree courses. As a health science department, Child Development education¹ also requires students to complete several fieldwork experiences both in preschool education and in special education and rehabilitation centers. The aim of these fieldwork requirements is to provide the right set of circumstances to observe the typical development of children as well as children with disabilities, neurodivergent children, and children who have special behavioral or mental conditions².

The crucial role the fieldwork process plays in the health science undergraduate students, and particularly child development students, entails careful planning and implementation of the process. This is important not only for the students but also for the children who will encounter the fieldwork participants during the process and benefit from the services. For this reason, the vital purpose of maximizing the efficiency and educational value of the fieldwork process requires obtaining feedback from all involved parties — such as internship institutions, schools, and especially the undergraduate students who directly participate in the fieldwork.

Child development department is an undergraduate program that provides students with the necessary theoretical and practical knowledge to understand and support children's development. As in 2025, 44 different universities in Türkiye are training undergraduate students in Child Development departments³. In this department, detailed information is provided about children's physical, social, cognitive, and emotional development, and strategies are taught to support these developmental areas. Students examine the processes from the prenatal period to the end of adolescence of children. Language development, cognitive development, motor skills, socio-emotional development, and learning are among the focal points of this program. The standard curriculum in such programs covers typical developmental milestones and includes identifying atypical developmental patterns along with related interventions⁴.

The field of child development can be seen as an interdisciplinary field; considering the multifaceted nature of development, child development students are expected to explore many fields such as psychology, physiology, education science, and social sciences⁵. Child development studies, which largely depend on the literature of the fields such as education, public health, social services, medicine, biology, and anthropology, guide the practitioners' details, such as providing accurate information about children's development and creating realistic expectations for parents, guiding what to pay attention to and how to behave during the development process, and providing support in detecting developmental differences and making correct referrals^{2,6}.

Special education and rehabilitation centers represent one of the key multidisciplinary and transdisciplinary domains where child development professionals play a significant role⁷. Special education encompasses services designed to elevate the developmental levels of children with significantly different developmental characteristics from their peers, aiming to meet their specific needs to the highest possible extent⁸. Special education centers are known as educational environments that aim to integrate individuals with special needs into society, aim to make them self-sufficient individuals, aim to support their cognitive, language, self-care, social, and physical developments, provide behavior teaching, and provide information and support to the families of individuals with special needs⁸.

In Türkiye, these centers operate under the supervision of the Ministry of National Education and are mostly private institutions contracted by the state. They provide individualized education programs (IEPs) for children with various developmental needs, including intellectual disabilities, autism spectrum disorder, and speech and language delays⁹. The core aim of these institutions is to support the cognitive, linguistic, motor, social-emotional, and adaptive development of children with disabilities, while also offering family education and psychosocial support. Services are typically delivered as weekly, outpatient-based sessions. Multidisciplinary teams collaborate in delivering these services, often comprising child development specialists, special education teachers, psychologists, physiotherapists, speech and language therapists, and social workers^{8,10}.

Within these teams, child developmentalists take on a distinct and multi-faceted role. They are primarily responsible for identifying each child's developmental needs through formal and informal assessment methods, preparing individualized developmental programs, and selecting appropriate support materials and intervention strategies. Moreover, they provide play-based developmental support, monitor children's progress, and organize structured activities tailored to each child's cognitive and socio-emotional profile^{7,8}. One of their most significant contributions is in family engagement: they provide guidance to parents about developmental goals, home-based reinforcement strategies, and emotional support throughout the intervention process^{7,8}.

Even though there is at least one detailed report¹¹ considering the problems and areas of development for the special education and rehabilitation centers in Türkiye, to this day, very little has been done to document the perspectives, experiences, and opinions of the undergraduate fieldwork participants.

A review of the literature reveals that studies on the subject are limited. Kumru and Demirtaş's study focuses on the views of vocational high school students in child development. The findings showed that students positively evaluated skill training but expressed negative views about problems experienced with instructors. Additionally, it was stated that students emphasized art activities in their work with children during the fieldwork and were successful in applying theoretical knowledge. However, it can be said that this study does not cover the general student population and focuses only on a specific high school¹².

In Acar-Çiftçi's evaluation, it was determined that despite students making various observations and applications during their fieldwork, reflective practices that form a

bridge between theory and practice were limited. The study focused only on associate degree programs and did not cover 4-year undergraduate programs¹³.

This study draws inspiration from the personal fieldwork experiences of two researchers who explored rehabilitation centers in socio-economically diverse environments. During their observations, they encountered striking disparities between two institutions they completed their fieldwork. The first, situated in a business center and characterized by low socio-economic status, lacked essential tools and exhibited indifferent instructors. In contrast, the second institution, designed specifically for autistic children, boasted high socio-economic status, proper tools, and attentive instructors. Based on these observations by the researchers, the study question, how the special education and rehabilitation centers and the fieldwork process were experienced by undergraduate fieldwork participants, emerged.

This study addresses rehabilitation centers from the perspective of students using qualitative phenomenological analysis. Specifically, understanding how students' fieldwork experiences reflect differences between institutions, how the students reflect differences between theoretical knowledge and applications of them in the field, and problems in the field from their perspective are main aims. Also, with an additional focus on international students, the effects of cultural diversity on these experiences are documented.

Material and Methods

Participants

In the research, the data collection process was facilitated through semi-structured in-depth interviews. For this purpose, one-on-one interviews were arranged with 15 child development students who conducted their fieldwork at Rehabilitation Centers or Special Education Centers. The interviews included open-ended questions that allowed students to share their experiences in depth. The full list of questions can be accessed from Table 1.

Table 1. Question list for semi-structured interviews.

English Translation of the questions
What do you know about rehabilitation centers? Have you experienced anything that bothered you at the institution? Could you share? Was the education provided at the institution sufficient? If not, what solution would you propose? Were your experiences at the institution different from what you learned in school? In rehabilitation centers, which disciplines should educators receive training in? Do you think instructors from different fields should provide education, apart from special education teachers and child development specialists? In your opinion, should individuals with different special education needs receive education in a single institution, or should separate educational institutions be established based on each individual's needs? For international students: Have you experienced any incidents related to understanding, language, cultural differences, or other matters?

Before the interview, the purpose and objectives of the research were explained in detail to the participants, and informed consent was obtained from the participants. The interviews to be conducted were recorded on a voice recorder with the participant's permission, and then the voice recording was transcribed, anonymizing the participant's name and the institution where they did their fieldwork. Participants were asked to fill out a form containing basic demographic information (such as age, gender, and university). Then a code number was given to the interview, matching the form and the interview. In this way, the participant's name was anonymized, and confidentiality was maintained.

Participants were selected from different universities and cultures to gather information from various perspectives. For this purpose, the aim was to conduct in-depth interviews with 15 participants who were students in the Child Development four-year undergraduate program and who have completed or are in the process of completing fieldwork at relevant institutions. The demographic information of the participants can be seen in Table 2.

Table 2. Demographic information about participants.

Code	Age	Gender	Grade	Fieldwork span
Participant 1 (P1)	22	Woman	Senior	1 semester
Participant 2 (P2)	24	Woman	Senior	2 semesters
Participant 3 (P3)	23	Woman	Senior	2 semesters
Participant 4 (P4)	24	Woman	Senior	2 semesters
Participant 5 (P5)	23	Woman	Senior	2 semesters
Participant 6 (P6)	23	Woman	Senior	1 semester
Participant 7 (P7)	22	Woman	Senior	2 semesters
Participant 8 (P8)	23	Woman	Senior	1 semester
Participant 9 (P9)	24	Woman	Graduate	More than 2 semesters
Participant 10 (P10)	24	Woman	Senior	1 semester
Participant 11 (P11)	23	Woman	Senior	2 semesters
Participant 12 (P12)	23	Woman	Senior	1 semester
Participant 13 (P13)	23	Man	Senior	1 semester
Participant 14 (P14)	26	Woman	Senior	2 semesters
Participant 15 (P15)	24	Woman	Senior	2 semesters

Ethical Statement

The research protocol has been approved by Istanbul Gelisim University Ethical Review Board (Date: 29.02.2024, Decision Number: 2024-03). The study has been supported and funded by TUBITAK as a part of the 2209-A Research Project Support Program for Undergraduate Students (2023/2 Term Call)

Data Analysis

For the evaluation of the data, the phenomenological analysis method was used. Phenomenological analysis is a methodological approach that focuses on participants expressing their experiences without any mediation and is frequently used in health sciences^{14,15}. This qualitative analysis allowed the data to be divided into meaningful themes and the interpretation of these themes. Thus, the data were analyzed in depth and in an explanatory manner in accordance with the purpose of the research. In the analysis, MAXQDA 2020 software was used in the stages of coding the data and creating a word cloud.

Results

Based on the data obtained through interviews, a total of five main themes have emerged: theory-practice discrepancy, suggestions, insufficiencies, diversity, and experience. The themes will be examined with quotes from the interviews.

Figure 1 represents a word cloud containing frequently used words in the interviews conducted.

Figure 1. Word frequency cloud.



As can be seen, the most frequently used word was “education,” followed by “different”, “special”, “institution”, “rehabilitation”, and “teacher”. In the following section, the themes that emerged in the interviews are conveyed sequentially using quotations.

Theory-Practice Differences

Participants mention the differences between the education they received at school and their fieldwork experiences in their interviews. It is emphasized that education at school is learned only theoretically from teachers, books, and other educational resources and does not have as much permanence as practice. It is emphasized that the fieldwork experience is more practical, the learned information is physically applied, and it is more permanent. The majority of the participants argued in their comments that practical experience is different from the theoretical knowledge learned and is more permanent. For example, participant (P11) stated in her comment that the education she received at school was superficial and insufficient, and that practice was more beneficial. She stated,

“Of course it was different. I don’t think we covered very detailed topics related to special education at school. It was always theoretical, just a superficial process, but when I did my fieldwork, I witnessed almost all types of obstacles and learned how children developed. Therefore, doing fieldwork was better for me.”

On the other hand, participant (P9) stated in her comment that the education she received at school was at a sufficient level, but practicing added more depth to the knowledge, and practicing was more important. She expressed,

“Of course, when you go to the field, you are adding more knowledge to your existing knowledge, and you are also learning something from the teachers you interned with. Therefore, there are differences between what I learned at school and my experiences at the institution.”

Suggestions

Participants provided suggestions regarding both the educational content and the educators, as well as the institution itself. They highlighted that the quality of education and the competence of educators were perceived as insufficient within fieldwork institutions. The majority of participants emphasized the necessity of having professionals such as child development experts, psychologists, special education teachers, and occupational therapists within these institutions. While some participants advocated for the inclusion of all types of disabilities within a single institution, others suggested the establishment of separate institutions tailored to each specific type of disability.

For example, participant (P14) emphasized in her comment that the education given in the institution was not sufficient, and as a solution, the educators to be taken to the institution should be more knowledgeable and compassionate.

“The education given in the institution was not sufficient, the solution I will suggest, I think the people taken or the people who graduate should be more knowledgeable or more compassionate.”

Participant (P4) also emphasized in her comment that the education should be based on play and the educators should be gentler.

“We learned that they’re supposed to be play-based and gentler, and you’re supposed to be patient with the children, but I never experienced that during my fieldworks.”

Participant (P11) emphasized in her comment that different institutions should be opened for each type of disability, and as a reason, it can be focused more on a type of disability and more support can be provided for the child’s development.

“I think different educational institutions should be established. As a reason for this, I can say this, if an institution is focused on only one type of disability, that type of disability is focused on a lot and more support is provided for the development of children. Therefore, I think a separate rehabilitation center should be established for each type of disability.”

Participant (P5), on the other hand, emphasized in her comment that many types of disabilities should be in the same institution, and as a reason, a single child can have

multiple disabilities and need to receive education according to their needs in an institution.

“There should be many types of disabilities in an institution, children, there is no child with only one disability. Let’s say a child needs physical therapy. At the same time, that child can also be mentally disabled, can be autistic. So, I don’t think it’s something specific to a single branch. Education should not be given from a single direction; education should be given according to the need.”

Insufficiencies

Participants highlighted both the inadequacy and deficiency of the education and educators, as well as the institutional shortcomings, in their comments. A significant number of participants emphasized the substandard education provided by the educators within the institutions. Some participants also pointed out the inadequacies of the institutional environment. For instance, one participant (P3) noted that interventions for disabled children were inappropriate, incorrect information was given to parents, and the education provided to the children was both insufficient and deficient.

“So, there were disabled children and then maybe autistic. Another child with ADHD, another with language difficulties aged between 3-4 and five years old, and she wasn’t doing intervention properly and she was pretending to the parents that she was working with them day by day. So, she was working on just marketing. She was probably ohh every day like every. Half an hour, even taking videos and photos of stuff that she never applied on the children and then sending it to the group of the parents. And I am the one with the who’s attending there. I observed that nothing from the from such stuff has been actually applied.”

Participant (P8) emphasized in her comment that the rooms in the institution were very small and there was not enough ventilation.

“In the rehabilitation center, our rooms were very small and there was not enough ventilation. So, there were no rooms that saw the sun. I can say that we didn’t have windows inside the rooms. So, this situation was a bit disturbing but there was no other problem besides that.”

Diversity

In the interviews, the subject of diversity was only asked to international participants. It was asked to find out whether international participants had any incidents regarding mutual understanding, language difficulties, difficulties related to cultural differences or other issues in the institutions where they conducted their fieldwork.

For instance, participant (P3) used the following expressions in her comments, emphasizing that the institution is an international institution and that she did not have a problem with mutual understanding. She stated,

“No, I didn’t endorse special education centers because my fieldworks were in international institutions that were speaking my language.”

Participant (P4), on the other hand, used the following expressions in her comments, emphasizing that she had a language problem in the institution where she did her fieldwork and had a problem with understanding. She expressed,

“Yes, I have as I been a foreign student here in Türkiye, so I have experienced the language barrier sometimes. And but after that there isn’t that much misunderstanding with the kids, but with parents, they might not understand you.”

Experience

Participants discussed the experiences they gained from situations and events during their fieldwork at the institutions. The comments made by the participants can be categorized into two groups: positive experiences and negative experiences. Some participants reported positive experiences, expressing satisfaction with the staff, educators, and educational programs provided at the institutions where they interned. Conversely, other participants reported negative experiences, highlighting dissatisfaction with the attitudes of educators towards children, the quality of education at the institution, and the behaviors of students.

As an example of a positive experience reported, participant (P13) emphasized in her comments that the institution where she did her fieldwork has an experienced and diverse staff. She stated,

“The place where I am currently doing my fieldwork is quite good because it has a very experienced staff. There are experienced educators in many fields such as speech and language therapist, physiotherapist, occupational therapist, and psychologist.”

Participant (P15), on the other hand, emphasized in her comments that she had a negative experience, stating that the attitudes towards children and the education provided at the institution where she did her fieldwork were insufficient, and that incorrect information was conveyed to parents. She expressed,

“I think the attitudes towards children and the education provided are insufficient. These really bothered me because what was told to the parents was different from the attitude shown to the children, it was upsetting to see this.”

Participant (P9) emphasized in her comments that she had a negative experience, highlighting situations such as a student with autism spectrum disorder not entering the class, trying to escape from the class, and biting the intern’s hand at the institution where she did her fieldwork. She stated,

“The child was atypical autism but there were more typical autism behaviors than atypical autism, such as not entering the class and trying to escape from the class. Of course, I was standing at the door of the class because she had to take a session for 40 minutes and she should not leave the class, and at that time there was a situation like biting my hand.”

Discussion

This study aimed to explore the experiences of child development undergraduate students completing fieldwork in special education and rehabilitation centers in Türkiye. The interview data are organized into five key themes—theory-practice discrepancy, suggestions, insufficiencies, diversity, and experience—reveal multiple tensions between

the educational preparation of students and the structural realities of fieldwork institutions.

The most dominant theme was the gap between theoretical coursework and practical application. While students acknowledged the importance of foundational knowledge provided by university education, they frequently described it as overly abstract or lacking in real-world applicability. This is consistent with existing research highlighting that child development curricula often remain disconnected from field realities, especially in specialized contexts such as disability services⁸. Many students felt unprepared for the diversity and severity of needs they encountered in the field. This suggests that university programs should revisit the depth and breadth of their special education coursework, ensuring that theoretical content is more closely aligned with the practical demands of field settings. At the same time, it should be acknowledged that child development programs in Türkiye often include intensive fieldwork components, which serve as a critical bridge between theory and practice. This approach is a strong asset of in-person education, offering students invaluable real-life experience that cannot be fully replicated in online or distance education models.

Another theme centered around institutional capacity and staff competencies. Students reflected on instances where they perceived a lack of adequately prepared or responsive educators, and some described witnessing practices they found ethically concerning. Although special education and rehabilitation centers in Türkiye are subject to periodic inspections by the Ministry of National Education, student observations suggest that these evaluations may not always provide continuous insight into the everyday dynamics of child–educator interactions or the developmental relevance of implemented practices. In some cases, students reported that inaccurate or misleading information was conveyed to parents. While the accuracy of such accounts cannot be independently verified, the fact that students were able to identify and interpret these situations through an ethical lens indicates a growing sense of professional responsibility. This highlights the role of fieldwork not only as a platform for skill development but also as a critical context for fostering ethical awareness and reflective engagement with institutional practices.

There were also important divergences in how students envisioned the ideal institutional model. Some supported integrated institutions serving children with multiple disabilities, emphasizing flexibility and responsiveness to comorbidity. Others advocated for specialization by diagnosis, arguing that tailored environments could offer more targeted developmental support. This debate reflects an unresolved policy-level tension between inclusive and specialized service delivery in Türkiye’s special education and rehabilitation system. It also provides a valuable insight that students are not passive learners but emerging professionals actively engaging with educational philosophy and institutional structure.

The theme of diversity—though only addressed by international students—surfaced important contextual issues. Language barriers and cultural mismatches were experienced primarily in communication with parents, rather than with children. While these challenges reflect the need for better preparatory support for international students engaging in local fieldwork, they also point toward a promising direction for the

future of child development education in Türkiye. In particular, they underscore the potential benefits of expanding English-medium Child Development programs alongside Turkish-language offerings. Such programs not only increase accessibility for international students but also help cultivate multicultural competencies and broaden intervention practices in special education and rehabilitation settings. Given the ongoing global population movements driven by factors such as employment mobility, political conflict, and climate change, particularly in a country like Türkiye, the development of inclusive and linguistically diverse educational environments presents an opportunity for future advancement in university-level Child Development education. Such diversity in instruction makes the field more accessible to international students and supports the development of multicultural intervention practices in special education and rehabilitation centers.

Finally, students' overall experiences were polarized: some described centers as ethically questionable or structurally inadequate, while others reported highly professional and collaborative environments. A key differentiator appears to be the staff composition and institutional culture; centers with experienced, multidisciplinary teams (including psychologists, occupational therapists, and physiotherapists) were viewed more positively. This reinforces the importance of effective institutional coordination and suggests that fieldwork placement quality is not consistent, which could be addressed by stricter selection and support mechanisms from universities.

In sum, the findings point to areas within child development education that would benefit from thoughtful enhancement. Ensuring that students have access to structured internship opportunities and face-to-face learning environments within university settings is crucial. These spaces allow for the integration of theoretical knowledge with hands-on experience, guided by reflective dialogue and supervision from instructors. Strengthening the fieldwork process also requires fostering deeper collaboration between universities and special education and rehabilitation centers. These centers should be seen not merely as placement sites, but as active parties in the educational process—partners who help nurture the professional growth of students. Importantly, students participating in fieldwork should not be viewed as unpaid labor but as future professionals whose presence in the institution contributes to their academic formation. This shared responsibility model can lead to more ethically sound, pedagogically rich, and mutually beneficial field education experiences.

While these findings offer insights into the complexities of field training in child development, several limitations of the current study should be acknowledged. First, participants sometimes avoided speaking freely or offered contradictory responses. It appeared that the presence of the recording device created tension, leading some to portray their experiences more positively than they may have been. To address such challenges, future research could employ mixed-method designs, allowing for the combination of qualitative and quantitative data to strengthen the reliability of findings.

Second, the geographical scope of the study presents a limitation. All participants were based in İstanbul, yet only 12 out of the 44 universities in Türkiye with Child Development departments are located in the city. Broader research incorporating

participants from diverse provinces, including rural regions, would allow for a more comprehensive understanding of the national landscape.

Finally, future studies could benefit from including additional stakeholder perspectives, such as parents, educators, and institution administrators. A multi-voiced approach would contribute to a more holistic picture of the fieldwork experience and its systemic implications.

Conclusion

This study explored the experiences of undergraduate child development students during their fieldwork in special education and rehabilitation centers in Türkiye. The findings highlighted meaningful tensions between university-based theoretical education and the realities of applied practice, raised concerns about institutional capacity and educator preparedness, and revealed diverse student perspectives on service models within special education. Experiences shared by international students also brought attention to linguistic and cultural dynamics in the field.

Considering these insights, there are several areas that offer opportunities for constructive development. University programs may consider enhancing the alignment between coursework and the complexities of fieldwork environments while also reinforcing supportive supervision structures. Special education and rehabilitation centers, in turn, could be engaged more actively as educational stakeholders—contributing not only to service delivery but also to the professional formation of future practitioners. Promoting open communication between universities and rehabilitation centers, as well as ensuring mutual understanding of the fieldwork’s educational objectives, may foster more consistent and enriching learning environments.

Importantly, the study highlights the value of empowering students not only as recipients of knowledge but also as reflective participants in shaping ethical and pedagogical standards. Field training, when grounded in strong institutional collaboration, holds the potential to cultivate not just skills, but professional judgment, critical engagement, and a sense of shared responsibility for quality care and inclusive practice.

REFERENCES

1. Keskin AD, Bayhan NP. Çocuk gelişiminin dünü, bugünü ve yarını. *Erken Çocukluk Çalışmaları Dergisi*. 2020;4(3):881-900. doi: 10.24130/eccd-jecs.1967202043242.
2. Keskin AD, Baykoç N. Türkiye’de bulunan üniversitelerin lisans programlarının çocuk gelişimi açısından incelenmesi. *Hacettepe Üniversitesi Sağlık Bilimleri Fakültesi Dergisi, Uluslararası Katılımlı 3 Çocuk Gelişimi ve Eğitimi Kongre Kitabı*. Published online 2015.
3. Çocuk Gelişimi (Fakülte) Programı Bulunan Tüm Üniversiteler. YÖK Lisans Atlası. 2025. Accessed June 29, 2025. <https://yokatlas.yok.gov.tr/lisans-bolum.php?b=10701>.
4. Aral N, Fındık Tanrıbuyurdu E, Yurteri Tiryaki A, Sağlam M, Aysu B. Türkiye Çocuk Gelişimi Alanındaki Lisansüstü Tezlerin İncelenmesi. *Ankara Sağlık Hizmetleri Dergisi*. 2015;14(1):7-16. doi: 10.1501/Ashd_0000000103.

5. Berk LE. *Child Development*. (Edn 9Th, ed.). Pearson; 2017.
6. Gander MJ. *Çocuk ve Ergen Gelişimi*. İmge Kitabevi; 2001.
7. Kaçmaz C, Kay MA, Boğa E, Temiz A, Ayanoğlu M, Sağlam M. Türkiye’de çocuk gelişimci olmak: çalışma alanları, görev ve yetkileri. *Çocuk ve Gelişim Dergisi*. 2022;4(8):117-133.
8. Yavuz EC, Kahraman ÖG. Özel eğitim ve rehabilitasyon merkezlerinde çocuk gelişimci olmak. *Toplum ve Sosyal Hizmet*. 2022;33(3):811-840. doi: 10.33417/tsh.979999.
9. *Özel Eğitim Hizmetleri Yönetmeliği (24736)*.; 2018. Accessed August 26, 2024. <https://www.mevzuat.gov.tr/mevzuat?MevzuatNo=24736&MevzuatTur=7&MevzuatTertip=5>
10. Elmacı D. Türkiye’de özel eğitim alanında korunmaya ihtiyacı olan çocuklar. *Ankara. Üniversitesi Eğitim Bilimleri Fakültesi Özel Eğitim Dergisi*. 2022;23(2):409-429.
11. Çiftçi A. *Destek Özel Eğitim Hizmetlerinin Verimliliğinin Araştırılması Projesi (Desöp)*. T.C. Aile ve Sosyal Politikalar Bakanlığı Engelli ve Yaşlı Hizmetleri Genel Müdürlüğü; 2013.
12. Kumru M, Demirtaş Z. İşletmelerde beceri eğitimine (staja) giden meslek lisesi çocuk gelişimi öğrencilerinin staja ilişkin görüşleri. *Hacettepe Fakültesi Sağlık Bilimleri Dergisi*. 2015;1(Özel Sayı 12):433-445.
13. Acar-Çiftçi Y. Bilgi ve eylem arasında köprü oluşturmak: Çocuk gelişimi önlisans programı öğrencilerinin yaz stajlarındaki öğrenmeleri üzerine bir değerlendirme. *Medeniyet Eğitim Araştırmaları Dergisi*. 2022;6(1):45-64.
14. Larkin M, Watts S, Clifton E. Giving voice and making sense in interpretative phenomenological analysis. *Qual Res Psychol*. 3(2):102-120.
15. Creswell JW. *Research Design*. SAGE Publications; 2009.

Sensory Processing Patterns in Preterm Toddlers

Ayşe YILDIZ*, Zehra Ebrar BAKIRCI**, Ramazan YILDIZ***

Abstract

Aim: This study aimed to investigate the sensory processing patterns of preterm toddlers aged 12 to 24 months and compare them with term peers. Sensory processing difficulties in this population may contribute to developmental delays and behavioral challenges later in life; thus, early identification is critical.

Method: A total of 49 preterm toddlers born before 37 weeks of gestation and 45 healthy term toddlers were included in the study. Sensory processing skills were evaluated using the Toddler Sensory Profile-2, a caregiver-reported assessment tool that examines responses to sensory input across multiple domains, including auditory, visual, tactile, vestibular, and oral. The sensory quadrants of low registration, sensory sensitivity, sensory avoidance, and sensory seeking were also analyzed.

Results: Atypical sensory processing patterns were seen more frequently in preterm toddlers than in their peers ($p<0.05$). Atypical sensory processing patterns in the low registration, sensory sensitivity, sensory avoidance, and sensory seeking sensory quadrants were statistically higher in preterm toddlers ($p<0.05$). In addition, atypical sensory processing patterns were statistically more common in preterm toddlers in all sensory processing areas, such as auditory, visual, tactile, verbal, behavioral, and movement ($p<0.05$).

Conclusion: The study highlights that preterm toddlers process sensory stimuli atypically compared to their counterparts. These differences may hinder the child's ability to adapt to their environment and affect their participation in daily activities.

Keywords: Premature birth, sensory processing, child.

Yürümeye Yeni Başlayan Preterm Çocuklarda Duyusal İşleme Paternleri

Öz

Amaç: Bu çalışmanın amacı, 12 ila 24 aylık preterm bebeklerin duysal işleme modellerini araştırmak ve term akranlarıyla karşılaştırmaktır. Bu popülasyondaki duysal işleme problemleri, yaşamın ilerleyen dönemlerinde gelişimsel gecikmelere ve davranışsal zorluklara katkıda bulunabilir; bu nedenle erken teşhis kritik öneme sahiptir.

Yöntem: Çalışmaya 37 haftadan önce doğan toplam 49 preterm bebek ve 45 sağlıklı term bebek dahil edildi. Duyusal işleme becerileri, işitsel, görsel, dokunsal, vestibüler ve oral olmak üzere birden fazla alanda duysal girdiye verilen yanıtları inceleyen, bakıcı tarafından bildirilen bir değerlendirme aracı olan Yeni Yürümeye Başlayan Çocuk Duyu Profili-2 kullanılarak değerlendirildi. Düşük kayıt, duysal duyarlılık, duysal kaçınma ve duysal arama kadrnaları da analiz edildi.

Bulgular: Preterm bebeklerin duysal işleme performansı term bebeklerden önemli ölçüde farklıydı ($p<0,05$). Düşük kayıt, duysal hassasiyet, duysal kaçınma ve duysal arama gibi örüntüler preterm

Özgün Araştırma Makalesi (Original Research Article)

Geliş / Received: 29.01.2024 & **Kabul / Accepted:** 07.07.2025

DOI: <https://doi.org/10.38079/igusabder.1628977>

* Asst. Prof., Erzurum Technical University, Faculty of Health Sciences, Department of Physical Therapy and Rehabilitation, Erzurum, Türkiye. E-mail: ayse.yildiz@erzurum.edu.tr [ORCID https://orcid.org/0000-0002-1101-1069](https://orcid.org/0000-0002-1101-1069)

** Student, Erzurum Technical University, Faculty of Health Sciences, Department of Physical Therapy and Rehabilitation, Erzurum, Türkiye. E-mail: zhrabr25@gmail.com [ORCID https://orcid.org/0009-0007-2043-7380](https://orcid.org/0009-0007-2043-7380)

*** Asst. Prof., Erzurum Technical University, Faculty of Health Sciences, Department of Physical Therapy and Rehabilitation, Erzurum, Türkiye. E-mail: ramazan.yildiz@erzurum.edu.tr [ORCID https://orcid.org/0000-0002-8007-7854](https://orcid.org/0000-0002-8007-7854)

ETHICAL STATEMENT: The Erzurum Technical University Ethics Committee approved the study to conduct the study (Meeting number: 7, Decision number: 5, Date: 06.06.2024).

bebeklerde daha sık gözlemlendi. Preterm bebekler işitsel, görsel, dokunsal, oral, davranışsal ve hareket işleme alt alanlarında atipik puanlar aldı ($p<0,05$).

Sonuç: Çalışma, preterm bebeklerin duyuşsal uyarıların akranlarına kıyasla atipik olarak işlediğini vurgulamaktadır. Bu farklılıklar çocuğun çevresine uyum sağlama yeteneğini engelleyebilir ve günlük aktivitelere katılımını etkileyebilir.

Anahtar Sözcükler: Erken doğum, duyuşsal işleme, çocuk.

Introduction

Preterm birth is a birth that occurs before 37 weeks of pregnancy¹. Preterm infants were at greater risk for developmental and cognitive problems². Although advances in perinatal care have improved survival rates for these infants, these infants are at greater risk of neurodevelopmental disorders and sensory processing problems than term infants. Due to their immature nervous systems, these infants are not ready to process the intense sensory input in neonatal intensive care units (NICU). Therefore, their sensory development is likely slower than in term infants³.

Sensory processing skills involve managing sensory stimuli from the central and peripheral nervous systems and providing responses to sensory information. This process involves perceiving sensory input, communicating it to the brain, and integrating information from various sensory systems to produce appropriate responses⁴. The sensory processing conceptual model assumes a link between neurological threshold and behavioral response strategies⁵. This is defined in the quadrants where the neurological threshold continuum and response strategy form the axes. The neurological threshold represents the level of sensory stimulus required to trigger a neuronal arousal response. The brain becomes attuned to stimuli demanding immediate attention and response, while it becomes desensitized to familiar stimuli that do not require sustained focus. This balance is maintained through modulation, a brain regulatory process that facilitates some responses while inhibiting others. The behavioral response continuum ranges from passive to active regulatory strategies, reflecting the individual's temperament or personality traits. In the low-registration quadrant, a person has a high neurological threshold and a passive behavioral response strategy, making them unaware of their environment and disengaged. In the sensory sensitivity quadrant, a person has a low threshold and a passive response strategy, leading to easy distraction and difficulty handling intense situations with sensory stimuli. In the sensory-seeking quadrant, a person has a high threshold and an active response strategy, prompting them to seek out intense sensory experiences. In the sensory avoiding quadrant, a person has a low threshold and an active response strategy, leading them to control and limit sensory stimuli^{5,6}. In general, deficits in sensory processing skills can lead to inattention, sensory-seeking behaviors, or sensory stimulus avoidance problems⁴.

Studies on sensory processing skills in the literature have reported that preterm infants have higher rates of sensory processing problems than their term peers around the age of one^{7,8}. Adams et al., who evaluated the sensory processing skills of preterm children in the preschool period, found that preterm children also experienced sensory problems during this period⁹. Sensory processing skills in preterm infants between 12 and 24

months have not been investigated. The current study examined the sensory profiles of preterm infants between 12 and 24 months.

Material and Methods

Participants

The study included 49 preterm infants and 45 healthy infants with corrected ages ranging from 12 to 24 months. The study was conducted in the Department of Physiotherapy and Rehabilitation, Erzurum Technical University. It was calculated that 95% confidence and 95% power could be achieved when 45 preterm infants and 45 term infants were included in the study (G*power version 3.1.9.2, Axel Buchner, Universität Kiel). The study was completed with 49 preterm and 45 term infants. Informed consent was obtained from the families who agreed to participate in the study.

The study included infants born before 37 weeks of gestation and those with a history of at least 15 NICU visits. Those with congenital malformations, metabolic and genetic diseases, and diagnoses such as cerebral palsy were excluded from the study.

Measurements

Toddler Sensory Profile 2: It is filled out by the baby's caregiver to obtain information about sensory processing skills. It evaluates the behavior and performance outputs of children between 7 and 36 months of age against sensory inputs. It consists of 54 items that measure sensory processing skills. It covers general, visual, auditory, vestibular, tactile, and oral sensory processing titles. The frequency of behaviors for each section is scored as 1: almost always, 5: almost never. A result is obtained from the recorded answers using standard scoring methods. The scores obtained in the test are interpreted by dividing them into sensory processing patterns (sensory quadrants) as sensory sensitivity, sensory seeking, sensory avoiding, and low registration¹⁰. The raw scores from the subparameter responses are documented and then categorized. These categories are based on the deviation from the standard deviation range indicated by the scores, with most falling between -1.0 and +1.0 standard deviation (SD). The categories include typical performance (scores within -1.0 to +1.0 SD), probable deviation (scores ranging from -1.0 to -2.0 SD or +1.0 to +2.0 SD), and definite deviation (scores below -2.0 SD or above +2.0 SD). These categories help to characterize the child's sensory processing traits¹¹.

Ethical Statement

Permission was received from the Erzurum Technical University Ethics Committee to conduct the study (Meeting number: 7, Decision number: 5, Date: 06.06.2024).

Statistical Analysis

The SPSS program 26 (SPSS Inc., Chicago, IL, USA) was used for data analysis. The conformity of the variables to normal distribution was examined visually and analytically. Descriptive statistics were presented as frequency and percentage for categorical variables and mean and standard deviation for continuous variables. The chi-square test was used to compare categorical variables between two groups, the Mann-Whitney test was used to compare numerical variables if not normally distributed, and

the Student's t-test was used if normally distributed. A p-value less than 0.05 was considered statistically significant.

Results

The birth information and demographic characteristics of the infants included in the study are presented in Table 1.

Table 1. Characteristics of the groups.

	Preterm (n=49)	Term (n=45)	p
Age (month) (Mean $\pm$ SD)	14.2 $\pm$ 4.2	14.0 $\pm$ 3.9	0.862 ^a
Gestational age (Week) (Mean $\pm$ SD)	31.38 $\pm$ 3.8	38.37 $\pm$ 1.1	< 0.001 ^b
Gender (F/M) n (%)	25/24 (51/49)	26/19 (57.8/42.2)	0.511 ^c
Birth weight (g) (Mean $\pm$ SD)	2300.29 $\pm$ 1027.98	3078.50 $\pm$ 419.60	0.041 ^b
Birth height (cm) (Mean $\pm$ SD)	43.45 $\pm$ 6.85	49.80 $\pm$ 2.44	0.007 ^a
Mother's age (years)	30.82 $\pm$ 5.78	31.09 $\pm$ 5.40	0.820 ^b
Type of birth			
Spontaneous vaginal delivery	16 (32.7)	23 (51.1)	0.07 ^c
Cesarian section	33 (67.3)	22 (48.9)	
Length of stay in NICU (days)	31.12 $\pm$ 30.83	-	-
Mother's educational status (%)			
Primary school	7 (14.3)	11 (24.4)	0.627 ^c
High school	20 (40.8)	17 (37.8)	
University	20 (40.8)	16 (35.6)	
Master's Degree	2 (4.1)	1 (2.2)	
Father's educational status (%)			
Primary school	1 (2)	3 (6.7)	0.430 ^c
High school	20 (40.8)	18 (40)	
University	24 (49)	23 (51.1)	
Master's Degree	4 (8.2)	1 (2.2)	

p < 0.05 is shown in bold. a: b: c: a: Student's t-test, b: Mann-Whitney U Test, c: Chi-Square test, SD: Standard Deviation; g: Gram; cm: Centimeter; F: Female; M: Male.

Twenty-six infants (55.32%) were born less than 32 weeks of gestation, and 21 infants (44.68%) were born more than 32 weeks. The infants' prenatal and/or perinatal risks are summarized in Table 2. Of the infants, 55.32% were classified as very preterm or extremely preterm (gestational age < 32 weeks), while 44.68% were categorized as moderate or late preterm (32 weeks $\leq$ gestational age < 37 weeks).

Table 2. Risk factors for infants.

Risk factors	Preterm (n=49)	
	n	%
Germinal Matrix and Intraventricular Hemorrhage	6	12.77
Hyperbilirubinemia	8	17.02
Periventricular Leukomalacia	5	10.64
Intrauterine Growth Restriction	7	14.89
Bronchopulmonary Dysplasia	9	19.15
Perinatal Asphyxia	6	12.77
Patent Ductus Arteriosus	6	12.77
Necrotizing Enterocolitis	7	14.89

Both groups' sensory profiles (typical performance, probable difference, and defined difference) are shown in Table 3 and Figure 1. In the preterm group, the proportion of children who showed typical sensory processing patterns in all quadrants of poor registration, sensory seeking, sensory avoiding, and sensory sensitivity was significantly lower than in the control group. Similarly, the proportion of infants with typical performance in all sensory domains was higher in the control group ($p<0.05$).

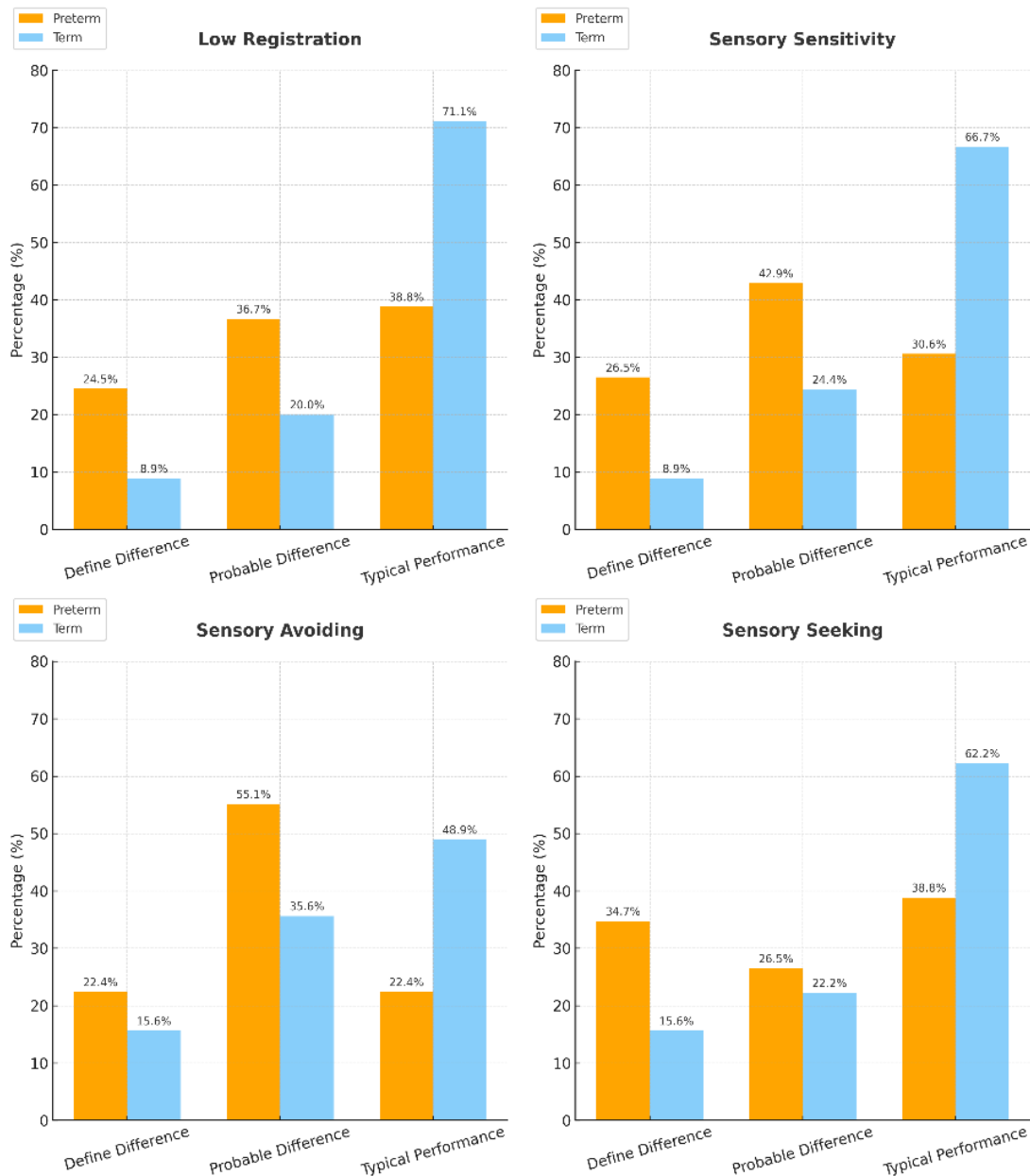
Table 3. Comparison of sensory profiles of the groups.

Sensory Quadrants	Groups	Typical n (%)	Probable n (%)	Define n (%)	p
Low Registration	Preterm	19 (38.8)	18 (36.7)	12 (24.5)	0.006
	Term	32 (71.1)	9 (20.0)	4 (8.9)	
Sensory Sensitivity	Preterm	15 (30.6)	21 (42.9)	13 (26.5)	0.002
	Term	30 (66.7)	11 (24.4)	4 (8.9)	
Sensory Avoiding	Preterm	11 (22.4)	27 (55.1)	11 (22.4)	0.027
	Term	22 (48.9)	16 (35.6)	7 (15.6)	
Sensory Seeking	Preterm	19 (38.8)	13 (26.5)	17 (34.7)	0.047
	Term	28 (62.2)	10 (22.2)	7 (15.6)	
Sensory Profile Sections					
General	Preterm	18 (36.7)	15 (30.6)	16 (32.7)	0.003
	Term	31(68.9)	10 (22.2)	4 (8.9)	
Auditory	Preterm	18(36.7)	14(28.6)	17 (34.7)	0.009
	Term	29(64.4)	11(24.4)	5(11.1)	
Visual	Preterm	25(51)	12 (24.5)	12(24.5)	0.007
	Term	32(71.1)	12 (26.7)	1(2.2)	
Touch	Preterm	17 (34.7)	12 (24.5)	20 (40,8)	0.003
	Term	28 (62.2)	12 (26.7)	5 (25.5)	
Movement	Preterm	20 (40.8)	22 (44.9)	7 (14.3)	0.003
	Term	32 (71.1)	13 (28.9)	-	
Oral	Preterm	18 (36.7)	13 (26.5)	18 (36.7)	0.007

	Term	29 (64.4)	11 (24.4)	5 (11.1)	
Behavioral	Preterm	16 (32.7)	16 (32.7)	17 (34.7)	0.001
	Term	30 (66.7)	11 (24.4)	28.7 ()	

p < 0.05 is shown in bold

Figure 1. Comparison of sensory profile quadrants of groups.



Discussion

This study aimed to evaluate sensory processing skills in preterm toddlers. As a result of the study, it was found that preterm toddlers showed atypical sensory processing patterns in the low registration, sensory sensitivity, sensory avoidance, and sensory seeking quadrants and all sensory profile sections compared to their term peers.

Sensory processing skills are negatively affected in preterm infants. Crozier et al. investigated the prevalence of sensory processing in very preterm children and found that almost half (46%) exhibited atypical sensory processing patterns¹². Ryckman et al. reported that half of premature infants born before 30 weeks of gestation had sensory processing disorder¹³. In another study evaluating children born prematurely with the Sensory Profile, preterm children reported a high risk of atypical scores in all Sensory Profile quadrants¹⁴. In the present study, preterm children were found to have atypical performance in all four sensory quadrants. In parallel with our findings, it has been reported that preterm children are more prone to sensory sensitization, resulting in higher responses to sensory experiences¹⁵. In the present study, the most common sensory behavior patterns in premature infants were avoidance and sensitivity. Recently, Niutanen et al. reported that the prevalence of possible atypical avoidance patterns in premature infants was 18-54%¹⁶. Similarly, Yardımcı-Lokmanoğlu et al. reported that sensory avoidance and sensitization patterns were most frequently observed in preterm children¹⁷. Preterm infants are not exposed to natural sensory experiences in late pregnancy and are likely to have sensory problems. In the NICU, preterm infants are exposed to adverse stimuli such as painful procedures, intubation, and exposure to light/sound in the environment. These altered sensory experiences during neurodevelopmental vulnerability and fragility can lead to sensory processing disorder. Early in life, altered sensory experiences and responses can affect development and influence how children respond to their environment^{18,19}.

Preterm children have been reported to be at high risk of atypical scores in auditory, tactile, and vestibular processing Section¹⁴. Preterm infants scored more atypical on the Sensory Profile's auditory and oral sensory processing components than their term peers¹⁹. Preterm school-age children have been reported to have more deficits in movement processing than term children²⁰. In the present study, in parallel with the literature, infants were found to have atypical performance in auditory, visual, tactile, movement, oral, and behavioral processing areas. The presence of many risk factors accompanying prematurity in the present study may have led to atypical performance in all sensory domains in the present population. Especially among infants, there is a high number of those who experience brain damage due to ischemia and bleeding. Bleeding and ischemia-induced brain injury are well-known risk factors for adverse neurodevelopment²¹. Therefore, it is no coincidence that sensory processing problems were encountered in our study group.

Future research with larger sample sizes is necessary to distinguish children across different points on the spectrum and to evaluate the risk factors associated with an atypical Sensory Profile. It should be noted that the Toddler Sensory Profile is a caregiver-reported questionnaire rather than a direct assessment tool, making it

inherently subjective. Consequently, incorporating both objective and subjective assessment methods in future studies will be crucial.

Conclusion

The results indicate that preterm toddlers are at higher risk for atypical sensory processing, which may negatively affect their motor development, behavior, and participation in daily activities. These findings highlight the importance of including sensory processing evaluations in early developmental follow-ups. Early detection and targeted interventions, such as sensory integration therapy and caregiver education, may improve this population's developmental outcomes and quality of life.

Supporting Organization

The study was supported by TUBITAK (Application No. 1919B012314473) under the 2209-A Program, 2nd term, 2023.

Conflict of Interest

The authors declared no conflict of interest.

Funding

None.

REFERENCES

1. Blencowe H, Cousens S, Chou D, et al. Born too soon: The global epidemiology of 15 million preterm births. *Reproductive Health*. 2013;10:1-14.
2. Feldman R, Eidelman AI. Neonatal state organization, neuromaturation, mother-infant interaction, and cognitive development in small-for-gestational-age premature infants. *Pediatrics*. 2006;118(3):e869-e878.
3. Lubbe W. *Prematurity: Adjusting your dream*. London: Little Steps Publications CC; 2008.
4. Powers KM. Sensory Processing. In: Wolkmar FR, ed. *Encyclopedia of Autism Spectrum Disorders*. Springer; 2021:4261-4265.
5. Dunn W. The sensations of everyday life: Empirical, theoretical, and pragmatic considerations. *The American Journal of Occupational Therapy*. 2001;55(6):608-620.
6. Dunn W. The infant toddler sensory profile. *Psychological Corporation*. 2002.
7. Celik HI, Elbasan B, Gucuyener K, Kayihan H, Huri M. Investigation of the relationship between sensory processing and motor development in preterm infants. *The American Journal of Occupational Therapy*. 2018;72(1):7201195020p1-7201195020p7.
8. Yildiz R, Yildiz A, Zorlular R, Elbasan B. Relationship between sensory processing and motor skills in 12-month-old infants. *Brain and Behavior*. 2024;14(9):e70052.
9. Adams JN, Feldman HM, Huffman LC, Loe IM. Sensory processing in preterm preschoolers and its association with executive function. *Early Human Development*. 2015;91(3):227-233.
10. Dunn W. *Child Sensory Profile-2 User's Manual*. Bloomington: Pearson; 2014.

11. Kılıç BK, Kayıhan H, Çifci A. Sensory processing in typically developing toddlers with and without sleep problems. *Infant Behavior and Development*. 2024;76:101981.
12. Crozier SC, Goodson JZ, Mackay ML, et al. Sensory processing patterns in children born very preterm. *The American Journal of Occupational Therapy*. 2016;70(1):7001220050p1-7.
13. Ryckman J, Hilton C, Rogers C, Pineda R. Sensory processing disorder in preterm infants during early childhood and relationships to early neurobehavior. *Early Human Development*. 2017;113:18-22.
14. Wickremasinghe A, Rogers E, Johnson B, Shen A, Barkovich A, Marco E. Children born prematurely have atypical sensory profiles. *Journal of Perinatology*. 2013;33(8):631-635.
15. Pekçetin S, Sarıdaş B, Üstünyurt Z, Kayıhan H. Sensory-processing patterns of preterm children at 6 years of age. *Infants & Young Children*. 2019;32(1):33-42.
16. Niutanen U, Harra T, Lano A, Metsäranta M. Systematic review of sensory processing in preterm children reveals abnormal sensory modulation, somatosensory processing, and sensory-based motor processing. *Acta Paediatrica*. 2020;109(1):45-55.
17. Yardımcı-Lokmanoğlu BN, Mutlu A, Livanelioğlu A. The early spontaneous movements, developmental functioning and sensory processing outcomes in preterm toddlers: A prospective study. *Early Human Development*. 2021;163:105508.
18. Bar-Shalita T, Vatine JJ, Parush S. Sensory modulation disorder: A risk factor for participation in daily life activities. *Developmental Medicine & Child Neurology*. 2008;50(12):932-937.
19. Bart O, Shayevits S, Gabis L, Morag I. Prediction of participation and sensory modulation of late preterm infants at 12 months: A prospective study. *Research in Developmental Disabilities*. 2011;32(6):2732-2738.
20. MacKay TL, Jakobson L, Ellemberg D, Lewis T, Maurer D, Casiro O. Deficits in the processing of local and global motion in very low birthweight children. *Neuropsychologia*. 2005;43(12):1738-1748.
21. Woodward LJ, Anderson PJ, Austin NC, Howard K, Inder TE. Neonatal MRI to predict neurodevelopmental outcomes in preterm infants. *New England Journal of Medicine*. 2006;355(7):685-694.

A Vicious Cycle of Access to Excluded Medicines: Evidence from a Qualitative Study

Haşim ÇAPAR*

Abstract

Aim: Medications procured through out-of-pocket payments from abroad are often more expensive compared to local treatment options, and the process is further prolonged even when medications are brought in. This situation generates a vicious cycle for both those with purchasing power and those without. This study aims to examine the challenges associated with accessing medications procured from abroad and to provide stakeholders with evidence-based solutions to these challenges.

Method: This study was conducted using a qualitative content analysis method with complaints of 68 patients in Türkiye about challenge to access their medications. Visual analyses were conducted using the MAXQDA program.

Results: The most frequently encountered themes in patient statements are "victimization," "communication issues", "delays in medicine supply," and "addressing authorities to politicians." Patients with genetic disorders, dermatological conditions, those undergoing transplants, as well as individuals suffering from cancer, neurological diseases, cardiovascular issues, rheumatological conditions, and psychiatric or addiction-related disorders reported that delays in medication supply hindered their treatments or forced them to discontinue them. Additionally, patients indicated ongoing communication problems with foreign drug supply units, expressing difficulties in accessing medications and frustration due to their inability to receive treatment.

Conclusion: In seeking solutions to these issues, they often held authorities and politicians accountable. This finding highlights the need for a more effective communication network between drug supply units and patients. A new system or reorganization of the current system is necessary to quickly address patient needs and make processes more understandable. Patients have expressed concerns about a lack of information regarding drug supply abroad.

Keywords: Access to medication, affordability, MAXQDA, Türkiye.

Kapsam dışı İlaçlara Erişimin Kısır Döngüsü: Nitel Bir Çalışmadan Elde Edilen Kanıtlar

Öz

Amaç: Yurtdışından cepten ödemelerle temin edilen ilaçlar, yerel tedavi seçeneklerine kıyasla genellikle daha pahalıdır ve ilaçlar getirildiğinde bile süreç daha da uzar. Bu durum, hem satın alma gücü olanlar hem de olmayanlar için bir kısır döngü yaratır. Bu çalışma, yurtdışından temin edilen ilaçlara erişimle ilgili zorlukları incelemeyi ve paydaşlara bu zorluklara kanıta dayalı çözümler sunmayı amaçlamaktadır.

Yöntem: Bu çalışma, Türkiye'de ilaçlara erişimde zorluklarla ilgili 68 hastanın şikayetleriyle nitel içerik analizi yöntemi kullanılarak gerçekleştirilmiştir. Görsel analizler MAXQDA programı kullanılarak yapılmıştır.

Bulgular: Hasta ifadelerinde en sık karşılaşılan temalar "mağduriyet", "iletişim sorunları", "ilaç tedarikindeki gecikmeler" ve "yetkili ve politikacıları adres gösterme"dir. Genetik bozuklukları, dermatolojik rahatsızlıkları, organ nakli geçirenleri, kanser, nörolojik hastalıklar, kardiyovasküler sorunlar, romatolojik rahatsızlıklar ve psikiyatrik veya bağımlılıkla ilgili bozukluklardan muzdarip hastalar, ilaç tedarikindeki gecikmelerin tedavilerini engellediğini veya kesintiye uğramaya zorladığını bildirmişlerdir. Ek olarak,

Özgün Araştırma Makalesi (Original Research Article)

Geliş / Received: 10.04.2025 & **Kabul / Accepted:** 14.07.2025

DOI: <https://doi.org/10.38079/igusabder.1673550>

* Asst. Prof., Dicle University, Faculty of Economics and Administrative Sciences, Department of Health Management, Diyarbakır, Türkiye. E-mail: hasim.capar@dicle.edu.tr **ORCID** <https://orcid.org/0000-0001-7056-7879>

hastalar yabancı ilaç tedarik birimleriyle devam eden iletişim sorunlarını belirtmiş, ilaçlara erişimde zorluklar yaşadıklarını ve tedavi alamadıkları için hayal kırıklığı yaşadıklarını ifade etmişlerdir.

Sonuç: Bu sorunlara çözüm arayışında, genellikle yetkilileri ve politikacıları sorumlu tutmuşlardır. Bu bulgu, ilaç tedarik birimleri ile hastalar arasında daha etkili bir iletişim ağına duyulan ihtiyacı vurgulamaktadır. Hasta ihtiyaçlarını hızlı bir şekilde karşılamak ve süreçleri daha anlaşılır hale getirmek için yeni bir sistem veya mevcut sistemin yeniden düzenlenmesi gerekmektedir. Hastalar, yurt dışından ilaç tedarikiyle ilgili bilgi eksikliği konusunda endişelerini dile getirmişlerdir.

Anahtar Sözcükler: İlaç erişimi, satın alınabilirlik, MAXQDA, Türkiye.

Introduction

The high cost of certain medications that are unavailable in the country, along with disruptions in the supply chain, complicates access to these medications¹. Access-related issues concerning medications create a complex process in some countries, continuing to disadvantage both patients and their caregivers^{2,3}. Medications procured through out-of-pocket payments from abroad are often more expensive compared to local treatment options, and the process is further prolonged even when medications are brought in. This situation generates a vicious cycle for both those with purchasing power and those without⁴⁻⁶. Particularly in the procurement of certain life-saving medications that are not available in every country, such as those for cancer, neurology, transplantation, and cardiovascular diseases, communication issues may arise between patients and the institutions providing these medications⁷.

Bureaucratic barriers related to the supply chain of medications, along with poorly managed processes, hinder patients from receiving the medications they need in a timely manner. Especially concerning is the prolonged waiting times that can negatively impact the course of a patient's illness, adversely affecting their treatment processes^{6,8}. The importation of medications from abroad has become problematic not only in terms of cost but also due to legal regulations and communication deficiencies with overseas medication procurement units^{6,9}. Communication challenges extend the procurement process for the medications that patients require, leading to disruptions in their treatment regimens^{10,11}.

The communication deficiencies of overseas medication procurement units directly lead to delays in the procurement process of medications^{12,13}. Communication issues result in the untimely arrival of necessary medications for patients, causing disruptions in their treatment processes^{14,15}. Furthermore, bureaucratic barriers and legal regulations associated with importing medications from abroad further extend patients' treatment times¹⁶. Therefore, addressing the challenges faced in obtaining medications from overseas is critically important for the improvement of Türkiye's healthcare system. By tackling this issue, evidence-based policies can be developed. The evidence generated from this analysis emerges as a global concern that should also be considered in health policy¹⁷.

This study aims to examine the challenges associated with accessing medications procured from abroad and to provide stakeholders with evidence-based solutions to these challenges. Through this research, it seeks to offer policymakers the necessary evidence to reevaluate and restructure the procurement process for medications that are

imported into Türkiye and are not covered by reimbursement. Focusing on the research question "What are the main difficulties experienced by patients in Türkiye in the process of obtaining medicines from abroad and what are the related solutions?", this study aims to offer concrete suggestions for a new supply chain model for medicines supplied from abroad.

Material and Methods

Research Design

This study was conducted using a qualitative content analysis (QCA) method to examine complaints from some patients in Türkiye about not being able to access their medications, which are prescribed by a doctor and must be obtained out-of-pocket from abroad¹⁸.

Participant Profile, Selection and Sampling

The participants consist of 68 patients or patient representatives who have problems accessing medication despite paying out of pocket, who share their problems with documents through a website established to complain, and who provide detailed information such as medication information, why they could not get their medication, etc. Since all complaints on the website where the participants reported their complaints were included in the research, no sample selection was made¹⁹.

Inclusion, Exclusion Criteria and Keywords

The inclusion criteria were determined as having a complaint made visible to everyone on the website set up for complaints, complaints of patients who paid for their medicine out of pocket, and complaints about accessing medicines abroad prescribed by a doctor. The exclusion criteria were selected as complaints about accessing medicines domestically and complaints about pharmacies. The relevant website was searched with the keywords "Turkish Pharmacists Association Overseas Medicines", "Turkish Pharmacists Association Overseas Medicine Supply", "Turkish Pharmacists Association Telephone" and "Turkish Pharmacists Association Overseas Pharmacists Association".

Data Collection, Coding and Theming Processes

The patients' complaints were scanned on the website using defined keywords, resulting in a total of 218 complaints. After removing those unrelated to foreign drugs and local pharmacies, 110 complaints remained. From these, 40 duplicates were eliminated, leaving 70 complaints. Two of these were excluded as they had been removed from the website, resulting in 68 patient complaints for examination.

Each complaint was transferred to a Word document, which were then read and categorized into themes based on the types of inaccessible drugs. Main and sub-codings were determined by a single researcher after obtaining expert opinion on the subject. The documents were subsequently uploaded to their respective themes. After a second review, main and subcodes were established. The main and subcodes, and themes were transferred to an Excel file, and the document contents were then uploaded to the relevant main and subcodes in the MAXQDA 2022 program²⁰.

Data Analysis

The data were analyzed in two stages. In the first stage, the data collected through keywords were transferred to individual Word documents for each patient. The data were then sorted based on their relevance to the subject. The extracted content underwent observational analysis, leading to the identification of themes, codes, and subcodes, which were documented in an Excel file²¹. In the second stage, the organized documents were imported into the MAXQDA program. The documents were categorized into themes within the program, and the relevant content was reviewed and assigned to the appropriate themes, main codes, and subcodes. After the assignments were completed, visual analyses were conducted using the MAXQDA 2022 program for a more in-depth evaluation²⁰.

The Role of the Researcher and Ethical Statement

In this study, the role of the researcher is objective. Because it is stated that the role of the researcher in qualitative research is to try to reach the feelings and thoughts of the participants²². However, since the contents previously declared by the participants were examined in this study, the researcher adopted a completely objective attitude and a possible bias originating from the researcher was avoided. Therefore, since the researcher maintained his independence, no ethical violations were made. Since the data were secondary, no ethics committee approval was obtained for this research.

Reliability and Validity

The study was conducted based on the validity criteria suggested by²³, focusing on the reliability, appropriateness, auditability, and confirmability of qualitative research. The data comprised 68 distinct patient complaints that were categorized into predefined themes and codes. The necessary number of responses for each theme and code was met, ensuring the reliability of the data prior to analysis. The results were validated by checking whether the complaints articulated by individual participants were also mentioned by others. To further ensure the validity of the findings, an examination was conducted to determine if the comments and support messages associated with each complaint were contributed by different individuals. The data collection and analysis processes were carried out by an experienced qualitative researcher, and each step was meticulously documented. To enable readers and stakeholders to verify the findings, participants' statements were included in the visuals.

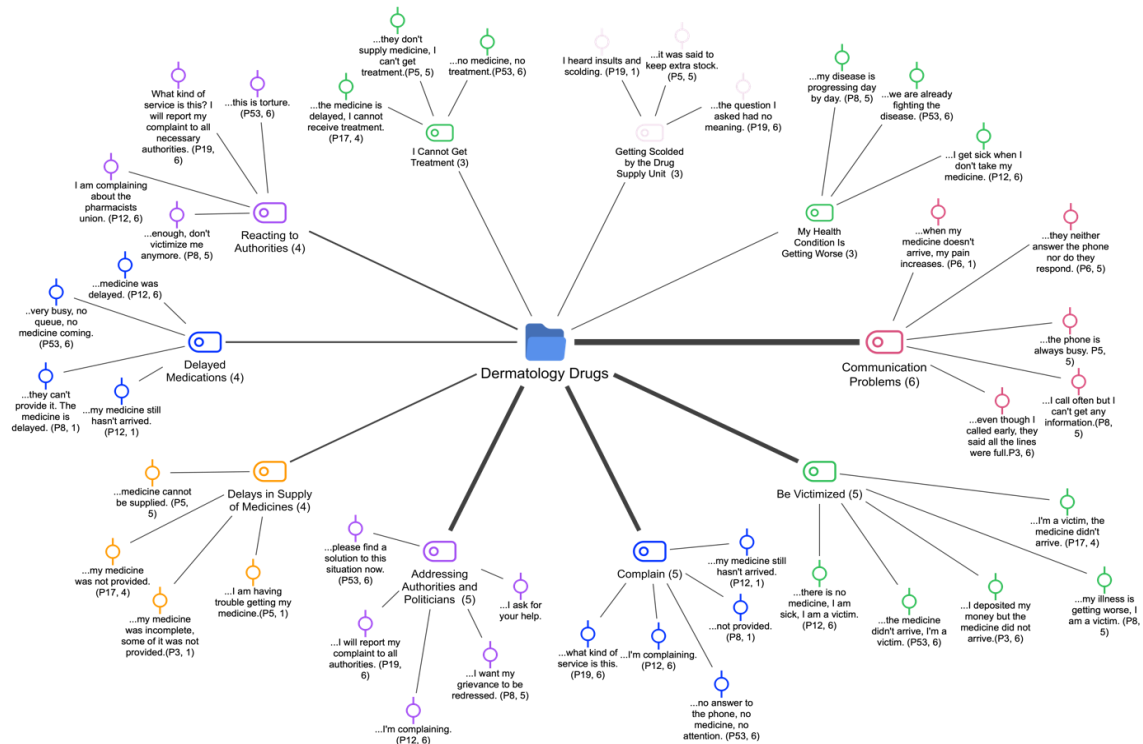
Permission to Reproduce Material from other Source

Since the questions and all other materials in this study were prepared by the author, no permission was obtained. No material from any other source was used.

Results

The frequency distribution of codes in patient complaints is shown in Figure 1. In Figure 1, codes that occur frequently in patient statements are shown in larger font sizes, while less frequent codes are shown in smaller font sizes. Accordingly, the most frequent codes in patient statements are "be victimized", "communication problems", "delays in supply of medicines", and "addressing authorities and politicians", respectively.

Figure 3. Participant statements on the dermatology drug access theme single-case model

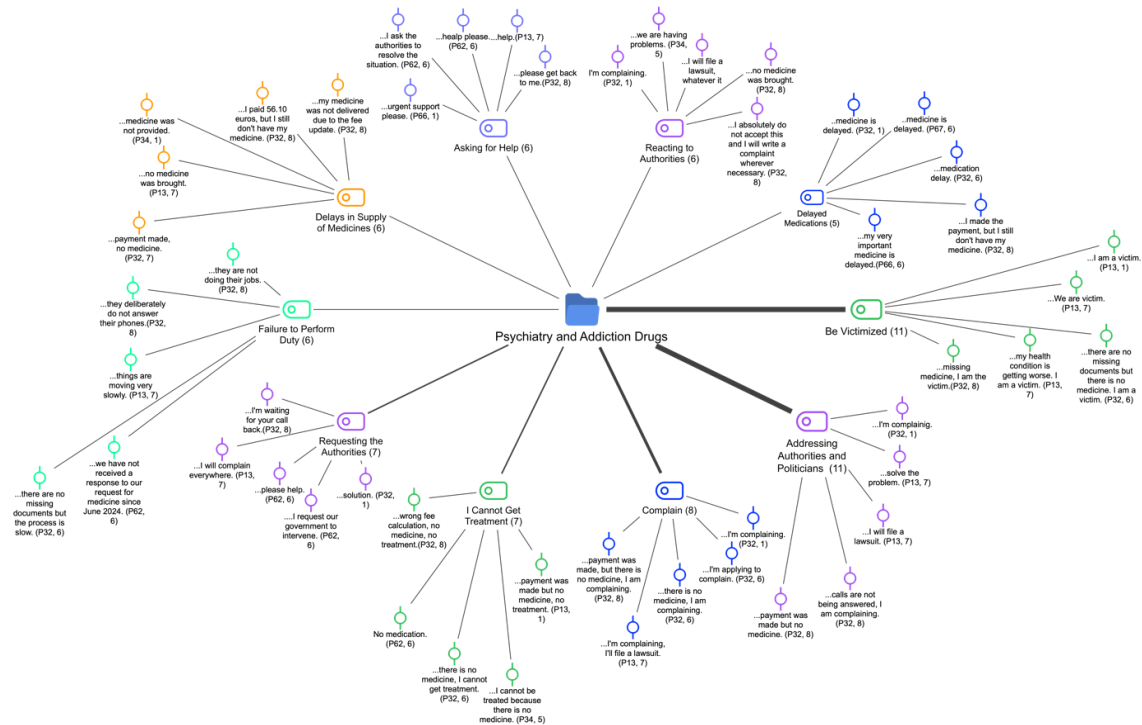


In the theme of access to psychiatry and addiction drugs, patients expressed their complaints with the codes in Figure 4. Patients stated that they were heavily victimized due to the supply of psychiatric and addiction medications and that the reason for this victimization was the authorities and politicians (Figure 4). The statements of patients coded P13 and P32 on the subject are as follows:

“We are incredibly victimized and I will continue to complain everywhere and file a lawsuit, whatever it takes. My patient's illness has also progressed.” (P13)

“Although we applied for the epilepsy medication that we had previously brought from abroad through the drug supply unit in March and sent the shipping fee they requested in Euros, we never received the medication. No information is given, my child is a victim, we are experiencing a drug shortage. We want it to be resolved as soon as possible.” (P32)

Figure 4. Participant statements on the psychiatry and addiction drugs access theme single-case model

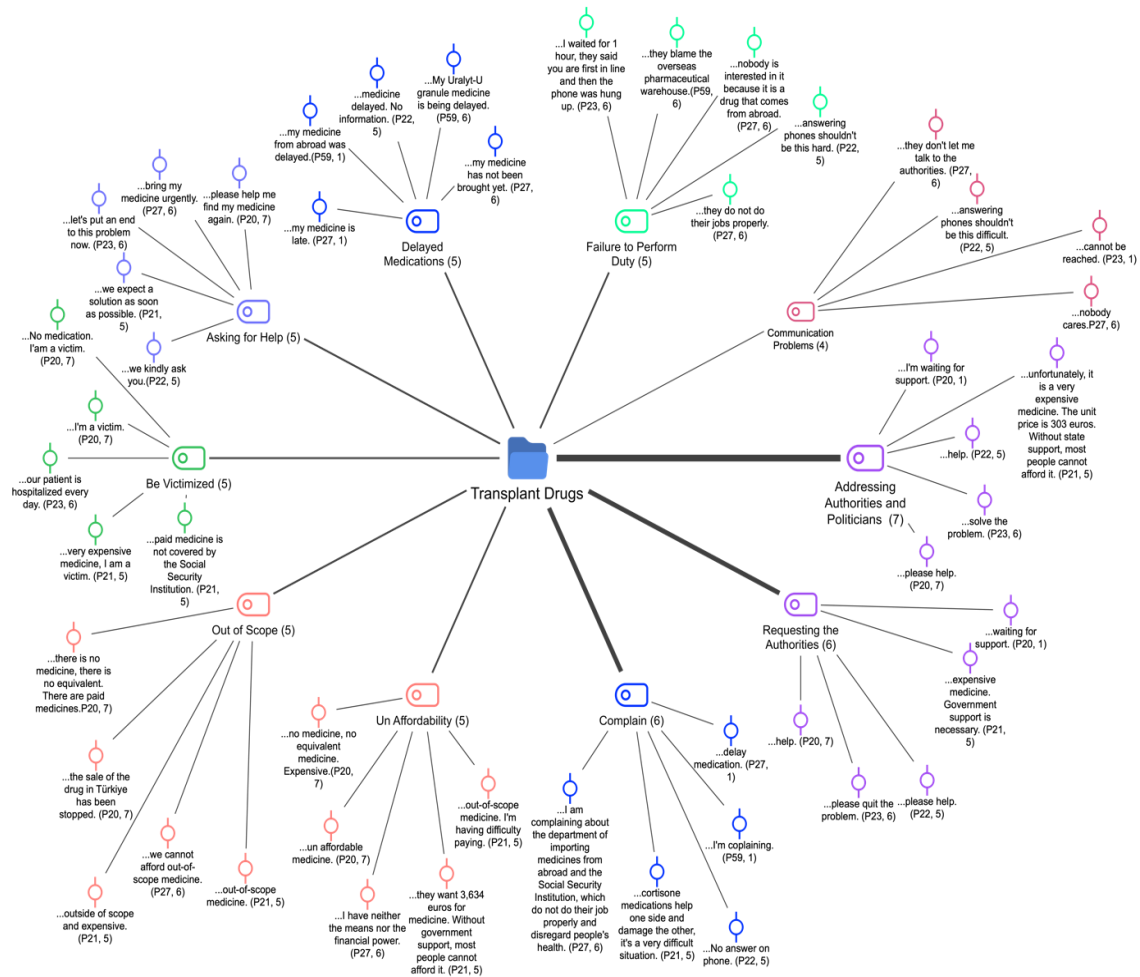


In the theme of access to transplant drugs, patients expressed their complaints with the codes in Figure 5. Patients frequently mentioned authorities and politicians for access to transplant drugs (Figure 5). Patients P20 and P21 expressed their situation on the subject as follows:

“Pegasys, which is used the most by many patients, is not available anywhere and there is no equivalent; we are a victim. It is not included in the scope of foreign drug supply. Please help find it again. The return of this drug will be a remedy for many people's problems.” (P20)

“I paid 3,634 euros for 12 medicines. I use one a week and it is enough for me for 3 months but I cannot afford to buy it. Unfortunately, it is very expensive and the price per unit is 303 euros. Most people cannot afford this without government support. At least accept that we pay the exchange rate determined by the government for imported medicines.” (P21)

Figure 5. Participant statements on the transplant drugs access theme single-case model

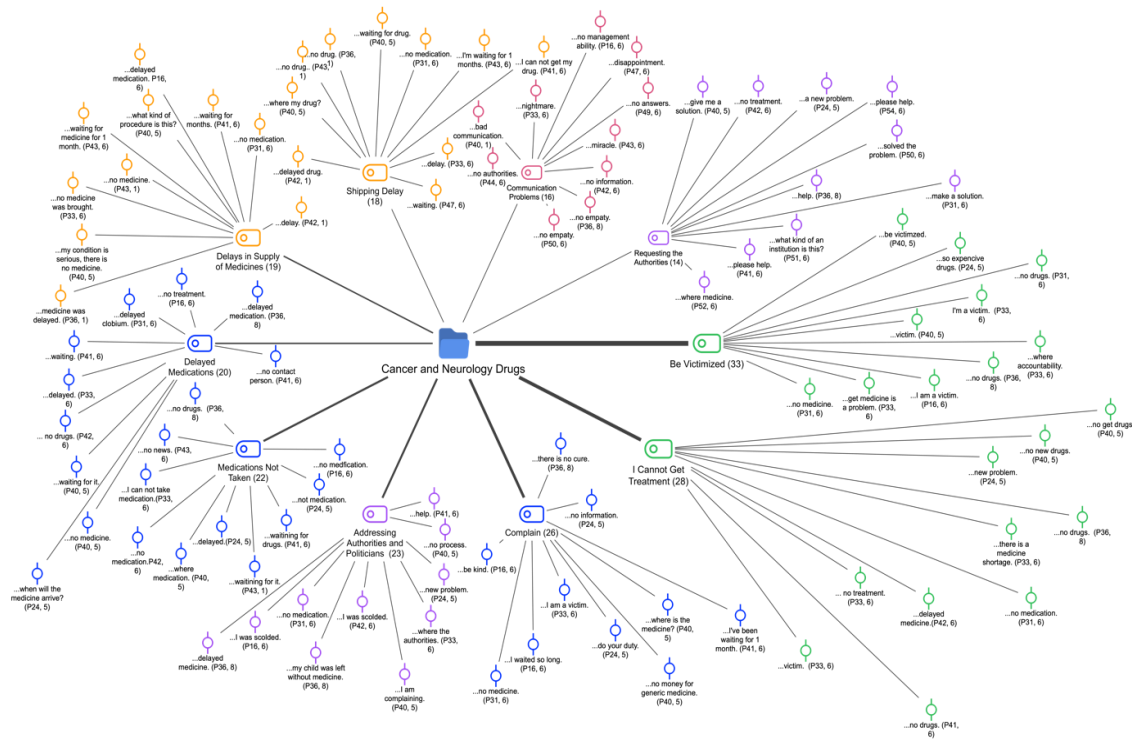


In the theme of access to cancer and neurology, patients expressed their complaints with the codes in Figure 6. Patients expressed intensely that they were unable to access cancer and neurological disease treatment and that they were suffering because of this (Figure 6). Patients P16 and P33 expressed their situation on the subject as follows:

“We applied for medicine abroad for my brother who has cancer and paid the fee. When we made the payment in Euros, we were told that the medicine would arrive within 1 to 6 weeks. It has been three months, even a day is very important to us, but today I learned that there is no medicine. We are victims.” (P16)

“I can't get the medicine. I have to pay for the medicine. I'm a victim.” (P33)

Figure 6. Participant statements on the cancer and neurology drugs access theme single-case model



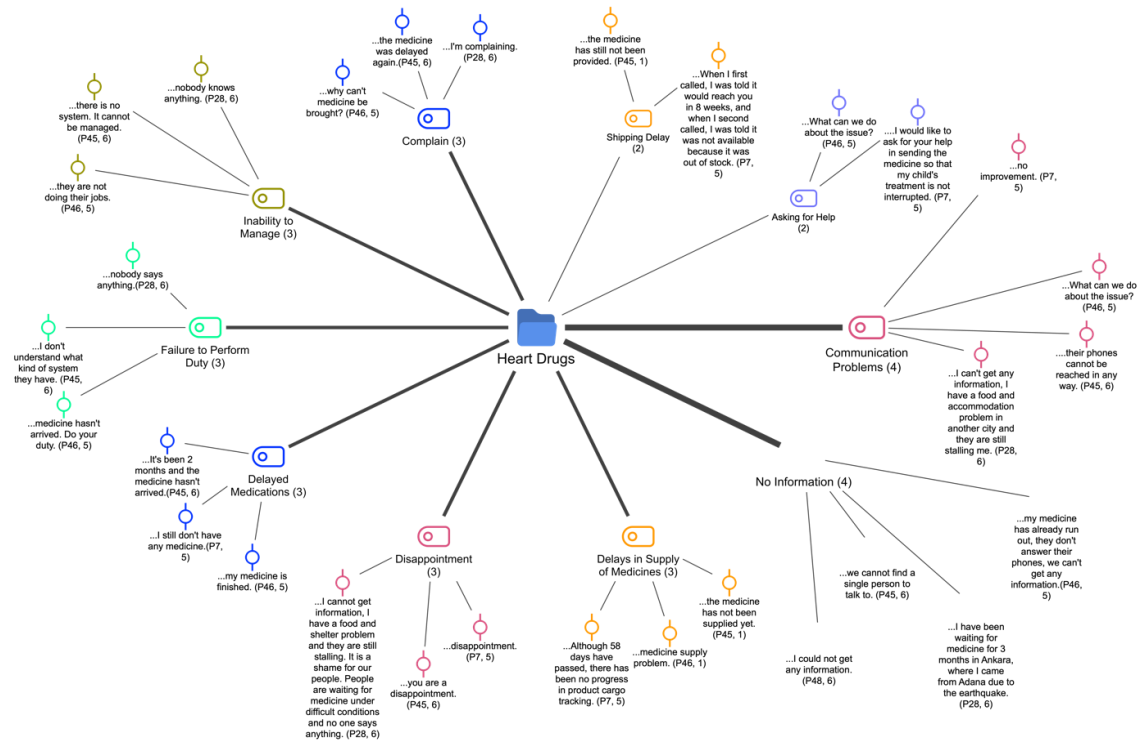
In the theme of access to heart drugs, patients expressed their complaints with the codes in Figure 7. Patients frequently stated that they had communication problems regarding access to heart medication and were unable to obtain information on the subject (Figure 7). Patients coded P28, P45 and P48 reported the following statements regarding access to heart medication.

“Is it that hard to answer that phone? I’ve been calling for 3 days and no one is answering.” (P28)

“The prescription I gave for the second treatment has not arrived yet. I call on the phone, if they answer, I introduce myself and ask about my medicine. They say it will come. I have been waiting for 20 days, my treatment date is passing, I have become a victim.” (P45)

“We requested medicine from abroad. We paid for it. It’s been 5 months and still no response. We can’t even reach them to meet. Will they call back when the patient dies? We definitely can’t reach them with their numbers. We are waiting for a solution. Our patient is in bad condition and I think he will die before the medicine arrives. Shame on them, they don’t even call back.” (P48)

Figure 7. Participant statements on the heart drugs access theme single-case model

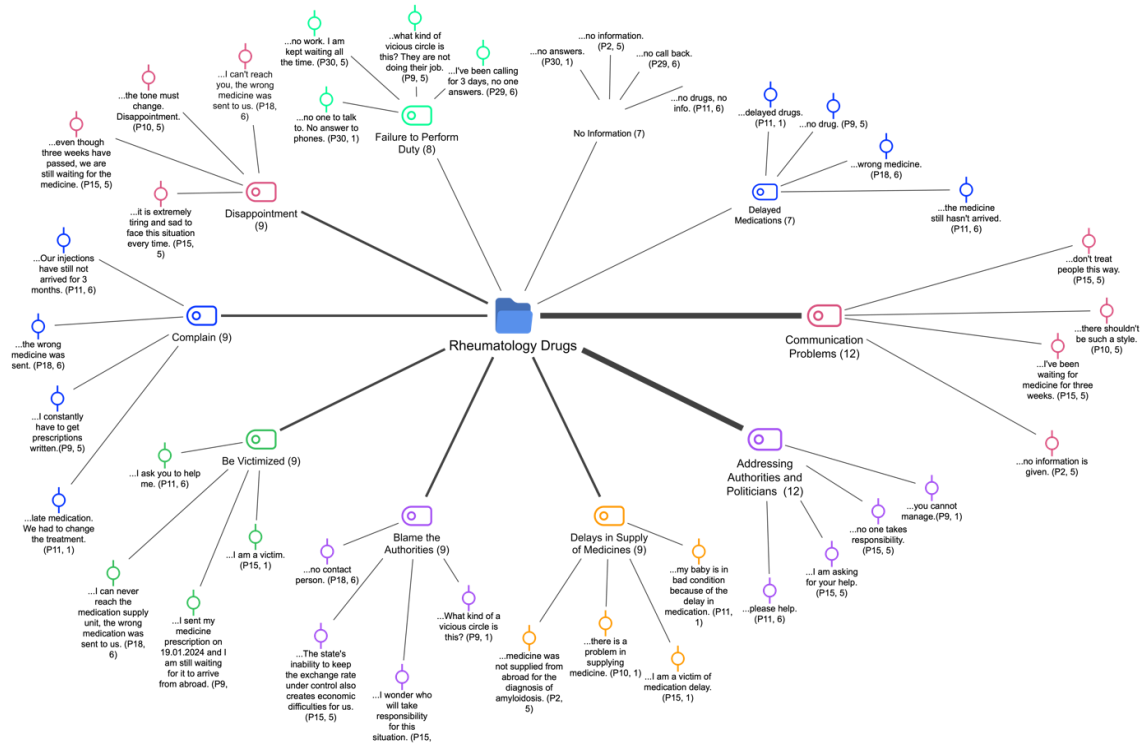


In the theme of access to rheumatology drugs, patients expressed their complaints with the codes in Figure 8. Patients frequently stated that they had communication problems regarding access to rheumatology medications and that they viewed authorities and politicians as responsible for the issue (Figure 8). Patients coded P11 and P15 reported the following statements regarding access to rheumatology medications.

“We applied for injections. However, our injections have not arrived for almost 3 months. My baby is 10 months old and we need these injections very much. His seizures are relentless and my child is in a very bad condition. Please let our medicines come now, my baby is very sick. I ask you to help.” (P11)

“I have been waiting for medicine for three weeks. How long will this situation continue? Enough is enough. It is extremely tiring and sad to face this situation every time. We want to pay for medicine and get it. Every three months we have to apply with anxiety about whether the medicine will be available or not. Even though three weeks have passed, we are still waiting for medicine. I wonder who will take responsibility for this situation. I don't even want to think about what our citizens who are in a more difficult situation have to do. The state's failure to control the exchange rate is also making it difficult for us economically.” (P15)

Figure 8. Participant statements on the rheumatology drugs access theme single-case model



Discussion

Access to medications procured from abroad continues to be a significant issue for patients in Türkiye. According to the research findings, patients have expressed concerns regarding the challenges they face in accessing medications, highlighting that communication problems and delays in the procurement process adversely affect their treatment journeys. In particular, delays in obtaining genetic medications complicate patients' access to treatment or may lead them to discontinue their therapies^{4,17}. This situation has become a matter that raises questions about the effectiveness of the healthcare system. In fact, studies on the subject report that access problems related to medicines are a problem in all low, middle and high-income countries from time to time and that this indicates a lack of a health system^{6,24}.

The communication problems encountered by patients in obtaining medications for dermatological conditions highlight the deficiencies in the operations of the foreign drug procurement units. These communication issues prevent patients from accessing the information they need, consequently prolonging their treatment processes^{6,10}. In addition, the grievances experienced by patients undergoing psychiatric and addiction treatment reflect the challenges associated with the procurement of medications for this group. Patients are calling on authorities and healthcare professionals to address these issues²⁵. A report published in 2024 on the subject offers solutions and strategies specifically addressing the vicious cycle of drug access. It provides evidence that

communication and supply problems exist in drug access and that these can be resolved through methods such as patient-centered communication²⁶.

Another notable point in the research is the difficulties encountered in the procurement of medications for cancer and neurological diseases. Patients have expressed that these access deficiencies pose a serious threat to their health. These findings highlight the necessity for a review of health policies and the need to make the medication supply system more effective²⁷⁻²⁹. Additionally, communication issues in accessing cardiac and rheumatology medications are another significant factor negatively impacting patients' treatment processes^{30,31}. A comprehensive report on access to medicines in OECD countries found that many new medicines, often targeting small populations, enter the market at very high prices, creating challenges for both payers and patients³². In this context, recommendations can be made to increase the economic value of medicines in countries, facilitate incentives for pharmaceutical Research and Development, and facilitate government subsidies for pharmaceuticals. These recommendations are anticipated to address issues related to access to medicines.

Lack of communication in the supply of medicines abroad restricts patients' access to the information they need and therefore paves the way for the extension of their treatment processes. In addition, patients receiving psychiatric and addiction treatment experience serious grievances due to the difficulties they experience in obtaining medicines in this group. This situation negatively affects not only the physical health of the patients but also their mental health. Similar studies have also demonstrated that individuals experiencing medication access issues experience physical, mental, and social well-being^{1,33,34}. In this context, the study is consistent with other studies in the literature and yields similar results.

Patients' complaints about access to transplant medicines are also striking. Patients who stated that they think that the authorities and politicians are not taking enough steps in this regard stated that this situation seriously victimizes them. In general, access problems experienced for cancer, neurological diseases and rheumatology medicines are also among the important factors that restrict patients' treatment processes. Communication problems frequently experienced in accessing heart medicines increase patients' concerns about their treatment processes and this situation reinforces their distrust of the authorities.

As a result, problems experienced in the access of medicines supplied from abroad constitute a significant challenge for the healthcare system in Türkiye. It is obvious that communication processes need to be improved and authorities need to take effective responsibility in order to eliminate the grievances experienced by patients. Restructuring health policies by taking these problems into account may help reduce the difficulties experienced by patients during the treatment process.

Limitations

This study was conducted under some limitations. Therefore, the results should be evaluated according to these limitations. One of these limitations is the lack of generalization that arises from the nature of the qualitative study. Another important limitation is that the limitations based on patient statements were reported. Because

there may be some difference between the subjective judgments of the patients and what is actually experienced. However, considering these limitations, it is thought that this study will attract the attention of politicians by presenting a problem and providing solution suggestions. Considering these limitations, it is recommended that future studies be conducted using the same methodology and coding across different patient groups. This will provide evidence on the challenges faced by different populations regarding access to medicines abroad and the strategies needed to address these challenges.

Conclusion

This finding highlights the need for a more effective communication network between drug supply units and patients. A new system or reorganization of the current system is necessary to quickly address patient needs and make processes more understandable. Patients have expressed concerns about a lack of information regarding drug supply abroad. Authorities should implement tools like brochures, websites, and mobile apps to provide timely information.

Support programs should be developed for vulnerable groups, such as psychiatric and addiction patients, to minimize their suffering during treatment. Emergency procedures for supplying vital medications, like those for cancer and heart diseases, should be established, ensuring timely delivery. Additionally, training for personnel on patient challenges is essential, fostering empathy to improve communication.

Current policies must be regularly reviewed and updated to prevent supply delays, especially for genetic drugs and rare diseases. Patients seek transparency and speed in drug supply processes to avoid interruptions in their treatment. This emphasizes the need for health policies to reflect actual patient needs. Persistent communication issues erode patients' trust in health services, making it crucial to resolve these problems swiftly. Patients stress the accountability of authorities in forming health policies and advocate for system improvements, underscoring the importance of their involvement in healthcare management. Delays in drug supply can have lasting impacts on health, highlighting the necessity for continuity in health services.

REFERENCES

1. Yenet A, Nibret G, Tegegne BA. Challenges to the availability and affordability of essential medicines in African countries: A scoping review. *Clin Outcomes Res CEOR*. 2023;15:443-458. doi: 10.2147/CEOR.S413546.
2. Fuller JM, Barenfeld E, Ekman I. Why do patients struggle with their medicines?—A phenomenological hermeneutical study of how patients experience medicines in their everyday lives. *PLoS ONE*. 2021;16(8):e0255478. doi: 10.1371/journal.pone.0255478.
3. Krikorian G, Torreele E. We cannot win the access to medicines struggle using the same thinking that causes the chronic access crisis. *Health Hum Rights*. 2021;23(1):119-127.
4. Atikeler EK, Leufkens HGM (Bert), Goettsch W. Access to medicines in Turkey:

- Evaluation of the process of medicines brought from abroad. *Int J Technol Assess Health Care*. 2020;36(6):585-591. doi: 10.1017/S0266462320000872.
5. Gupta S, McColl MA, Guilcher SJT, Smith K. Managing medication cost burden: A qualitative study exploring experiences of people with disabilities in Canada. *Int J Environ Res Public Health*. 2019;16(17):3066. doi: 10.3390/ijerph16173066.
 6. Shukar S, Zahoor F, Hayat K, et al. Drug shortage: Causes, impact, and mitigation strategies. *Front Pharmacol*. 2021;12:693426. doi: 10.3389/fphar.2021.693426.
 7. Tiwary A, Rimal A, Paudyal B, Sigdel KR, Basnyat B. Poor communication by health care professionals may lead to life-threatening complications: Examples from two case reports. *Wellcome Open Res*. 2019;4:7. doi: 10.12688/wellcomeopenres.15042.1.
 8. Shore C, Brown L, Hopp WJ. Causes and consequences of medical product supply chain failures. In: *Building Resilience into the Nation's Medical Product Supply Chains*. National Academies Press (US); 2022.
 9. Acosta A, Vanegas EP, Rovira J, Godman B, Bochenek T. Medicine shortages: Gaps between countries and global perspectives. *Front Pharmacol*. 2019;10:763.
 10. Tan SC, Poh WT, Yong ACH, et al. Challenges and strategies for improving access to cancer drugs in Malaysia: Summary of opinions expressed at the 2nd macr international scientific conference 2022. *Cancer Manag Res*. 2023;15:851-862.
 11. Tucker EL, Daskin MS. Pharmaceutical supply chain reliability and effects on drug shortages. *Comput Ind Eng*. 2022;169:108258. doi: 10.1016/j.cie.2022.108258.
 12. Vledder M, Friedman J, Sjöblom M, Brown T, Yadav P. Improving supply chain for essential drugs in low-income countries: Results from a large scale randomized experiment in Zambia. *Health Syst Reform*. 2019;5(2):158-177. doi: 10.1080/23288604.2019.1596050.
 13. Wong WP, Saw PS, Jomthanachai S, Wang LS, Ong HF, Lim CP. Digitalization enhancement in the pharmaceutical supply network using a supply chain risk management approach. *Sci Rep*. 2023;13(1):22287. doi 10.1038/s41598-023-49606-z.
 14. Frydenberg K, Brekke M. Poor communication on patients' medication across health care levels leads to potentially harmful medication errors. *Scand J Prim Health Care*. 2012;30(4):234-240. doi: 10.3109/02813432.2012.712021.
 15. Tariq RA, Vashisht R, Sinha A, Scherbak Y. Medication dispensing errors and prevention. In: *StatPearls*. StatPearls Publishing; 2024.
 16. Scheckel CJ, Vincent Rajkumar S. Drug importation: Limitations of current proposals and opportunities for improvement. *Blood Cancer J*. 2021;11(7):132.
 17. Çalıkuşu M, Özçelikay G. Opinions of pharmacists in Türkiye on drug shortages and effects on treatment. *Hacet Univ J Fac Pharm*. 2024;44(1):18-28.
 18. Schreier M, Stamann C, Janssen M, Dahl T, Whittal A. Qualitative content

- analysis: Conceptualizations and challenges in research practice—introduction to the fqs special issue “Qualitative Content Analysis I.” *Forum Qual Sozialforschung Forum Qual Soc Res.* 2019;20(3). doi: 10.17169/fqs-20.3.3393.
19. Ahmed SK. How to choose a sampling technique and determine sample size for research: A simplified guide for researchers. *Oral Oncol Rep.* 2024;12:100662.
 20. VERBI Software. MAXQDA 2022 [computer software]. Published online 2021. Available from maxqda.com.
 21. Sterrantino AF. Observational studies: practical tips for avoiding common statistical pitfalls. *Lancet Reg Health - Southeast Asia.* 2024;25:100415.
 22. Sutton J, Austin Z. Qualitative research: Data collection, analysis, and management. *Can J Hosp Pharm.* 2015;68(3):226-231.
 23. Lincoln YS, Guba EG. *Naturalistic Inquiry.* SAGE Publications, Inc; 1985.
 24. Crowley R, Daniel H, Cooney TG, Engel LS; Health and Public Policy Committee of the American College of Physicians. Envisioning a better U.S. health care system for all: coverage and cost of care. *Ann Intern Med.* 2020;172(2 Suppl):S7-S32.
 25. Iseselo MK, Ambikile JS. Medication challenges for patients with severe mental illness: Experience and views of patients, caregivers and mental health care workers in Dar es Salaam, Tanzania. *Int J Ment Health Syst.* 2017;11(1):17.
 26. Burton J, McCaffrey G, Oputu T, Warner B. *Medicines Shortages: Solutions for Empty Shelves.* Royal Pharmaceutical Society; 2024:76. Accessed June 12, 2025. <https://www.rpharms.com/Portals/0/RPS%20document%20library/Open%20access/Medicines%20Shortages/Medicines%20Shortages%20-%20Digital%20-%20201124.pdf>
 27. Barrios C, de Lima Lopes G, Yusof MM, Rubagumya F, Rutkowski P, Sengar M. Barriers in access to oncology drugs — a global crisis. *Nat Rev Clin Oncol.* 2023;20(1):7-15.
 28. Chakraborty S, Rahman T. The difficulties in cancer treatment. *Ecancer Medical Science.* 2012;6:ed16. doi: 10.3332/ecancer.2012.ed16.
 29. Petricca K, Carson L, Kambugu J, Denburg A. Strengthening access to cancer medicines for children in East Africa: Policy options to enhance medicine procurement, forecasting, and regulations. *Glob Health Res Policy.* 2024;9(1):24. doi: 10.1186/s41256-024-00365-y.
 30. Georgopoulou S, Prothero L, D’Cruz DP. Physician–patient communication in rheumatology: A systematic review. *Rheumatol Int.* 2018;38(5):763-775.
 31. Gil-Guillen VF, Balsa A, Bernárdez B, et al. Medication non-adherence in rheumatology, oncology and cardiology: A review of the literature of risk factors and potential interventions. *Int J Environ Res Public Health.* 2022;19(19):12036.
 32. Organisation for Economic Co-operation and Development (OECD). *Pharmaceutical Innovation and Access to Medicines.* OECD; 2018:192. Accessed June 12, 2025.

33. Vecchio N, Davies D, Rohde N. The effect of inadequate access to healthcare services on emergency room visits. A comparison between physical and mental health conditions. *PLoS ONE*. 2018;13(8):e0202559. doi: 10.1371/journal.pone.0202559.
34. Carbonell Á, Navarro-Pérez JJ, Mestre MV. Challenges and barriers in mental healthcare systems and their impact on the family: A systematic integrative review. *Health Soc Care Community*. 2020;28(5):1366-1379. doi: 10.1111/hsc.12968.

Investigation of Malnutrition and Sarcopenia in Individuals Aged 65 and Over Receiving Both Nursing Home or Home Care Services*

Haydar ÖZPINAR**, Şevval ÖZŞİRİN***

Aim: This study examines the physical activity levels, malnutrition, and sarcopenia status of elderly individuals receiving nursing home or home care services.

Method: The research was conducted in Manisa between November 2024 and February 2025 with a total of 180 elderly individuals aged 65 and over, 93 of whom were women and 87 men, all of whom were either receiving home care services or residing in a nursing home. Sociodemographic information was obtained through a structured questionnaire. Nutritional status was evaluated using the Mini Nutritional Assessment (MNA), while muscle strength was determined through a handgrip strength test. Additionally, a 24-hour dietary recall was collected during face-to-face interviews.

Results: Regarding income status, 29.9% of elderly individuals receiving home care had no income, whereas this rate was only 1.2% among those living in a nursing home. Regarding water consumption, it was observed that in both groups, the elderly consumed less than 2 liters per day, indicating inadequate fluid intake. As for physical activity levels, 39.2% of elderly individuals receiving home care and 44.6% of those in nursing homes reported walking for 30 minutes or more per day. When it comes to malnutrition, 38.1% of home care participants and 22.9% of nursing home residents were found to be at risk of malnutrition. Additionally, 6.2% of home care participants and 3.6% of those in the nursing home were classified as malnourished. Regarding sarcopenia, based on handgrip strength tests, 11.3% of home care participants and 22.9% of nursing home residents had low handgrip strength, indicating a potential risk of sarcopenia.

Conclusion: Elderly individuals who received care at home exhibited a higher rate of malnutrition compared to those residing in nursing homes. In contrast, the rate of low handgrip strength—indicating reduced muscle strength—was higher among nursing home residents than among elderly individuals receiving home care. As a result, both in home care and nursing home settings, it was determined in this study through sociodemographic surveys conducted via face-to-face interviews that the elderly individuals' water intake was below 2 liters, and their physical activity levels were insufficient. Therefore, it is essential to raise awareness among elderly individuals in both care settings about proper nutrition and regular physical activity.

Keywords: Elderly, malnutrition, sarcopenia, water intake, physical activity.

Huzurevinde ve Evde Bakım Desteği Alan 65 Yaş ve Üstü Bireylerin Malnütrisyon ve Sarkopeni Yönünden İncelenmesi

Öz

Amaç: Bu araştırmada huzurevinde ve evde bakım desteği alan yaşlı bireylerin fiziksel aktiviteleri, malnütrisyon ve sarkopeni yönünden incelenmesi amaçlanmıştır.

Özgün Araştırma Makalesi (Original Research Article)

Geliş / Received: 11.04.2025 & **Kabul / Accepted:** 28.05.2025

DOI: <https://doi.org/10.38079/igusabder.1673909>

* This study is derived from the master's thesis titled "Investigation of the Prevalence of Malnutrition and Sarcopenia in Individuals Aged 65 and Above Living in Nursing Homes and Receiving Home Care Support" being prepared by Şevval ÖZŞİRİN under the supervision of Prof. Dr. Haydar ÖZPINAR at the Graduate School of Health Sciences, Department of Nutrition and Dietetics, Istanbul Aydın University.

** Prof. Dr., Istanbul Aydın University, Graduate Education Institute, Department of Nutrition and Dietetics, Istanbul, Türkiye. E-mail: haydarozpinar@aydin.edu.tr [ORCID https://orcid.org/0000-0003-3846-9907](https://orcid.org/0000-0003-3846-9907)

*** MSc, Istanbul Aydın University, Graduate Education Institute, Department of Nutrition and Dietetics, Istanbul, Türkiye. E-mail: sevvalozsirin@stu.aydin.edu.tr [ORCID https://orcid.org/0009-0004-6851-9252](https://orcid.org/0009-0004-6851-9252)

ETHICAL STATEMENT: Ethical approval for the study was obtained from the Ethics Committee of Istanbul Aydın University (Date: 20/11/2024, Decision No: 114/2024). A signed subject consent form in accordance with the Declaration of Helsinki was obtained from each participant.

Yöntem: Araştırma, Kasım 2024 – Şubat 2025 tarihleri arasında Manisa’da huzurevinde kalan ve aynı zamanda evde bakım desteği alan 65 yaş ve üstü 93’ü kadın 87’si erkek olmak üzere 180 yaşlı birey üzerinde yürütülmüştür. Katılımcıların sosyodemografik özelliklerini belirlemek için anket formu, malnütrisyon durumlarını saptamak amacıyla Mini Nütrisyonel Değerlendirme Testi (MNA), kas gücünü ölçebilmek için el kavrama gücü testi uygulanmıştır. Ayrıca tüm yaşlı bireylerin 24 saatlik besin tüketim kaydı yüz yüze görüşülerek çıkarılmıştır.

Bulgular: Gelir durumları açısından, evde bakım alan yaşlı bireylerin gelirinin olmama durumu %29,9 iken, huzurevindekiler için bu oran %1,2 olarak bulunmuştur. Su tüketimi açısından, iki grubun da su tüketimlerinin 2 litrenin altında olduğu, yani yetersiz su tükettikleri görülmektedir. Fiziksel aktivite düzeyleri açısından, evde bakım alan yaşlı bireylerin %39,2’sinin, huzurevinde bakım alan yaşlı bireylerin %44,6’sının günde 30 dakika ve üstü yürüyüş yaptığı görülmektedir. Malnütrisyon durumları açısından, evde bakım alan katılımcıların %38,1’inin, huzurevinde bakım alan katılımcıların %22,9’unun malnütrisyon riski altında olduğu görülürken evde bakım alan katılımcıların %6,2’sinin, huzurevinde kalan katılımcıların %3,6’sının malnütrisyonlu olduğu saptanmıştır. Sarkopeni durumları, yani el kavrama gücü testi bakımından, evde bakım alan katılımcıların %11,3’ü, huzurevinde bakım alan katılımcıların ise %22,9’u zayıf el kavrama gücüne sahiptir.

Sonuç: Malnütrisyon görülme oranı evde bakımda huzurevine kıyasla daha yüksek bulunmuştur. El kavrama gücü ile yapılan incelemede ise huzurevinde evde bakıma kıyasla zayıf el kavrama gücü daha yüksek bulunmuştur. Sonuç olarak hem evde bakım hem de huzurevi ortamlarında, bu çalışmada yüz yüze görüşmelerle yapılan sosyodemografik anketler aracılığıyla, yaşlı bireylerin su tüketiminin 2 litrenin altında olduğu ve fiziksel aktivitelerinin yetersiz olduğu belirlenmiştir. Bu sebepten evde bakım alan ve huzurevinde yaşayan yaşlı bireylerin beslenme ve fiziksel aktivite açısından bilinçlendirilmesi gereklidir.

Anahtar Sözcükler: Yaşlı, malnütrisyon, sarkopeni, su tüketimi, fiziksel aktivite.

Introduction

Aging is a process that gradually diminishes an individual's physical and mental capacities. According to the World Health Organization (WHO), individuals aged 65 and older are considered elderly, and this stage is further divided into three subgroups: 65-74 (young-old), 75-84 (old), and 85 and above (oldest-old)¹.

According to 2023 data, the global proportion of the elderly population was found to be 10.0%, while the proportion in Turkey was slightly higher at 10.2%². Of this population, 44.6% were male and 55.4% were female³.

Adequate and balanced nutrition becomes increasingly important with aging. Aging is widely recognized as a key contributor to the increased likelihood of malnutrition among the elderly. Inadequate nutrition can lead to a weakened immune system and muscle loss. Sufficient nutrient intake helps protect tissues and organs against infections. Therefore, proper nutrition is a critical concern for elderly individuals⁴.

Factors contributing to inadequate nutrition include living alone, level of education, and socioeconomic status⁵. Elderly individuals who live alone often experience negative effects on their nutrition and, for these reasons, may prefer to live in nursing homes. Consequently, the prevalence of malnutrition among the elderly can reach up to approximately 50%⁶.

Inadequate nutrition leads to malnutrition and sarcopenia. Malnutrition is a condition that causes changes in body weight and impairs physical and mental functions⁷.

Defined as a geriatric syndrome by the European Working Group on Sarcopenia in Older People (EWGSOP)⁵. Sarcopenia is marked by a continuous reduction in both muscle

mass and physical function⁸. In addition to being a significant concern for older adults, sarcopenia also increases the risk of disability and falls⁹.

In our country, the number of studies on malnutrition and sarcopenia among elderly individuals by region is insufficient. This study examined the nutritional status, levels of physical activity, and the occurrence of both malnutrition and sarcopenia in individuals aged 65 and older who were either receiving home care or living in institutional settings within the Manisa area.

Material and Methods

Participants

This study was carried out in Manisa between November 2024 and February 2025 with a total of 180 older adults aged 65 and above, including 93 women and 87 men. The participants consisted of individuals either residing in nursing homes or receiving home care support. Data were obtained through face-to-face surveys.

Sociodemographic Form

A questionnaire consisting of 11 questions was administered to determine the sociodemographic characteristics, health status, physical activity levels, and nutritional status of the elderly individuals.

Mini Nutritional Assessment (MNA): The Mini Nutritional Assessment (MNA) was administered to determine the nutritional status of elderly individuals. The MNA consists of two parts. In the first part, participants can score up to a maximum of 14 points. There are three levels of nutritional status: a score of 12–14 points indicates normal nutritional status, 8–11 points indicates a risk of malnutrition, and 0–7 points indicates malnutrition.

If a participant is found to be at risk of malnutrition in the first part, the second part of the assessment is conducted. In this section, the maximum score is 16 points. The scores from both parts are then summed. Based on the total score, three nutritional categories are identified: According to the scoring system, a total score between 24 and 30 indicates a normal nutritional state, while scores ranging from 17 to 23.5 suggest a potential risk for malnutrition. Values below 17 are considered indicative of malnutrition¹⁰.

24-Hour Dietary Recall: A 24-hour dietary recall was conducted to assess the daily energy and nutrient intake of the elderly individuals. Nutritional intake was evaluated through the use of BeBiS version 7.2, a specialized software designed for dietary analysis. To assess dietary intake, participants were prompted to remember and report everything they had consumed in the previous day, including meals and snacks, along with portion sizes¹¹.

Handgrip Strength Test: Muscle strength in older adults was evaluated using a handgrip test, which served as an indicator of physical capability. Measurements were taken from the participants' dominant hands using a CAMRY brand hand dynamometer, whose reliability and validity have been proven. According to the EWGSOP2 (European Working Group on Sarcopenia in Older People, second consensus) criteria, handgrip strength values are interpreted as low muscle strength when they are below <16 kg for women and <27 kg for men¹².

Ethical Statement

Ethical approval for the study was obtained from the relevant institutional ethics committee (Date: 20/11/2024, Decision No: 114/2024). A signed subject consent form in accordance with the Declaration of Helsinki was obtained from each participant.

Data Analysis

Statistical evaluations were carried out using IBM SPSS software, version 25.0. Descriptive analyses, including measures such as the mean and standard deviation, were applied to summarize the study variables. For quantitative data that met the assumptions required for parametric testing, comparisons between two independent groups were made using the Independent Samples T-test. For categorical variables, the Chi-Square test was conducted to determine whether there was a significant association between frequency and percentage distributions. The results were evaluated within a 95% confidence interval, with statistical significance set at $p < 0.05$.

Results

An analysis of educational attainment revealed that a greater proportion of elderly individuals receiving home-based care 93.8% had completed primary school compared to those residing in nursing homes.

When examining living arrangements, 35% of elderly individuals receiving home care and only 3.6% of those in nursing homes were living with their spouses, while the majority in both groups were living alone.

Assessment of income levels indicated that most elderly individuals, whether receiving care at home or residing in nursing homes, had earnings below the minimum wage threshold. Among the elderly receiving home care, 29.9% reported having no income at all, while this rate was only 1.2% among those living in nursing homes.

When examining the presence of chronic diseases, the prevalence was found to be high in both groups.

When examining nutritional habits, it was observed that 100% of elderly individuals living in nursing homes consumed more than three meals a day, whereas this rate was 35.1% among those receiving home care.

When examining water consumption, it was found that elderly individuals in both groups consumed less than 2 liters of water per day, indicating insufficient hydration.

When examining physical activity levels, 39.2% of elderly individuals receiving home care and 44.6% of those in nursing homes were found to engage in 30 minutes or more of physical activity per day, which is considered insufficient. The demographic characteristics of the participants are presented in Table 1.

Table 1. Demographic characteristics of the participants (n=180)

	Home Care (n=97)		Nursing Home (n=83)			
Education Level	n	%	n	%	x²	p
Primary School	91	93.8	65	78.3	9.815 ^a	0.020*
Middle School	3	3.1	8	9.6		
High School	1	1.0	6	7.2		
University	2	2.1	4	4.8		
Marital Status						
Single	63	64.9	80	96.4	27.069 ^a	0.000*
Married	34	35.1	3	3.6		
Income Level						
Below Minimum Wage	66	68.0	65	78.3	37.119 ^a	0,000*
Above Minimum Wage	2	2.1	17	20.5		
No Income	29	29.9	1	1.2		
Presence of Chronic Illness						
Yes	80	82.5	63	75.9	1.182 ^a	0.277
No	17	17.5	20	24.1		
Number of Daily Meals						
1-3 meals	63	64.9	0	0.0	82.934 ^a	0.000*
3-5 meals	34	35.1	83	100.0		
Daily Water Consumption						
1-2 glasses	35	36.1	13	15.7	9.543 ^a	0.008*
2-3 glasses	35	36.1	40	48.2		
3 or more glasses	27	27.8	30	36.1		
Physical Activity (Walking)						
30 minutes	33	34.0	23	27.7	6.609	0.037*
30-60 minutes	5	5.2	14	16.9		
No	59	60.8	46	55.4		

When examining nutritional status, it was found that elderly individuals receiving home care were consuming insufficient amounts of energy and protein compared to those living in nursing homes. Additionally, when intake levels of calcium, magnesium, and table salt – which are important for older adults – were examined, the intake of calcium and magnesium was found to be higher among elderly individuals living in nursing homes. However, table salt consumption was higher among those receiving home care compared to nursing home residents. The participants' macro- and micronutrient intake information is presented in Table 2 and Table 3.

Table 2. Evaluation of participants' macronutrient intake (n=180)

Nutrients	Home Care (n=97)		Nursing Home (n=83)		t ^b	p
	X̄	Ss	X̄	Ss		
Energy (kcal)	1126.01	334.91	1304.12	340.05	-3.532	0.001*
Protein (g)	38.12	14.53	52.51	16.74	-6.172	0.000*
Fat (g)	47.46	18.28	56.91	18.32	-3.455	0.001*
Carbohydrate (g)	133.66	45.41	141.21	39.75	-1.177	0.241

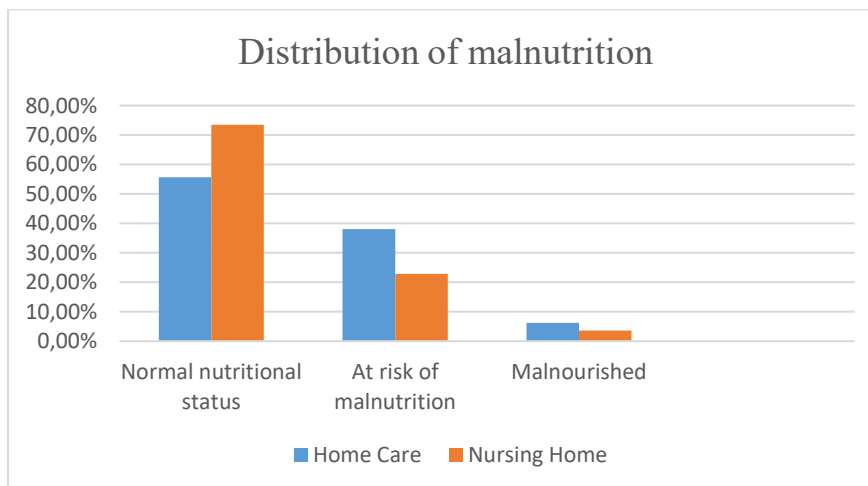
a. Independent samples T test, *p<0,05

Table 3. Evaluation of participants' micronutrient intake (n=180)

Nutrients	Home Care (n=97)		Nursing Home (n=83)		t ^b	p
	X̄	Ss	X̄	Ss		
Table Salt (g)	5.86	2.29	7.90	2.55	-5.652	0.000*
Calcium (mg)	442.66	179.77	630.90	198.30	-6.678	0.000*
Magnesium (mg)	128.95	54.28	178.20	49.28	-6.330	0.000*

b. Independent samples T test, *p<0,05

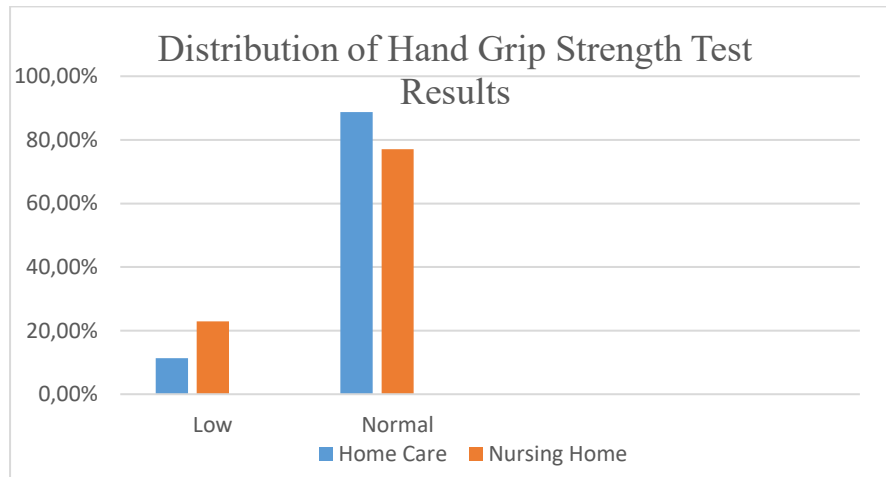
When malnutrition, or inadequate nutrition, was examined, it was found that 55.7% of the home care participants and 73.5% of the nursing home residents were adequately nourished. However, 38.1% of the home care participants and 22.9% of the nursing home residents were found to be at risk of malnutrition. Additionally, 6.2% of the home care participants and 3.6% of the nursing home residents were identified as malnourished. The distribution of malnutrition among the participants is presented in Figure 1.

Figure 1. Distribution of malnutrition

When sarcopenia status, assessed by the handgrip strength test, was examined, 11.3% of the home care participants and 22.9% of the nursing home residents were found to have low handgrip strength. Meanwhile, 88.7% of the home care participants and 77.1% of the

nursing home residents had normal handgrip strength. The distribution of the participants' handgrip strength test results is presented in Figure 2.

Figure 2. Distribution of participants' handgrip strength test results



Discussion

The poverty rate among elderly individuals in Turkey is 23.3% of the total population³. In this study, it was observed that elderly individuals with good financial status tend to prefer nursing homes, whereas those with lower income levels tend to prefer home care support. It has been reported that as the income levels of elderly individuals increase, their quality of life also improves¹³.

In Turkey, 46.7% of elderly individuals are primary school graduates³. In this study, it was observed that 93.8% of the elderly receiving home care were primary school graduates, while this rate was also high in nursing homes, at 78.3%.

According to the Turkish Statistical Institute (TÜİK), 78.7% of elderly individuals in Turkey have a chronic illness³. In this study, the rate of chronic illness among elderly individuals receiving home care was found to be 82.5%, while it was 75.9% among those living in nursing homes. Other studies have shown that approximately 78.9% of elderly individuals have chronic illnesses¹⁴⁻¹⁶. Evidence from another study suggests that older adults who have at least one chronic illness face an increased likelihood of developing malnutrition¹⁷. Similarly, in this study, individuals receiving home care had higher rates of chronic illness and malnutrition, supporting previous research findings.

Water is an essential nutrient defined as the fundamental element of life¹⁸. With aging, the functions of the body slow down, and the need for water increases¹⁹. Studies have shown that elderly individuals consume less than 2 liters of water per day and that there is a correlation between educational level and water consumption^{18,20,21}. In this study as well, it was observed that water consumption was below 2 liters in both home care and nursing home settings. Additionally, elderly individuals receiving home care had lower levels of both education and water consumption compared to those living in nursing homes. The results obtained in this study show a clear parallel with earlier academic research in the field.

Beyond the biological transformations brought on by the aging process, insufficient physical activity leads to health problems, muscle weakness, and, similarly, chronic diseases²². Physical activity is essential to prevent sarcopenia, which emerges with aging²³. Studies have shown that the rate of physical activity among elderly individuals is quite low, at around 26.7%, with walking being the most preferred form of exercise^{24,25}. In this study, the rate of elderly individuals who walk for 30 minutes or more per day was found to be 39.2% among those receiving home care and 44.6% among those living in nursing homes. Low levels of physical activity were observed in both participant groups.

Malnutrition may arise due to various physical, psychological, or financial challenges. It has detrimental effects on overall well-being and, especially in the elderly, it is associated with a higher risk of falling, slower recovery from illnesses or injuries, and increased susceptibility to infections²⁶. The prevalence of malnutrition varies by setting, affecting approximately 5% of older adults residing in the general population, 20–40% of those in institutional care, and 20–50% of hospitalized elderly patients²⁷. In this study, it was found that 38.1% of participants receiving home care and 22.9% of those in nursing homes were at risk of malnutrition. Additionally, 6.2% of home care participants and 3.6% of nursing home residents were found to be malnourished. Previous studies have reported that approximately 35% of elderly individuals are at risk of malnutrition, while 17% are malnourished. This study is consistent with the findings of previous research²⁸⁻³¹. Studies examining the energy and protein intake of elderly individuals have shown that they are generally undernourished^{32,33}. In this study as well, it was found that elderly individuals had insufficient energy and protein intake; however, those receiving home care had lower energy and protein intake compared to those living in nursing homes. These findings are consistent with previous studies.

Hand grip strength is influenced by factors such as nutrition and physical activity³⁴. In this study, the proportion of individuals with weak hand grip strength was higher among those living in nursing homes, and physical activity levels were low in both groups. Previous studies have shown that 19–52.6% of elderly individuals are diagnosed with sarcopenia^{35,36}. Previous research has similarly reported that older adults often consume insufficient amounts of calcium and magnesium^{33,37}. In parallel with previous findings, this study revealed that both groups had insufficient calcium and magnesium consumption, with those receiving care at home showing the lowest levels.

Conclusion

Among older adults, both malnutrition and sarcopenia represent frequently encountered and clinically important health issues. Risk factors for these conditions include inadequate nutrition, low physical activity, living alone, low educational level, and poor income status. This study was conducted in the Manisa region, focusing on individuals with low income levels living in nursing homes and those receiving home care support. Malnutrition was more prevalent in individuals receiving home care, whereas sarcopenia was more common among those living in a nursing home. Additionally, insufficient engagement in physical movement and inadequate hydration were common in both groups—issues of particular concern for the elderly.

In conclusion, elderly individuals receiving home care support due to poor economic conditions are more likely to experience inadequate nutrition compared to those living

in nursing homes, both because of financial difficulties and less favorable living conditions. Early diagnosis of health issues such as malnutrition and sarcopenia is crucial for elderly individuals, whether they live in institutions or at home. Therefore, providing regular education and conducting routine screenings for malnutrition and sarcopenia are essential to ensure a healthier and more comfortable life for elderly individuals in their remaining years.

Acknowledgments

Our sincere thanks go to the volunteers who participated in this research.

Funding Information

No specific funding was received for this study.

REFERENCES

1. Kuzu A, Aydın C, Yıldız M, et al. Dünya sağlık örgütü Avrupa Bölgesinde yaşlanma ile ilgili seçilmiş bazı ölçütlerin değerlendirilmesi. *STED*. 2019;28(1):17-27.
2. Türkiye İstatistik Kurumu. Dünya Nüfus Günü, 2024. <https://data.tuik.gov.tr/Bulten/Index?p=Dunya-Nufus-Gunu-2024-12345>. Türkiye İstatistik Kurumu. Published July 11, 2024. Accessed April 8, 2025.
3. Türkiye İstatistik Kurumu. Hizmetlere Erişim ve Ayrımcılık, 2024. <https://data.tuik.gov.tr/Bulten/Index?p=Hizmetlere-Erisim-ve-Ayrimcilik-2024-57935> Published March 18, 2024. Accessed April 8, 2025.
4. De Luis D, Lopez Guzman A. Nutritional status of adult patients admitted to internal medicine departments in public hospitals in Castilla y Leon, Spain – A multi-center study. *Eur J Intern Med*. 2006;17:556-560. doi: 10.1016/j.ejim.2006.02.030.
5. Besora-Moreno M, Llauradó E, Tarro L, Solà R. Social and economic factors and malnutrition or the risk of malnutrition in the elderly: A systematic review and meta-analysis of observational studies. *Nutrients*. 2020;12(3):737. doi:10.3390/nu12030737.
6. Volkert D, Beck AM, Cederholm T, et al. Management of malnutrition in older patients—current approaches, evidence and open questions. *J Clin Med*. 2019;8(7):974.
7. Cederholm T, Barazzoni R, Austin P, et al. ESPEN guidelines on definitions and terminology of clinical nutrition. *Clin Nutr*. 2017;36(1):49-64.
8. Traub J, Bergheim I, Eibisberger M, Stadlbauer V. Sarcopenia and liver cirrhosis—comparison of the European Working Group on Sarcopenia criteria 2010 and 2019. *Nutrients*. 2020;12(2):547.
9. Senior HE, Henwood TR, Beller EM, Mitchell GK, Keogh JW. Prevalence and risk factors of sarcopenia among adults living in nursing homes. *Maturitas*. 2015;82(4):418-423.

10. Guigoz Y, Vellas B, Garry PJ. Assessing the nutritional status of the elderly: The mini nutritional assessment as part of the geriatric evaluation. *Nutr Rev.* 1996;54(1 Pt 2):S59-S65. doi: 10.1111/j.1753-4887.1996.tb03793.x.
11. Pekcan G. *Beslenme Durumunun Saptanması*. Ankara: Sağlık Bakanlığı Yayınları; 2008.
12. Cruz-Jentoft AJ, Bahat G, Bauer J, et al. Sarcopenia: Revised European consensus on definition and diagnosis. *Age Ageing.* 2019;48(1):16-31. doi: 10.1093/ageing/afy169.
13. Soysal G. Türkiye’de Toplumsal Yaşlanma ve Çalışma Hayatı: Özellikler, Sorunlar ve Bir Uygulama [doctoral dissertation]. Bursa, Türkiye: Bursa Uludağ University; 2023.
14. Erdoğan Z. Huzurevinde Kalan Yaşlılarda Reikinin Ağrı, Yaşam Kalitesi ve Depresyon Üzerine Etkisi [master's thesis]. İstanbul, Türkiye: Marmara Üniversitesi Sağlık Bilimleri Enstitüsü; 2013.
15. Altıparmak S. Huzurevinde yaşayan yaşlı bireylerin yaşam doyumu, sosyal destek düzeyleri ve etkileyen faktörler. *Fırat Üniversitesi Sağlık Bilimleri Tıp Dergisi.* 2009;23(3):159-164.
16. Altay B, Avcı İA. Huzurevinde yaşayan yaşlılarda özbakım gücü ve yaşam doyumu arasındaki ilişki. *Dicle Tıp Dergisi.* 2009;36(4):275-282.
17. Uyar M, Eken K. Prevalence of malnutrition/ malnutrition risk and relevant factors among older adults. *ESTUDAM Public Health J.* 2021;6(3):200-208.
18. Muz G, Özdil K, Erdoğan G, Sezer F. Huzurevi ve evde kalan yaşlılarda su tüketimi ve ilişkili faktörlerin belirlenmesi. *Türk Hijyen ve Deneysel Biyoloji Dergisi.* 2017;74(Ek-1):143-150.
19. Çavak BY. Yaşlılık döneminde dehidratasyon riski ve yaşlılarda su tüketiminin önemi. *Karya J Health Sci.* 2022;3(1):35-39.
20. Ertuğ N. Hastaların su ve diğer sıvıları tüketme durumu. *Anadolu Hemşirelik ve Sağlık Bilimleri Dergisi.* 2011;14(4):47-53.
21. Aksoydan E. Ankara’da kendi evinde ve huzurevinde yaşayan yaşlıların sağlık ve beslenme durumlarının saptanması. *Türk Geriatri Dergisi.* 2006;9(3):150-157.
22. Özmen T, Contarlı N. Yaşlılarda fiziksel aktivite ve egzersiz. *Unika Sağlık Bilimleri Dergisi.* 2023;3(1):452-459.
23. Eckstrom E, Neukam S, Kalin L, Wright J. Physical activity and healthy aging. *Clin Geriatr Med.* 2020;36(4):671-683. doi: 10.1016/j.cger.2020.06.009.
24. Çakıroğlu FP, Haklı G. Yaşlıların kardiyovasküler hastalıklara ilişkin beslenme bilgileri ve alışkanlıklarının incelenmesi. *Yaşlı Sorunları Araştırma Dergisi.* 2009;2(2):89-104.
25. Yardımcı H, Özçelik AÖ, Sürücüoğlu MS. Yaşlılarda hipertansiyon durumu ve beslenme alışkanlıkları. *Yaşlı Sorunları Araştırma Dergisi.* 2011;(1-2):15-27.
26. Dişli E, Samancıoğlu S. Geriatrik hastalarda malnütrisyon ve düşme riski arasındaki ilişki. *Karya J Health Sci.* 2018;3(1):24-29.

27. Türk Klinik Enteral Parenteral Nutrisyon Derneği (KEPAN). Yaşlılarda malnütrisyon ve nutrisyonel destek. KEPAN. <https://www.kepan.org.tr>. Accessed April 8, 2025.
28. Karaman D, Topal K, Aksoy H, Gereklioğlu Ç. Huzurevinde kalan yaşlılarda malnütrisyon, depresyon ve yaşam kalitesi üzerine etki eden faktörlerin belirlenmesi. *Pamukkale Med J*. 2019;12(3):545-553.
29. Bektaş Y, Başbüyük GÖ, Çınar Z, Ay F, Alan A. Huzurevinde kalan yaşlılarda malnütrisyon sıklığı. *Ahi Evran Üniversitesi Sosyal Bilimler Enstitüsü Dergisi*. 2017;3(2):339-348.
30. İncedal Irgat S, Kızıltan G. Yaşlı bireylerde kırılgnalık ile malnütrisyon ilişkisi. *Başkent Üniversitesi Sağlık Bilimleri Fakültesi Dergisi - BÜSBİD*. 2021;6.
31. Kefeli D. Zübeyde Hanım Huzurevinde Yaşayan Yaşlıların Malnütrisyon Düzeyleri, Beslenme Durumları ve Yaşam Kalitelerinin Belirlenmesi [master's thesis]. Ankara, Türkiye: Başkent Üniversitesi Sağlık Bilimleri Enstitüsü; 2020.
32. Saeidlou SN, Merdol TK, Mikaili P, Bektaş Y. Assessment of the nutritional status and affecting factors of elderly people living at six nursing home in Urmia, Iran. *Int J Acad Res*. 2011;3(1).
33. Kaya PS, Şahin G. Samsun'da evinde ve huzurevinde kalan 65 yaş ve üzeri bireylerin beslenme durumlarının değerlendirilmesi. *Düzce Üniversitesi Sağlık Bilimleri Enstitüsü Dergisi*. 2015;5(1):22-27.
34. Yalçın E, Rakıcioğlu N. Yaşlılarda el kavrama gücünün sağlıkla ilişkisi. *Beslenme ve Diyet Dergisi*. 2018;46(1):77-83.
35. Zengin A. Huzurevinde Yaşayan Yaşlılarda Sarkopeni ve Mini Nutrisyonel Araştırma Tarama Testi ile Malnütrisyon Riskinin Belirlenmesi [master's thesis]. Gaziantep, Türkiye: Hasan Kalyoncu Üniversitesi Sağlık Bilimleri Enstitüsü Beslenme ve Diyetetik Programı; 2019.
36. İncedal Irgat S. Yaşlı Bireylerde Kırılgnalıkla Malnütrisyon, Sarkopeni, Duygu Durumu, Günlük Yaşam Aktivitesi ve Beslenme Durumunun İlişkisi [doctoral dissertation]. Ankara, Türkiye: Başkent Üniversitesi Sağlık Bilimleri Enstitüsü; 2021.
37. Hoca M, Türker PF. Gazimağusa'da yaşayan yaşlı bireylerin beslenme alışkanlıkları, beslenme durumları ve yaşam kalitesinin değerlendirilmesi. *Bes Diy Derg*. 2018;45(1):44-52.

The Role of Transobturator Tape (TOT) Operation in the Treatment of Pelvic Organ Prolapse and Stress Urinary Incontinence

Teymur BORNAUN*

Abstract

Aim: This study aimed to assess the efficacy and safety of the Transobturator Tape (TOT) procedure in treating stress urinary incontinence (SUI), both independently and when combined with pelvic floor reconstruction surgery.

Method: In a retrospective analysis, data were collected from 251 female patients treated for SUI at Health Sciences University, İstanbul Bağcılar Training and Research Hospital, from April 2020 to April 2022. Patients were divided into two groups based on the surgical approach: TOT alone and TOT with pelvic reconstruction. The Patient Global Impression of Improvement (PGI-I) scale was used to evaluate patient-reported outcomes, measuring improvements in symptoms and quality of life post-surgery.

Results: The results demonstrated a high success rate in SUI management, with a significant percentage of patients reporting the absence of incontinence after surgery. Notably, cases with TOT alone showed slightly higher success rates and patient satisfaction compared to those combined with pelvic reconstruction. The outcomes aligned with existing research, supporting TOT as an effective intervention in diverse surgical settings.

Conclusion: TOT is a highly effective treatment for SUI, with its use either alone or in combination with pelvic reconstruction. The study emphasizes the importance of individualized surgical approaches based on patient-specific characteristics, highlighting the need for thorough preoperative assessments and patient counseling to optimize outcomes.

Keywords: Transobturator tape, stress urinary incontinence, pelvic floor reconstruction.

Transobturator Bant (TOT) Operasyonunun Pelvik Organ Prolapsusu ve Stres Üriner İnkontinans Tedavisindeki Rolü

Öz

Amaç: Bu çalışmanın amacı, stres üriner inkontinansın (SÜİ) tedavisinde transobturator bant (TOT) yönteminin, tek başına veya pelvik taban rekonstrüksiyon cerrahisiyle birlikte kullanıldığında etkinliğini ve güvenliğini değerlendirmektir.

Yöntem: Retrospektif olarak gerçekleştirilen bu çalışmada, Nisan 2020 - Nisan 2022 tarihleri arasında Sağlık Bilimleri Üniversitesi, İstanbul Bağcılar Eğitim ve Araştırma Hastanesi'nde SÜİ tedavisi gören 251 kadın hastanın verileri incelendi. Hastalar, TOT tek başına uygulananlar ve TOT ile pelvik rekonstrüksiyon yapılanlar olmak üzere iki gruba ayrıldı. Hasta Küresel İyileşme İzlenimi (PGI-I) ölçeği ile cerrahi sonrası semptomlar ve yaşam kalitesindeki iyileşmeler değerlendirildi.

Bulgular: Sonuçlar, SÜİ yönetiminde yüksek bir başarı oranı göstermiş olup, cerrahi sonrası önemli bir hasta grubunda inkontinansın sona erdiği bildirilmiştir. Sadece TOT uygulanan hastalarda, pelvik rekonstrüksiyon eklenen vakalara kıyasla başarı oranı ve hasta memnuniyeti biraz daha yüksek

Özgün Araştırma Makalesi (Original Research Article)

Geliş / Received: 10.11.2024 & **Kabul / Accepted:** 07.07.2025

DOI: <https://doi.org/10.38079/igusabder.1582478>

* MD, University of Health Sciences, İstanbul Bağcılar Training and Research Hospital, Department of Obstetrics and Gynecology, İstanbul, Türkiye. E-mail: teymurbornaun1@gmail.com **ORCID** <https://orcid.org/0009-0007-8081-8003>

ETHICAL STATEMENT: This retrospective study was conducted at the Gynecology and Obstetrics Clinic of Health Sciences University Dr. Sadi Konuk Training and Research Hospital. Ethical approval for the study was obtained from the Clinical Research Ethics Committee of Dr. Sadi Konuk Training and Research Hospital (Approval date: 02.11.2023 / Decision No. 2023/170).

bulunmuştur. Sonuçlar, mevcut literatürle uyumlu olarak TOT yönteminin çeşitli cerrahi bağlamlarda etkili bir müdahale olduğunu desteklemektedir.

Sonuç: TOT yöntemi, SÜİ için son derece etkili bir tedavi olup gerek tek başına gerekse pelvik rekonstrüksiyon ile birlikte kullanılabilir. Çalışma, hasta özelliklerine göre bireyselleştirilmiş cerrahi yaklaşımların önemini vurgulayarak, başarılı sonuçlar için ayrıntılı preoperatif değerlendirme ve hasta bilgilendirmesinin gerekliliğine dikkat çekmektedir.

Anahtar Sözcükler: Transobturator bant, stres üriner inkontinans, pelvik taban rekonstrüksiyonu.

Introduction

Pelvic organ prolapse (POP) and stress urinary incontinence (SUI) represent significant health concerns, affecting a substantial portion of the female population, particularly in the post-menopausal stage^{1,2}. These conditions not only impair physical health but also have profound impacts on the psychological and social well-being of affected individuals^{3,4}. POP entails the descent of pelvic organs, including the uterus, bladder, and rectum, due to weakening of the supporting structures, leading to symptoms like a bulging sensation and discomfort^{5,6}. SUI, characterized by involuntary leakage of urine during activities that increase intra-abdominal pressure, such as coughing or exercising, significantly diminishes quality of life^{7,8}.

The pathophysiology of these conditions is multifaceted, involving genetic predispositions^{9,10}, hormonal changes, and lifestyle factors^{11,12}. The co-occurrence of POP and SUI is common, necessitating comprehensive therapeutic approaches^{13,14}.

In the realm of surgical interventions, the Transobturator Tape (TOT) procedure has emerged as a pivotal technique for the management of SUI, particularly in the context of POP^{15,16}. The TOT operation, involving the placement of a synthetic mesh tape through the obturator foramen, aims to provide support to the mid-urethra, thereby mitigating SUI symptoms^{17,18}. Its efficacy and relative safety have been substantiated through numerous studies^{19,20}. Furthermore, comparisons with other surgical techniques, such as the Tension-Free Vaginal Tape (TVT), have highlighted the unique advantages and applicability of TOT in varied clinical scenarios^{21,22}.

This article aims to delve into the role of TOT in the treatment of patients with POP and SUI, integrating insights from a wide spectrum of research studies and clinical trials^{23,24}. By analyzing these diverse sources, we seek to provide a comprehensive overview of the TOT procedure's efficacy, safety, and place in current urogynecological practice.

Material and Methods

Participant Selection and Grouping

The study participants comprised women who underwent surgical treatment for stress incontinence between April 2020 and April 2022. The patients were retrospectively divided into two groups:

TOT-only group: Patients who received only the TOT procedure.

TOT with Pelvic Reconstruction group: Patients who underwent TOT in conjunction with pelvic floor reconstruction surgery.

Inclusion Criteria: Women diagnosed with stress incontinence and stage 2 pelvic organ prolapse (POP). Patients symptomatic for prolapse were assigned to the TOT with pelvic reconstruction group, while those asymptomatic were placed in the TOT-only group.

Exclusion Criteria: Patients with a history of neuromuscular disease, connective tissue disease, radiotherapy, long-term steroid use, non-stress incontinence, or previous pelvic surgery were excluded from the study.

Data Collection and Patient Demographics

Of the 282 eligible patients, 251 consented to participate and completed the Informed Voluntary Consent Form. Collected data included demographic and clinical characteristics such as age, height, weight, BMI, parity, mode of delivery, smoking status, alcohol use, marital status, menopausal status, and education level.

Intervention and Techniques

TOT-only group: 73 patients with SUI and no symptoms of prolapse underwent the TOT procedure using the lateral-to-medial suspension arm technique.

TOT with Pelvic Reconstruction group: 178 patients with symptomatic prolapse underwent simultaneous pelvic floor reconstruction surgery along with TOT. The surgical techniques varied apical, anterior, posterior, or combined repair based on the type and severity of prolapse.

Follow-Up and Outcome Measures

Patients were evaluated at one month and one year post-operation for clinical outcomes. The primary outcome measures included a stress test and the Patient Global Impression of Improvement (PGI-I) questionnaire, which were administered during the first year post-operation.

Ethical Statement

This retrospective study was conducted at the Gynecology and Obstetrics Clinic of Health Sciences University Dr. Sadi Konuk Training and Research Hospital. Ethical approval for the study was obtained from the Clinical Research Ethics Committee of Dr. Sadi Konuk Training and Research Hospital (Approval date: 02.11.2023/Decision No. 2023/170).

Results

The demographic and clinical characteristics of the 251 patients in this study provide valuable insights into the profile of women undergoing the Transobturator Tape (TOT) operation for stress urinary incontinence (SUI) and pelvic organ prolapse (POP) (Table 1).

Table 1. Demographic and clinical characteristics of participants

Characteristic	Mean±SD	Median (Min-Max)	n (%)
Age (years)	52.06±9.91	(50-75)	-
Weight (kg)	76.60±12.57	(41.1-118.0)	-
Height (cm)	159.51±6.32	(145-180)	-
BMI	30.15±5.00	(22.16-49.12)	-
Parity	3.33±1.79	(0-16)	-
Type of Operation	-	-	TOT: 29.0% TOT+Pelvic Recon.: 71.0%
Hysterectomy Status	-	-	Hysterectomized: 19.5% Not Hysterectomized: 80.5%
Complications	-	-	None: 98.0% Present: 2.0%
Cesarean Section (C/S) Delivery	-	-	No: 82.5% Yes: 17.5%
Normal Spontaneous Delivery (NSD)	-	-	No: 3.2% Yes: 96.8%
Menstrual Status	-	-	Premenopausal: 41.4% Menopausal: 58.6%
Marital Status	-	-	Married: 86.9% Single: 13.1%
Smoking Status	-	-	Non-smoker: 80.5% Smoker: 19.5%
Education Level	-	-	None: 14.3% Primary: 77.7% Secondary: 5.2% Higher: 1.6% Postgraduate: 1.2%
Literacy	-	-	Illiterate: 11.6% Literate: 88.4%

BMI = Body Mass Index; TOT = Transobturator Tape; POP = Pelvic Organ Prolapse; NSD = Normal Spontaneous Delivery; C/S = Cesarean Section.

Table 1 shows the results:

“Age and Body Metrics”: The average age of 52.06 years and a BMI of 30.15 indicate that the study predominantly involved middle-aged, overweight women. This is consistent with the literature indicating increased prevalence of SUI and POP in this demographic.

“Surgical Intervention”: A significant majority (71%) underwent TOT with pelvic reconstruction, underscoring the common co-occurrence of SUI with POP.

“Hysterectomy Status”: Nearly one-fifth of the patients had undergone a hysterectomy, which aligns with existing research suggesting a possible link between hysterectomy and increased risk of POP and SUI.

“Lifestyle Factors”: The low percentage of smokers (19.5%) in the study contrasts with some literature that suggests smoking as a risk factor for SUI and POP.

“Education and Literacy Levels”: The varied levels of education and literacy among the participants reflect the diverse socioeconomic backgrounds, which can influence health awareness and treatment-seeking behavior.

Study Outcomes

“Efficacy of TOT”: The majority of patients reported improvement in incontinence symptoms post-TOT.

“Safety and Complications”: The low complication rate (2%) further validates the safety profile of the TOT procedure.

“Patient Satisfaction”: The high rates of reported improvement (approximately 75%) reporting 'Very Much Better' or 'Much Better' in the PGI-I scores underscore the positive impact of TOT on patient quality of life (Table 2 and Table 3).

Table 2. Incontinence status of patients.

Incontinence Status	n	%
Absent (No Incontinence)	169	67.3
Present (Incontinence)	82	32.7

Following the TOT procedure, two-thirds of the patients reported no urinary incontinence symptoms, suggesting a substantial treatment benefit.

Table 3. Patient global impression of improvement (PGI-I).

PGI-I Score	Description	n	%
1	Very Much Better	122	48.8
2	Much Better	65	26.0
3	A Little Better	33	13.2
4	No Change	12	4.8
5	A Little Worse	14	5.6
6	Much Worse	3	1.2
7	Very Much Worse	1	0.4

The PGI-I results reflect high levels of subjective improvement, with nearly 75% of patients reporting their condition as “Much Better” or “Very Much Better” postoperatively.

Table 2 and Table 3 reveal significant insights into the efficacy of the Transobturator Tape (TOT) operation in managing stress urinary incontinence (SUI).

“Incontinence Status Post-TOT”: (The data shows that 67.3% of patients reported no incontinence post-operation, indicating a high success rate of the TOT procedure in alleviating SUI symptoms.

“Patient Global Impression of Improvement (PGI-I)”: The majority of patients (74.8%) reported their condition as 'Very Much Better' or 'Much Better'. This high level of patient

satisfaction and perceived improvement is a critical indicator of the procedure's success and mirrors findings.

“Efficacy Comparisons”: The high efficacy rate observed in this study is consistent with the findings. The absence of incontinence in over two-thirds of patients post-TOT suggests a comparable or even superior efficacy to other studies.

“Patient Satisfaction”: The PGI-I scores in this study indicate a high level of patient satisfaction. The positive patient perception is a crucial aspect of the overall success of the treatment.

“Comparative Efficacy and Safety”: The low incidence of worsening conditions post-TOT (7.2% reporting 'A Little Worse' or more) in this study is noteworthy. This suggests that while TOT is highly effective, it also maintains a favorable safety profile.

Table 4. Distribution of types of operations among patients.

Type of Operation	n (Number of Patients)	% (Percentage)
Transobturator Tape (TOT) Only	73	29%
TOT with Pelvic Reconstruction	178	71%

The majority of patients (71%) underwent TOT combined with pelvic reconstruction, reflecting the frequent coexistence of stress urinary incontinence and pelvic organ prolapse requiring simultaneous surgical management.

Table 4 outlines the distribution of surgical procedures among patients, providing critical insights into treatment choices for stress urinary incontinence (SUI) and pelvic organ prolapsed (POP).

“Predominance of Combined Surgery”: The data indicates that a significant majority (71%) of the patients underwent TOT in conjunction with pelvic reconstruction surgery. This highlights the frequent co-occurrence of SUI with POP and the need for comprehensive surgical management.

“TOT Only Procedures”: 29% of the patients underwent the TOT procedure alone. This suggests that a significant subset of patients presented with SUI without significant POP or with POP that did not warrant surgical intervention.

“Surgical Approach”: The high rate of combined surgeries in this study aligns with the trend observed in the literature. The decision for combined surgery generally depends on the severity and presence of both conditions.

“Efficacy of Combined Surgery”: Studies have also reported the effectiveness of combined pelvic floor reconstruction and TOT, indicating this approach's suitability for patients with concurrent SUI and POP.

“Selection for TOT Only”: The choice for TOT only in 29% of cases reflects a targeted approach for SUI management, consistent with recommendations for patient selection based on symptomatology and diagnostic findings.

Table 5. Comparison of incontinence based on type of operation.

Incontinence Status	Type of Operation	No Incontinence (n =169)	%	Incontinence (n =82)	%	Test Statistic	P-value
	TOT	52	71.2	21	28.8	χ^2 =0.713	0.399
	TOT + Pelvic Reconstruction	117	65.7	61	34.3		-

 χ^2 Chi-Square

There was no statistically significant difference in postoperative incontinence rates between the two surgical groups ($p > 0.05$). The chi-square test was used to assess the association between type of operation and incontinence outcome.

Table 5 provides a comparative analysis of incontinence outcomes based on the type of surgical procedure performed – Transobturator Tape (TOT) alone versus TOT with pelvic reconstruction.

“Incontinence Outcomes”: The table shows that 71.2% of patients who underwent only TOT reported no incontinence, compared to 65.7% in the TOT with pelvic reconstruction group. This suggests a slightly higher success rate in managing incontinence with TOT alone, although the difference is not statistically significant (P -value = 0.399).

“Impact of Combined Surgery”: The slightly lower rate of complete continence in the TOT with pelvic reconstruction group (34.3% with incontinence) might reflect the complexity of cases involving both SUI and POP.

“Effectiveness of TOT”: The high efficacy of TOT in reducing incontinence observed in this study is consistent with the results.

“Comparative Success with Combined Surgery”: The findings of slightly lower success rates in the combined surgery group compared to TOT alone resonate.

“Statistical Significance”: The lack of statistical significance in the difference between the two groups (P -value = 0.399) suggests that while there are variations in success rates, these differences might not be substantial in clinical practice.

Discussion

This study evaluated the effectiveness and safety of the Transobturator Tape (TOT) procedure in treating stress urinary incontinence (SUI), both as a standalone procedure and in combination with pelvic floor reconstruction. The findings offer valuable insights into patient demographics, procedural outcomes, and postoperative satisfaction, aligning with current literature on SUI and pelvic organ prolapse (POP) management.

The TOT operation demonstrated a high success rate in alleviating incontinence symptoms, with 67.3% of patients reporting no incontinence post-surgery (Table 2). This aligns with prior studies that highlight the efficacy of TOT in providing significant symptom relief for SUI patients^{21,22}. Importantly, our study found a slightly higher success rate in patients undergoing TOT alone (71.2%) compared to those who had combined pelvic reconstruction (65.7%), though the difference was not statistically significant ($p = 0.399$). This observation is consistent with other research indicating that

while TOT is effective in treating SUI, additional pelvic reconstruction may be necessary only for patients with symptomatic POP^{3,4}.

The study's results further underscore the importance of personalized treatment approaches in managing SUI. The absence of statistically significant correlations between patient demographics (e.g., age, BMI, and parity) and perceived improvement, as indicated by Patient Global Impression of Improvement (PGI-I) scores, highlights that traditional demographic factors may not fully predict treatment outcomes^{23,24}. This supports findings from recent studies suggesting that while certain demographic characteristics correlate with SUI prevalence, they do not necessarily determine the efficacy or perceived success of surgical interventions^{7,25,26}. This reinforces the need for a patient-centered approach in assessing SUI severity and deciding on the most appropriate treatment method²⁷.

An interesting finding of this study is the relationship between hysterectomy status and postoperative incontinence outcomes. Patients who had previously undergone hysterectomy exhibited a reduced risk of postoperative incontinence, a finding that contrasts with some studies linking hysterectomy with an increased risk of pelvic floor dysfunction¹¹. However, other research suggests that, in selected cases, hysterectomy may alleviate SUI symptoms, particularly when combined with appropriate surgical support, such as TOT²⁸. Further investigation is warranted to elucidate the factors contributing to this complex relationship, as hysterectomy may impact pelvic anatomy differently depending on the individual patient profile¹¹.

In terms of patient-reported outcomes, the majority of participants reported substantial improvements in quality of life post-surgery, with 74.8% indicating that their condition was 'Very Much Better' or 'Much Better' on the PGI-I scale (Table 3). These high levels of satisfaction align with findings from other studies emphasizing TOT's positive impact on patient quality of life and symptom perception^{20,28}. Furthermore, the low complication rate (2%) observed in this cohort is consistent with previous reports highlighting TOT's safety profile in SUI treatment¹⁴. Complication rates were comparable across both surgical groups, suggesting that TOT, whether alone or combined with pelvic reconstruction, remains a viable and safe option for SUI management.

From a clinical perspective, these findings emphasize the importance of comprehensive preoperative assessment and patient counseling. As indicated by our data and supported by literature, individualized treatment planning that considers each patient's specific symptoms and anatomy can optimize surgical outcomes²⁶. Moreover, given the high patient satisfaction and low complication rates associated with TOT, clinicians can confidently recommend this approach to suitable candidates, particularly those without significant POP or with minimal prolapse symptoms.

In conclusion, our study supports the TOT procedure as a highly effective and safe intervention for SUI, whether performed alone or in conjunction with pelvic reconstruction. These findings reinforce the procedure's utility in a variety of clinical contexts and underscore the value of patient-centered approaches in SUI management.

Conclusion

Study's findings offer significant insights into the effectiveness of the Transobturator Tape (TOT) operation for treating stress urinary incontinence (SUI), both as a standalone procedure and in conjunction with pelvic floor reconstruction surgery.

The majority of patients (67.3%) reported an absence of incontinence post-surgery, indicating a high success rate of the TOT procedure. This is particularly notable in the group that underwent TOT alone, where 71.2% of patients experienced no incontinence post-operation. According to the Patient Global Impression of Improvement (PGI-I) scores, a significant proportion of patients reported substantial improvement in their condition post-surgery, with 48.8% stating they felt 'Very Much Better' and 26% 'Much Better'. The slightly higher success rate of TOT alone (71.2% no incontinence) compared to TOT with pelvic reconstruction (65.7% no incontinence) suggests that TOT is very effective in treating SUI, especially in less complicated cases.

Based on the outcomes of our study and the comparative analysis with existing literature, the following recommendations can be proposed for clinical practice and future research:

Tailored Surgical Approach: Clinicians should consider individual patient characteristics, such as the presence and severity of pelvic organ prolapse (POP), when deciding between TOT alone and TOT combined with pelvic reconstruction. The decision-making process should be patient-centric, involving detailed discussions about potential outcomes and complications.

Preoperative Assessment and Counseling: Comprehensive preoperative assessments, including urodynamic studies, should be mandatory to accurately diagnose SUI and any associated pelvic floor disorders. Counseling about the possible outcomes and realistic expectations should be an integral part of preoperative preparation.

Monitoring and Follow-Up: Postoperative follow-up, including objective measures such as stress tests and subjective assessments like the PGI-I, is crucial. Regular monitoring can help in early identification and management of any complications or recurrent symptoms.

Patient-Reported Outcomes: Future studies should continue to emphasize patient-reported outcomes, as they provide valuable insights into the patient's perspective on the effectiveness and impact of surgical interventions on their quality of life.

Training and Skill Development: Given the technical nuances of TOT and combined pelvic reconstruction procedures, ongoing training and skill development for surgeons are recommended. This would help in optimizing surgical outcomes and minimizing complications.

REFERENCES

1. Barber MD. Pelvic organ prolapse. *BMJ*. 2016;354. doi: 10.1136/bmj.i3853.
2. Abed H, Rogers RG. Urinary incontinence and pelvic organ prolapse: diagnosis and treatment for the primary care physician. *Med Clin North Am*. 2008;92(5):1273-1293.

3. Bai SW, Jeon MJ, Kim JY, Chung KA, Kim SK, Park KH. Relationship between stress urinary incontinence and pelvic organ prolapse. *Int Urogynecol J*. 2002;13:256-260.
4. Allen-Brady K, Chua JW, Cuffolo R, Koch M, Sorrentino F, Cartwright R. Systematic review and meta-analysis of genetic association studies of pelvic organ prolapse. *Int Urogynecol J*. 2022;33(1):67-82. doi: 10.1007/s00192-021-04791-5.
5. Altman D, Forsman M, Falconer C, Lichtenstein P. Genetic influence on stress urinary incontinence and pelvic organ prolapse. *Eur Urol*. 2008;54(4):918-923.
6. Arts-de Jong M, Van Altena AM, Aalders CIM, Dijkhuizen FPHLJ, Van Balken MR. Improvement of sexual function after transobturator tape procedure in women with stress urinary incontinence. *Gynecol Surg*. 2011;8:315-319. doi: 10.1007/s10397-011-0654-y.
7. Collins S, Lewicky-Gaupp C. Pelvic organ prolapse. *Gastroenterol Clin North Am*. 2022;51(1):177-193. doi: 10.1016/j.gtc.2021.12.007.
8. Barber MD, Maher C. Epidemiology and outcome assessment of pelvic organ prolapse. *Int Urogynecol J*. 2013;24:1783-1790. doi: 10.1007/s00192-013-2169-9.
9. Borstad E, Abdelnoor M, Staff AC, Kulseng-Hanssen S. Surgical strategies for women with pelvic organ prolapse and urinary stress incontinence. *Int Urogynecol J*. 2010;21:179-186.
10. Bø K. Pelvic floor muscle training in treatment of female stress urinary incontinence, pelvic organ prolapse and sexual dysfunction. *World J Urol*. 2012;30:437-443.
11. Brasoveanu S, Ilină R, Balulescu L, Pirtea M, Secosan C, Grigoraş D, Pirtea L. Evaluating patient preferences and clinical outcomes in stress urinary incontinence treatment: A short-term follow-up study of the transobturator tape procedure and pubourethral ligament plication—a minimally invasive technique. *J Pers Med*. 2023;14(1):34.
12. Chapple CR, Cruz F, Deffieux X, et al. Consensus statement of the European Urology Association and the European Urogynaecological Association on the use of implanted materials for treating pelvic organ prolapse and stress urinary incontinence. *Eur Urol*. 2017;72(3):424-431. doi: 10.1016/j.eururo.2017.01.035.
13. Fleischer K, Thiagamoorthy G. Pelvic organ prolapse management. *Post Reprod Health*. 2020;26(2):79-85. doi: 10.1177/2053369120925566.
14. Giberti C, Gallo F, Cortese P, Schenone M. Transobturator tape for treatment of female stress urinary incontinence: objective and subjective results after a mean follow-up of two years. *Urology*. 2007;69(4):703-707. doi: 10.1016/j.urology.2007.01.073.
15. Jelovsek JE, Maher C, Barber MD. Pelvic organ prolapse. *Lancet*. 2007;369(9566):1027-1038. doi: 10.1016/S0140-6736(07)60462-0.

16. Lin L, Huang MC, Su TH, Lau HH. Comparison between tension-free vaginal tape and transobturator tape in treating stress urinary incontinence after vaginal mesh surgery. *Taiwan J Obstet Gynecol*. 2018;57(4):528-531. doi: 10.1016/j.tjog.2018.04.014.
17. Han L, Wang L, Wang Q, Li H, Zang H. Association between pelvic organ prolapse and stress urinary incontinence with collagen. *Exp Ther Med*. 2014;7(5):1337-1341.
18. Carroll L, O'Sullivan C, Perrotta C, Fullen B. Pelvic organ prolapse: the lived experience. *PLoS One*. 2022;17(11). doi: 10.1371/journal.pone.0276788.
19. Kim HG, Park HK, Paick SH, Choi WS. Comparison of effectiveness between tension-free vaginal tape (TVT) and trans-obturator tape (TOT) in patients with stress urinary incontinence and intrinsic sphincter deficiency. *PLoS One*. 2016;11(5).
20. Jeon MJ, Chung DJ, Park JH, Kim SK, Kim JW, Bai SW. Surgical therapeutic index of tension-free vaginal tape and transobturator tape for stress urinary incontinence. *Gynecol Obstet Invest*. 2008;65(1):41-46. doi: 10.1159/000107935.
21. Lo TS. Combined pelvic reconstructive surgery and transobturator tape (monarc) in women with advanced prolapse and urodynamic stress incontinence: A case control series. *J Minim Invasive Gynecol*. 2009;16(2):163-168. doi: 10.1016/j.jmig.2008.12.004.
22. Carroll L, O'Sullivan C, Doody C, Perrotta C, Fullen B. Biopsychosocial profile of women with pelvic organ prolapse: A systematic review. *Womens Health (Lond)*. 2023;19:17455057231181012. doi: 10.1177/17455057231181012.
23. Mayekar RV, Bhosale AA, Kandhari KV, Nandanwar YS, Shaikh SS. A study of transobturator tape in stress urinary incontinence. *Urol Ann*. 2017;9(1):9-13.
24. Mori da Cunha MG, Mackova K, Hympanova LH, Bortolini MAT, Deprest J. Animal models for pelvic organ prolapse: Systematic review. *Int Urogynecol J*. 2021;32:1331-1344. doi: 10.1007/s00192-020-04599-y.
25. Pang H, Zhang L, Han S, et al. A nationwide population-based survey on the prevalence and risk factors of symptomatic pelvic organ prolapse in adult women in China—a pelvic organ prolapse quantification system-based study. *BJOG*. 2021;128(8):1313-1323.
26. Chen B, Wen Y, Polan ML. Elastolytic activity in women with stress urinary incontinence and pelvic organ prolapse. *Neurourol Urodyn*. 2004;23(2):119-126.
27. Iglesia CB, Smithling KR. Pelvic organ prolapse. *Am Fam Physician*. 2017;96(3):179-185.
28. Giberti C, Gallo F, Cortese P, Schenone M. Transobturator tape for treatment of female stress urinary incontinence: objective and subjective results after a mean follow-up of two years. *Urology*. 2007;69(4):703-707. doi: 10.1016/j.urology.2007.01.073.

Investigating the Relationship between Affective Neuroscience Personalities, Job Satisfaction and Emotional Appetite in Long-Shift Healthcare Workers

Öznur Özge ÖZCAN*, Merve ELDOĞAN**, Lütfiye Büşra DEMİREZEN***, Mesut KARAHAN****

Abstract

Aim: To determine the relationship between emotional neuroscience personality traits, job satisfaction and emotional appetite in healthcare professionals working long shifts.

Method: A total of 140 healthcare workers working long and short shifts were included in the study. The participants' emotional appetite, affective personality types and job satisfaction levels were assessed with the Emotional Appetite Questionnaire (EAQ), Affective Neuroscience Personality Scale (ANPS) and Job Satisfaction Scale (JSS), respectively.

Results: We found significantly lower total job satisfaction in long shift participants (133.19 ± 37.69 $p < 0.001$). A positive statistically significant relationship was found between the Emotional Appetite Questionnaire "Positive" score and the Job Satisfaction subscales "Individual Factors" ($r = 0.245$ $p = 0.041$), "Physical Conditions" ($r = 0.255$ $p = 0.033$), "Interpersonal Relations" ($r = 0.311$ $p = 0.009$) scores.

Conclusion: According to the results of our study, it was found that long-shift healthcare workers had lower job satisfaction compared to short-shift workers, but there was no difference between emotional appetite and affective neuroscience personalities. However, it was revealed that job satisfaction was positively related to positive emotional appetite in the long-shift worker group.

Keywords: Affective neuroscience personality, emotional appetite, healthcare, job satisfaction, shift workers.

Uzun Vardiyalı Sağlık Çalışanlarında Duygusal Sinir Bilimi Kişiliklerinin, İş Doyumunun ve Duygusal İştah Arasındaki İlişkinin Araştırılması

Öz

Amaç: Bu çalışmanın amacı uzun vardiyalı çalışan sağlıkçılarda duygusal nörobilim kişilik özellikleri, iş tatmini ve duygusal iştah arasındaki ilişkiyi belirlemektir.

Yöntem: Çalışmaya uzun ve kısa vardiyalarda çalışan toplam 140 sağlık çalışanı dahil edildi. Katılımcıların duygusal iştahı, duygusal kişilik tipleri ve iş doyum düzeyleri sırasıyla Duygusal İştah Anketi (EAQ), Afektif Sinirbilim Kişilik Ölçeği (ANPS) ve İş Doyum Ölçeği (JSS) ile değerlendirildi.

Bulgular: Uzun vardiyalı katılımcılarda toplam iş doyumunun anlamlı derecede düşük olduğunu bulduk (133.19 ± 37.69 $p < 0.001$). Duygusal İştah Anketi "Olumlu" puanı ile İş Doyumu alt ölçekleri "Bireysel

Özgün Araştırma Makalesi (Original Research Article)

Geliş / Received: 05.02.2024 & **Kabul / Accepted:** 07.03.2025

DOI: <https://doi.org/10.38079/igusabder.1586726>

* Asst. Prof., Üsküdar University, Vocational School of Health Sciences, Department of Electroneurophysiology, Istanbul, Türkiye. E-mail: oznurozge.ozcan@uskudar.edu.tr [ORCID https://orcid.org/0000-0001-8992-0556](https://orcid.org/0000-0001-8992-0556)

** Dietician, Üsküdar University, Faculty of Health Sciences, Department of Nutrition and Dietetics, Istanbul, Türkiye. E-mail: merveelldogan@hotmail.com [ORCID https://orcid.org/0009-0008-7197-7130](https://orcid.org/0009-0008-7197-7130)

*** Dietician, Üsküdar University, Faculty of Health Sciences, Department of Nutrition and Dietetics, Istanbul, Türkiye. E-mail: busrademirezeno@gmail.com [ORCID https://orcid.org/0009-0005-1890-9700](https://orcid.org/0009-0005-1890-9700)

**** Prof. Dr., Üsküdar University, Vocational School of Health Sciences, Department of Medical Laboratory Techniques, Istanbul, Türkiye. E-mail: mesut.karahan@uskudar.edu.tr [ORCID https://orcid.org/0000-0002-8971-678X](https://orcid.org/0000-0002-8971-678X)

ETHICAL STATEMENT: Ethical approval for the study was obtained from the Ethics Committee of Üsküdar University (Date-form number: 30.12.2021; E-61351342/ARALIK2021-47). Informed consent was obtained from all participants.

Faktörler” ($r=0,245$ $p=0,041$), “Fiziksel Durumlar” ($r=0,255$ $p=0,033$), “Kişilerarası İlişkiler” ($r=0,311$ $p=0,009$) puanları arasında pozitif ve istatistiksel olarak anlamlı bir ilişki bulundu.

Sonuç: Çalışmanın sonuçlarına göre uzun vardiyalı sağlık çalışanlarının kısa vardiyalı çalışanlara göre iş doyumlarının azaldığı ancak duygusal iştah ve afektif sinirbilim kişilikleri arasında bir fark yaratmadığı bulundu. Ancak uzun vardiyalı çalışan grubunda iş doyumunun olumlu duygusal iştah ile pozitif yönde bir ilişkisi olduğu ortaya kondu.

Anahtar Sözcükler: Affektif sinirbilim kişilik, duygusal iştah, sağlık hizmeti, iş tatmini, vardiyalı çalışanlar.

Introduction

The health sector has an important place in the service sector. The fact that health services are directly related to human life and the importance of professional skills of health workers in diagnosis and treatment makes the interaction between the service receiver and the service provider more intense compared to other sectors¹. For numerous hospital nurses, working in shifts is a standard part of their job, allowing them to deliver healthcare services 24 hours a day². Shift work often means that nurses must work overnight, which can impact their health by causing changes in appetite, drowsiness, or sleep disruptions^{3,4}. People working regular daytime hours typically eat three meals within a 24-hour period and do so during daylight hours. In contrast, shift workers often develop varied eating habits, consuming food at different times around the clock, including during the night⁵. Shift workers regularly experience appetite problems that occur when their feeding times are not synchronized with a regular schedule. Bayraktaroğlu et al.⁶ reported that shift workers had lower average perceived stress, physical activity and positive emotional appetit.

Shift workers frequently experience psychological issues, including moodiness, depression, irritability, anxiety, changes in personality, and challenges in their personal relationships^{7,8}. Working systems in the health sector are carried out in the form of 24-hour long shifts and short shifts during the day. It should be taken into account that long shifts can affect employees psychologically and emotionally, and therefore job satisfaction can be affected accordingly⁹. The findings indicate variations in work schedule satisfaction and overall well-being based on the type of work schedule. Specifically, shift workers report lower levels of satisfaction and well-being compared to those who work regular daily schedules¹⁰.

To our knowledge, this was the first study to address affective neuroscience personalities specifically in nurses. This study aimed to investigate the relationship between affective neuroscience personality traits, job satisfaction and emotional appetite in healthcare professionals working long shifts, especially in nurses.

Material And Methods

Study Sample

This cross-sectional study was conducted by asking face-to-face questions to long- and short-shift healthcare workers working in a hospital. A total of 140 people, including healthcare workers working long shifts ($n=70$) and healthcare workers working short shifts during the day ($n=70$), aged 18-64, from health center in Istanbul who met inclusion criteria.

Sample Size

The sample size was determined using the G-Power 3.1.9.4 software, considering the significance level of the hypothesis and the effect size. Based on the Job Satisfaction Scale Total scores reported in İntepeler et al.'s¹¹ study— 2.89 ± 0.59 for on-duty nurses and 3.29 ± 0.50 for off-duty nurses—a medium effect size of 0.66 was identified. To detect a meaningful difference between the groups with an alpha level of 0.05, a power of 95%, and an error margin of 0.005, the minimum required sample size was calculated as 50 participants per group.

Data Collection Instruments

The “Demographic Data Form” was used to determine the demographic characteristics of the healthcare workers who participated in the study and who worked short shifts during the day. Demographic Information Form includes eight questions about the personal information of healthcare workers. It provides information about the gender, age, marital status, educational status, any disease status, medication use, smoking status and alcohol consumption status of the individuals. When the participants were asked about their job, 140 people answered as nurses. Afterwards, the participants were divided into two groups, with equal numbers of those who stayed for the long shift and those who did not. The Affective Neuroscience Personality Scale was used to record information about the participants, including their play, curiosity, love, anger, sadness, fear and spirituality. Their Emotional Appetite levels were assessed using the Emotional Appetite Questionnaire (EAQ), and their job satisfied was evaluated through the Job Satisfaction Scale.

Inclusion Criteria

- Being healthy
- Being between the ages of 18-64,
- Not having difficulties in communicating to understand and answer the evaluation questions correctly,

Exclusion Criteria

- Chronic illness (orthopedic, neurological, rheumatological, or cardiopulmonary disease or surgery)
- pregnancy and breastfeeding
- Any psychiatric or mental disorder and medication use

Affective Neuroscience Personality Scale (ANPS): This scale based on the hypothesis that personality diversity is largely due to strengths or weaknesses in six different emotional systems in the brain¹². The scale consists of 110 items and 7 subscales. These subscales are play, curiosity, love, anger, sadness, fear and spirituality. It is a four-point likert-type self-report scale with each item being scored between 1 and 4. The analyses described in the original article were followed in the same way. For validity studies, the scale was compared with the Goldberg-70 Personality Scale. The analyses concluded that the Turkish version of the scale is both valid and reliable¹³.

Emotional Appetite Questionnaire (EAQ): This scale originally created by Nolan et al.¹⁴, assesses emotional eating by examining how various emotions and situations impact appetite. Participants rate their responses on a scale of 1 to 9, where 1-4 signify a decrease, 5 indicates no change, and 6-9 represent an increase in appetite. The questionnaire includes 14 items related to positive and negative emotions and 8 items focused on positive and negative situations. Scores for negative emotional eating (EIA Negative) are calculated by summing the responses to items on negative emotions and situations, while positive emotional eating (EIA Positive) scores are based on positive emotions and situations. Although the questionnaire does not establish a specific threshold for emotional eating, it helps identify the emotions and situations influencing it. The scale has been validated and shown to be reliable for use in Turkish populations¹⁵.

Job Satisfaction Scale (JSS): A 32-item scale prepared by researchers by scanning various literature and lists on the subject in order to measure job satisfaction. Individuals are asked how much each of these 32 items given regarding work life satisfies them (gives satisfaction) and are asked to evaluate on a scale ranging from 0% to 100%. It is a Likert-type scale scored as 0%=1, 25%=2, 50%=3, 75%=4 and 100%=5. The score range is 1-160. A higher score on the scale reflects greater job satisfaction. The analyses concluded that the Turkish version of the scale is both valid and reliable¹⁶.

Ethical Statement

Ethics committee approval for this study was obtained from the Üsküdar University Rectorate Ethics Committee (Date-form number: 30.12.2021; E-61351342/ARALIK 2021-47). Participants signed and gave consent that they participated in the study voluntarily.

Statistical analysis

The data analysis for this study was conducted using the SPSS 25.0 software package. Descriptive statistics for participants' socio-demographic information were presented in frequency tables. Normality of the data was assessed using the Kolmogorov-Smirnov test, with results indicating $p < 0.05$, suggesting non-normal distribution. Consequently, the Spearman correlation analysis, a nonparametric test, was employed to examine relationships between scale scores. Additionally, the Mann-Whitney U test was used to evaluate significant differences between the scales. For significant group differences, a post-hoc test was conducted to identify the specific groups with significant differences. Given the lack of homogeneity of variance and unequal group sizes, the Games-Howell post-hoc test was applied. A p-value of less than 0.05 was considered statistically significant.

Results

The sociodemographic characteristics of the study participants are shown in Table 1. The research included a total of 140 participants, consisting of 101 females and 39 males. The mean age of individuals were 34.45 ± 7.49 years, were in the working long shifts group. This group consisted of 43 women (61.4%) and 27 men (38.6%). The mean age of individuals were 36.19 ± 5.03 years, were in the working short shifts group. This group consisted of 58 women (82.9%) and 12 men (17.1%). In the individuals with working long shifts group, 42.8% of the participants were married and 57.1% were not, 35.7% were

smoking and 64.3% were not, 30% were drinking alcohol, 70% were not. In the working short shifts group, while 48.6% of the participants were married, 51.4% were not, 30% were smoking and 70% were not, 21.4% were drinking alcohol and 78.6% were not.

Table 1. Sociodemographic characteristics of the study group (n=140)

		working long shifts (n=70)		working short shifts (n=70)	
Demographic variables		n	%	n	%
Gender	Women	43	61.4	58	82.9
	Male	27	38,6	12	17.1
Marital status	Married	30	42.8	34	48.6
	Single	40	57.1	36	51.4
Smoking	Yes	25	35.7	21	30
	No	45	64.3	49	70
Alcohol consumption	Yes	21	30	15	21.4
	No	49	70	55	78.6
Educational Status	High school	8	11.4	3	4.3
	BSc/BA	49	70	52	74.3
	Postgraduate	13	18.6	15	21.4
Age	Mean±SD	34.45±7.49		36.19±5.03	

SD: Standart deviation

Table 2 compares the scale and subscale scores of participants based on their work systems. No significant differences were observed in ANPS scores between the groups ($p>0.05$). However, a statistically significant difference was identified in the Total Job Satisfaction Scale score between work systems. Participants working short shifts reported higher Total Job Satisfaction Scale scores than those working long shifts ($Z=-3.593$, $p<0.001$).

Significant differences were also found in specific Job Satisfaction subscales. Participants working short shifts scored significantly upper on the "Business Policies" subscale compared to those working long shifts ($Z=-3.398$, $p=0.001$). Similarly, the "Individual Factors" subscale score was greater among short-shift workers than long-shift workers ($Z=-2.652$, $p=0.008$). The "Physical Conditions" subscale score was also higher for short-shift workers ($Z=-3.242$, $p=0.001$). Furthermore, the "Control/Autonomy" subscale score was significantly elevated in the short-shift group compared to the long-shift group ($Z=-2.998$, $p=0.003$).

For the "Salary" subscale, those working short shifts had higher scores compared to those working long shifts ($Z=-2.917$, $p=0.004$). Additionally, the "Interpersonal Relations" subscale score was significantly higher in the short-shift group compared to the long-shift group ($Z=-4.022$, $p<0.001$).

Table 2. Working short and long shift groups comparison (n=140)

Variables		Mean±SD	P Value	Z score
ANPS	working short shifts	359,33±53,88	0.952	-0,060
	working long shifts	367,43±63,92		
(EAQ)- Negative	working short shifts	53,14±27,06	0.144	-1,461
	working long shifts	57,19±24,82		
(EAQ)- Positive	working short shifts	44,96±11,99	0.317	-1,001
	working long shifts	42,03±14,74		
JSS Total	working short shifts	133,19±37,69	<0.001*	-3,593
	working long shifts	108,49±39,19		
JSS Business Policies	working short shifts	61,60±20,55	0.001*	-3,398
	working long shifts	49,39±20,51		
JSS Individual Factors	working short shifts	23,79±5,90	0.008*	-2,652
	working long shifts	20,64±7,06		
JSS Physical Conditions	working short shifts	17,59±5,42	0.001*	-3,242
	working long shifts	14,24±6,10		
JSS Control/ Autonomy	working short shifts	13,64±4,08	0.003*	-2,998
	working long shifts	11,63±4,21		
JSS Salary	working short shifts	7,33±3,82	0.004*	-2,917
	working long shifts	5,47±3,43		
JSS Interpersonal Relationships	working short shifts	9,24±2,98	<0.001*	-4,022
	working long shifts	7,11±3,22		

SD: Standart deviation, ANPS: The Affective Neuroscience Personality Scale, EAQ: Emotional Appetite Questionnaire, JSS: Job Satisfaction Scale * Statistically significant difference ($p < 0.05$).

Table 3 presents the correlations between scale and subscale scores among participants working in long-shift systems, using Spearman's correlation analysis. No significant correlations were found between the Affective Neuroscience Personality Scale (ANPS) and its subscales with the Job Satisfaction Scale (JSS) or the Emotional Appetite Questionnaire (EAQ). However, a positive correlation was observed between the "Positive" score of the Emotional Appetite Questionnaire and the Total Job Satisfaction Scale score ($r=0.252$, $p=0.035$). Additionally, positive correlations were found between the "Positive" score of the Emotional Appetite Questionnaire and the "Individual Factors" ($r=0.245$, $p=0.041$), "Physical Conditions" ($r=0.255$, $p=0.033$), and "Interpersonal Relations" ($r=0.311$, $p=0.009$) subscales of the Job Satisfaction Scale.

Table 3. Correlation results of scale and subscale relationships applied to participants working in long shift system (n=70)

		1	2	3	4	5	6	7	8	9	10
ANPS	r	1									
	p	.									
(EAQ)- Positive	r	0,030	1								
	p	.805									
(EAQ)- Negative	r	-.0010	0,146	1							
	p	.932	.229	.							
JSS Total	r	0,107	0,252*	0,110	1						
	p	.380	.035*	.364	.						
JSS Business Policies	r	0,083	0,187	0,141	0,956*	1					
	p	.493	.120	.243	<0,001*	.					
JSS Individual Factors	r	0,116	0,245*	-.0012	0,772*	0,674*	1				
	p	.337	.041*	.920	<0,001*	<0,001*	.				
JSS Physical Conditions	r	0,047	0,255*	0,190	0,829*	0,713*	0,685*	1			
	p	.701	.033*	.116	<0,001*	<0,001*	<0,001*	.			
JSS Control/ Autonomy	r	0,058	0,204	0,060	0,884*	.781*	0,756*	0,741*	1		
	p	.635	.090	.625	<0,001*	<0,001*	<0,001*	<0,001*	.		
JSS Salary	r	-.0075	0,157	0,131	0,650*	.627*	.297*	0,516*	0,591*	1	
	p	.537	.194	.281	<0,001*	<0,001*	0,012*	<0,001*	<0,001*	.	
JSS Interpersonal Relationships	r	0,116	0,311*	0,001	0,792*	.722*	0,564*	0,668*	0,703*	0,512*	
	p	.338	.009*	.990	<0,001*	<0,001*	<0,001*	<0,001*	<0,001*	<0,001*	1

ANPS: The Affective Neuroscience Personality Scale, EAQ: Emotional Appetite Questionnaire, JSS: Job Satisfaction Scale * *Indicates significance at the 0.05 level in the Spearman correlation analysis.

Discussion

This study aimed to investigate the relationship between affective neuroscience personality traits, job satisfaction and emotional appetite in healthcare professionals working long shifts. A total of 140 healthcare personnel participated in the study, 70 of whom worked overtime and 70 of whom worked on duty. We found that working long shifts increases the risk of job dissatisfaction in healthcare workers. There was no difference in emotional appetite and affective neuroscience personalities among healthcare workers working long shifts compared to those working short shifts.

Research in the literature suggests that working long shifts impacts job satisfaction. One study found a statistically significant difference in the mean scores for the sub-dimensions of institutional policies and strategies, self-actualization, overall quality of work life, interpersonal communication, and health insurance based on the long-shift working status of 309 nurses¹⁷. The analysis revealed that nurses working long shifts experienced lower satisfaction in these sub-dimensions. However, no statistically significant differences were identified in the other sub-scales in relation to nurses' on-duty status. Certain studies have indicated that nurses working long shifts have significantly higher total job satisfaction scores compared to those working short shifts¹⁸.

²⁰. In a study conducted by Platis et al.²¹ in which 246 nurses participated and important parameters in job satisfaction were evaluated, a relationship was found between working hours and job satisfaction. High weekly working hours are the result of weekend work and shift work.

There are also studies reporting that weekly working hours do not have a significant effect on job satisfaction. Gönültaş et al. reported that no significant relationship was found between employees' weekly working hours and their job satisfaction²². Evaluating with more comprehensive studies, considering concepts such as how often weekly overtime is done, the number of patients served during overtime, and work intensity may reveal differences between studies²³. A study conducted with nurses in Türkiye found a strong connection between job satisfaction, professional identity, and the likelihood of nurses leaving the profession. Findings suggest that lower job satisfaction and diminished professional identity may increase the intention to exit the profession²⁴. However, in the results of our study, no significance or correlation was found between the ANPS scores of long-shift workers and their JSS. Although neuroscientific personalities were not associated with job satisfaction in our study, emotional appetite had a strong and positive correlation. On the contrary, in a study conducted on academics (147 people in total), a significant and negative relationship was reported between general eating behavior score and job satisfaction²⁵. In another study with 150 participants, the effects of working during the day and at night on food consumption were examined. The results of the study showed that individuals working at night preferred more practically prepared and cold foods compared to those working during the day, and it was also observed that these individuals ate whenever they had time and preferred snacks more often instead of being physically hungry. In their study, the relationship between being on duty and intuitive eating was evaluated by looking at this data; however, no results supporting this data were found²⁶.

To our knowledge, there was no study measuring ANPS among long-shift workers. Our results did not find significant results in all subscales of this scale in short- and long-shift workers. There was no effect of working long shifts on emotional appetite, but our sample was limited for these results. This study is the first to investigate the relationship between affective neuroscience personality, emotional appetite, and job satisfaction levels among long-shift healthcare workers. Many studies on this topic do not assess personality types but are designed to assess a variety of health conditions. Study findings are further strengthened by the fact that the scales were too long to use approaches that examine the effects of personality types and long-shift work on healthcare workers. Therefore, we recommend that future studies increase their sample size and monitor their health or mental status.

Conclusion

Research shows that short shift workers have significantly higher job satisfaction than long shift workers. There were no significant differences between their affective neuroscientific personalities and emotional appetites. It was shown that as job satisfaction increased in long-shift workers, emotional appetite increased, and that it was especially dependent on individual factors and physical conditions. The positive increase in interpersonal relationships was associated with an increase in emotional appetite.

Although there was no relationship with neuroscientific personalities in long-shift workers, it was found that job satisfaction had a strong positive relationship with emotional appetite, but further studies are needed on a larger sample.

Author Contributions

Plan, design: ÖÖÖ, ME, LBD; **Material, methods and data collection:** ME, LBD; **Data analysis and comments:** ÖÖÖ, MK; **Writing and corrections:** ÖÖÖ, MK

Funding

No funding available.

Acknowledgement

The authors would like to express their sincere gratitude to all healthcare professionals who volunteered to participate in this study despite working long hours.

Conflict of Interest

The authors declare no potential conflicts of interest concerning the research, authorship, and/or publication of this article.

REFERENCES

1. Costa G. Shift work and health: Current problems and preventive actions. *Saf Health Work*. 2010;1(2):112-23. doi: 10.5491/SHAW.2010.1.2.112.
2. Dall'Ora C, Ball J, Recio-Saucedo A, Griffiths P. Characteristics of shift work and their impact on employee performance and wellbeing: A literature review. *International Journal of Nursing Studies*. 2016;57:12–27. doi: 10.1016/j.ijnurstu.2016.01.007.
3. Bouillon-Minois JB, Thivel D, Croizier C, et al. The negative impact of night shifts on diet in emergency healthcare workers. *Nutrients*. 2022;14(4):829. doi: 10.3390/nu14040829.
4. Kecklund G, Axelsson J. Health consequences of shift work and insufficient sleep. *BMJ*. 2016;355:i5210. doi: 10.1136/bmj.i5210.
5. Waterhouse J, Buckley P, Edwards B, Reilly T. Measurement of, and some reasons for, differences in eating habits between night and day workers. *Chronobiol Int*. 2003;20(6):1075-92. doi: 10.1081/cbi-120025536.
6. Bayraktaroglu E, Hizli-Guldemir H, Eti S, Kayali-Sevim M, Saleki N. The relationship between perceived stress and emotional eating in bus drivers: The effect of shift work. *Int J Food Sci Nutr*. 2024;75(7):707-716. doi: 10.1080/09637486.2024.2395818.
7. Brown JP, Martin D, Nagaria Z, Verceles AC, Jobe SL, Wickwire EM. Mental health consequences of shift work: An updated review. *Curr Psychiatry Rep*. 2020;22(2):7. doi: 10.1007/s11920-020-1131-z.
8. Natvik S, Bjorvatn B, Moen BE, Magerøy N, Sivertsen B, Pallesen S. Personality factors related to shift work tolerance in two- and three-shift workers. *Appl Ergon*. 2011;42(5):719-24. doi: 10.1016/j.apergo.2010.11.006.

9. Arlinghaus A, Bohle P, Iskra-Golec I, Jansen N, Jay S, Rotenberg L. Working time society consensus statements: Evidence-based effects of shift work and non-standard working hours on workers, family and community. *Ind Health*. 2019;57(2):184-200. doi: 10.2486/indhealth.SW-4.
10. Costa D, Silva IS. Shift work, satisfaction with work schedule, and well-being: An analysis in the health sector. In: Arezes PM, ed. *Occupational and Environmental Safety and Health V*. Studies in Systems, Decision and Control. Vol 492. Cham: Springer; 2024. doi: 10.1007/978-3-031-38277-2_48.
11. İntepeler ŞS, Güneş N, Bengü N, Yılmazmış F. Changes in job satisfaction and institutional commitment of nurses working in a university hospital. *Dokuz Eylül University Faculty of Nursing Journal*. 2014;7(1):2-6.
12. Davis KL, Panksepp J, Normansell L. The Affective Neuroscience Personality Scales: normative data and implications. *Neuropsychanalysis*. 2003;5(1):57-69. doi: 10.1080/15294145.2003.10773410.
13. Özkarar-Gradwohl FG, Panksepp J, İçöz FJ, et al. The influence of culture on basic affective systems: The comparison of Turkish and American norms on the affective neuroscience personality scales. *Cult. Brain*. 2014;2:173-192. doi: 10.1007/s40167-014-0021-9.
14. Nolan LJ, Halperin LB, Geliebter A. Emotional appetite questionnaire. Construct validity and relationship with BMI. *Appetite*. 2010;54(2):314-9. doi: 10.1016/j.appet.2009.12.004.
15. Demirel B, Yavuz KF, Karadere ME, Şafak Y, Türkçapar MH. Duygusal İştah Anketi'nin Türkçe geçerlik ve güvenilirliği, beden kitle indeksi ve duygusal şemalarla ilişkisi. *Bilişsel Davranışçı Psikoterapi ve Araştırmalar Dergisi*. 2014;3(3):171-181. doi: 10.5455/JCBPR.44046.
16. Durak-Batıgün A, Şahin NH. İş stresi ve sağlık psikolojisi araştırmaları için iki ölçek: A-tipi kişilik ve iş doyumu. *Türk Psikiyatri Dergisi*. 2006;17(1):32-45.
17. Söylemez D, Sur H, Cebeci D. Hemşirelerin iş doyumu ile ilgili bir meta analiz çalışması. *Hastane Yönetimi Dergisi*. 2005;34-41.
18. Dall'Ora C, Ejebu OZ, Ball J, Griffiths P. Shift work characteristics and burnout among nurses: Cross-sectional survey. *Occup Med (Lond)*. 2023;73(4):199-204. doi: 10.1093/occmed/kqado46.
19. Ejebu OZ, Dall'Ora C, Griffiths P. Nurses' experiences and preferences around shift patterns: A scoping review. *PLoS One*. 2021;16(8):e0256300. doi: 10.1371/journal.pone.0256300.
20. Varghese B, Joseph CM, Al-Akkam AAA, Al-Balawi RMOAM, Swallmeh E, Singh K. Nurse's experience working 12-hour shift in a tertiary level hospital in Qatar: A mixed method study. *BMC Nurs*. 2023;22(1):213. doi: 10.1186/s12912-023-01371-0.
21. Platis C, Reklitis P, Zimeras S. Relation between job satisfaction and job performance in healthcare services. *Procedia - Social and Behavioral Sciences*. 2015;175:480-487.

22. Gönültaş T, Aytaç N, Akbaba M. Investigation of job satisfaction in nurses working in Çukurova University Balcalı Hospital. *Sakarya Medical Journal*. 2018;8(1):30-40.
23. Hassoy D, Özurmaz S. Job satisfaction and affecting factors of healthcare workers in a state hospital. *Journal of Nursing Science*. 2019;2(3):27-32.
24. Sabanciogullari S, Dogan S. Relationship between job satisfaction, professional identity and intention to leave the profession among nurses in Turkey. *J Nurs Manag*. 2014;23:1076-85. doi: 10.1111/jonm.12256.
25. Kendirkiran G, Batur B. The relationship between eating behavior and job satisfaction of academic staff. *International Journal of Caring Sciences*. 2022;15(2):825-836.
26. Güveli H, Altay OM, Güven N, Özlü T, Kenger E. Sağlık çalışanları arasında sezgisel yeme davranışı sıklığının saptanması. *STED*. 2022;31(2):108-14.

Comparison of Intuitive Eating Behaviour, Eating Addiction and Nutritional Knowledge Level in Individuals Receiving Online and Face-to-Face Nutrition Counselling*

Nevin TİPİ**, Elif EDE ÇİNTESUN***

Abstract

Aim: This study compares the level of nutritional knowledge, eating addiction, and intuitive eating behaviors in individuals receiving online and face-to-face nutrition counseling.

Method: This cross-sectional, descriptive research was conducted with 51 online and 51 face-to-face counselees who applied to the nutrition and counseling center in İstanbul for 12 weeks. The demographic characteristic information, Intuitive Eating Scale (IES-2), Yale Food Addiction Scale (YFAS), and Nutrition Knowledge Level Scale for Adults (NKLSA) were recorded, and anthropometric measurements were taken. Statistical analyses were performed with SPSS-27.

Results: 12 weeks of nutritional counseling resulted in a decrease in anthropometric measurements in both groups ($p < 0.05$). Also, statistically significant improvement was observed in IES-2 and YFAS scores for both groups; however, no change was observed in NKLSA. There was no difference between the groups ($p > 0.05$). A negative correlation was found between IES-2 and YFAS subscales in the face-to-face group ($s: -0.162$).

Conclusion: Both online and face-to-face nutrition counseling methods have similar effects on weight loss, increasing intuitive eating, and reducing eating addiction. Also, an intuitive eating approach can be recommended to control eating addiction. Future studies should focus on the effect of nutrition counseling on lasting behavior changes with longer-term interventions.

Keywords: Nutrition counseling, nutrition knowledge level, intuitive eating, food addiction.

Çevrimiçi ve Yüz Yüze Beslenme Danışmanlığı Alan Bireylerde Sezgisel Yeme Davranışı, Yeme Bağımlılığı ve Beslenme Bilgi Düzeyinin Karşılaştırılması

Öz

Amaç: Bu çalışma, çevrimiçi ve yüz yüze beslenme danışmanlığı alan bireylerin beslenme bilgi düzeylerini, yeme bağımlılıklarını ve sezgisel yeme davranışlarını karşılaştırmayı amaçlamaktadır.

Yöntem: Bu kesitsel, tanımlayıcı araştırma, İstanbul'daki beslenme ve danışmanlık merkezine başvuran 51 çevrimiçi ve 51 yüz yüze danışan ile 12 hafta boyunca yürütülmüştür. Demografik özellikler, Sezgisel Yeme Ölçeği (SYÖ), Yale Besin Bağımlılığı Ölçeği (YBBÖ), Yetişkinler için Beslenme Bilgi Düzeyi Ölçeği (YETBİD) yanıtları kaydedilmiş ve antropometrik ölçümleri alınmıştır. İstatistiksel analizler SPSS 27 ile yapılmıştır.

Bulgular: 12 haftalık beslenme danışmanlığı her iki grupta da antropometrik ölçümlerde azalma ile sonuçlanmıştır ($p < 0,05$). Ayrıca, her iki grup için SYÖ ve YBBÖ skorlarında istatistiksel olarak anlamlı

Özgün Araştırma Makalesi (Original Research Article)

Geliş / Received: 07.10.2024 & **Kabul / Accepted:** 07.07.2025

DOI: <https://doi.org/10.38079/igusabder.1563118>

* This study has been derived from the master's thesis titled "Comparison of Nutritional Knowledge, Eating Addiction, and Intuitive Eating Receiving Online and Face-to-Face Nutritional Counseling", which was accepted in 2024 at İstanbul Sabahattin Zaim University Institute of Graduate Education Department of Nutrition and Dietetics and prepared by Nevin TİPİ under the consultancy of Asst. Prof. Elif EDE ÇİNTESUN.

** MSc, İstanbul Sabahattin Zaim University, Graduate Education Institute, Department of Nutrition and Dietetics, İstanbul, Türkiye. E-mail: Nevintipi51@gmail.com ORCID <https://orcid.org/0009-0004-6775-5181>

*** Corresponding author: Asst. Prof. Dr., PhD., İstanbul Sabahattin Zaim University, Faculty of Health Sciences, Department of Nutrition and Dietetics, İstanbul, Türkiye. E-mail: elifedecintesun@gmail.com ORCID <https://orcid.org/0000-0001-6103-2784>

ETHICAL STATEMENT: Ethical permission, approved by the Ethics Committee of İstanbul Sabahattin Zaim University Rectorate dated 28.07.2023 and numbered 2023/07. This study was conducted in accordance with the Helsinki declaration.

iyileşme gözlenirken, YETBİD'de herhangi bir değişiklik gözlenmemiştir. Gruplar arasında fark bulunmamıştır ($p>0,05$). SYÖ ve YBBÖ alt ölçekleri arasında yüz yüze grupta negatif korelasyon bulunmuştur ($s:-0,162$).

Sonuç: Hem çevrimiçi hem de yüz yüze beslenme danışmanlığı yöntemlerinin ağırlık kaybının sağlanması, sezgisel yemenin artırılması ve yeme bağımlılığının azaltılması üzerinde benzer etkileri vardır. Ayrıca, yeme bağımlılığını kontrol etmek için sezgisel yeme yaklaşımı önerilebilir. Gelecekteki çalışmalar, daha uzun süreli müdahalelerle beslenme danışmanlığının kalıcı davranış değişiklikleri üzerindeki etkisine odaklanabilir.

Anahtar Sözcükler: Beslenme danışmanlığı, beslenme bilgi düzeyi, sezgisel yeme, yeme bağımlılığı.

Introduction

Intuitive eating (IE) is "the integration of mind, body, and food in a dynamic process" and relies on hunger and satiety cues to regulate food intake¹. The non-diet approach requires full body acceptance regardless of size or shape and does not address health risks². This approach aims to maintain health and appropriate weight by focusing on internal body signals. The primary approach is to regain "body wisdom"; the individual eats when hungry and stops when full. It is mainly used in health-oriented applications and obesity treatment; unlike calorie-restrictive diets, it is an innate mechanism and focuses on creating balance in the body instead of weight loss³. There is an opposite relationship between IE behavior and body mass index (BMI); people with lower BMI show better IE behavior⁴. Therefore, a new trend is emerging in treating obesity that puts health at the center rather than focusing on weight loss⁵. Additionally, Intuitive eating is negatively correlated with eating disorder symptoms, body dissatisfaction, and the idea of being thin. In contrast, it is associated with lower eating disorder risk, more positive body image, and positive emotional functioning³.

Eating addiction (EA) is a disorder in which excessive food consumption leads to clinical weight gain and obesity. Psychological factors play an essential role in EA; it is suggested that high-calorie foods are used to cope with emotional stress⁶. A multidisciplinary approach and psychoeducation are necessary in the treatment of EA. Psychoeducation provides information about conscious food consumption and ways to cope with uncontrolled eating attack⁷. Nutrition and diet counseling provided by dietitians is also of critical importance. Nutrition information can be transferred to individuals through nutrition counseling. Today, nutrition counseling is provided through online or face-to-face interview methods, but studies on which method is more effective are limited. Lack of nutritional knowledge is essential for individuals' relationship with nutrients, and online nutrition counseling can be effective in increasing the level of nutritional knowledge⁸. It has been shown that online lifestyle interventions can help with weight loss and maintenance^{9,10}. However, online diets have not been widely implemented, and it remains unclear whether they are effective¹¹. Therefore, the present study aimed to compare IE, EA, and nutrition knowledge in individuals receiving online and face-to-face nutrition counseling.

Material and Methods

Participants

This cross-sectional, descriptive, and prospective study was conducted with participants who applied to a nutrition and dietary counseling center in Istanbul between September 2023 and May 2024 and who volunteered to participate in the study. The sample size was calculated using the G*power program with an effect size of 0.5, power 0.8, confidence level $\alpha=0.05$. Inclusion criteria for the study are being between the ages of 18 - 65, volunteering to participate in the study, being literate, not having received any professional nutrition/diet counseling in the past six months, and not having a previous diagnosis of eating disorder. Exclusion criteria include being under the age of 18, having a diagnosed eating disorder or any psychiatric illness, being pregnant or breastfeeding, and having a cognitive or physical disability that prevents participation in measurement or survey processes. A questionnaire form created by the researcher was used as a data collection tool. Demographic data and anthropometric data of the individuals were obtained through the questionnaire. “Intuitive Eating Scale-2 (IES-2)”, “Yale Food Addiction Scale (YFAS)” and “Nutrition Knowledge Level Scale for Adults (NKLSA)” questionnaire forms were evaluated before and after 12 weeks of diet program.

Nutrition Counseling

Individual nutrition counseling was provided to the participants by a dietitian (who had a Bachelor’s degree in the field of Nutrition and Dietetics) for 30 minutes for the first session and 15 minutes for the subsequent sessions. During the interviews, personalized nutrition plans were created in accordance with the Mediterranean-type nutrition model, taking into account the individual needs of the participants. To ensure standardization in the study, the participants in the online group were invited to the nutrition and dietary counseling center at the beginning of the study and end of the 12 weeks to respond to the questionnaire administered by the researcher and to have their anthropometric measurements taken in accordance with the same standard procedures. Nutrition counseling was provided weekly online for participants in the online group and weekly in person for participants in the face-to-face group.

Intuitive Eating Scale – 2: Intuitive Eating Scale-2 (IES-2) was developed by Tyłka and Diest¹², and Turkish adaptation and validity and reliability study was conducted by Akırmak⁵. The Intuitive Eating Scale consists of 21 judgments in a 5-point Likert type, graded between 1-5. The increase in the scores obtained from the scale indicates that the level of IE is also increasing. IES-2 comprises four sub-scales, including Unconditional Permission to Eat, Eating for Physical rather than Emotional Reasons, Reliance on Hunger and Satiety Cues, and Body-Food Choice Congruence. The Cronbach's alpha value for this study was found to be 0.67.

Yale Food Addiction Scale: The Yale Food Addiction Scale (YFAS) is a tool used to assess food addiction developed by Gerhard et al.¹³, and Turkish adaptation and validity and reliability study was conducted by Büyüktuncer et al.¹⁴. It is used as a mixed scale consisting of 27 items used to determine the addiction to certain foods and to explain the sub-criteria based on the diagnostic criteria of DSM-IV related to substance addiction. For seven symptoms, the total score obtained from the questions belonging to the

criterion must be ≥ 1 . The number of symptoms ranges from 0 to 7. YFAS comprises 8 sub-scales, including Consumption of food in excessive quantities and for a long time, Persistent desire or repeated unsuccessful attempt to quit, Much time/activity to obtain, use, recover, Important social, occupational, or recreational activities given up or reduced, Use continues despite knowledge of adverse consequences, Tolerance (Observed increase in quantity and decrease in impact), Characteristic withdrawal symptoms; somehow the person attempts to relieve withdrawal, The substance or behavior causes clinically significant impairment or distress. The Cronbach's alpha value for this study was found to be 0.57.

Nutrition Knowledge Level Scale for Adults: Nutrition Knowledge Level Scale for Adults was developed by Batmaz and Güneş. A basic nutrition score of less than 45 points is considered poor, 45-55 points is considered moderate, 56-65 points is considered good, and above 65 points is considered excellent nutritional knowledge¹⁵. The Cronbach's alpha value for this study was found to be 0.65.

Anthropometric Measurements: Weight, height, weight circumference (WC), hip circumference (HC), neck circumference (NC), waist-to-hip ratio, body fat, muscle, and body water percentage were evaluated. The participants' height was measured with a stadiometer, and WC, HC, and NC were measured by the researcher using a tape measure. NC was measured while the participant was standing, just below the larynx, parallel to the nape of the neck. WC was measured at the narrowest point between the lower ribs and the hip bone, and HC was measured at the widest point of the hip, with the tape measure parallel to the ground. All measurements were taken using a flexible yet taut measuring tape, directly on the skin, and by the same person. Body weight, body fat, lean mass, and body water ratios were determined with a bioelectrical impedance analysis device (BIA) using Tanita Tartı Perfecto. To ensure that BIA measurements are valid and reliable, participants were required to adhere to specific guidelines prior to the measurement. All participants were asked to refrain from eating for at least 4 hours before the measurement, avoid consuming any liquids other than water, avoid alcohol and caffeine for 12 hours prior to the measurement, and avoid strenuous physical activity. Prior to the measurement, participants were instructed to empty their bladders, remove any metal jewelry, and perform the measurement barefoot and wearing light clothing. Female participants were excluded from the measurement if possible during their menstrual period. All measurements were conducted by the same dietitian using the same device, in accordance with the device's measurement principles. Body Mass Index (BMI) was calculated with the Body weight (kg)/height(m²) formula¹⁶.

Ethical Statement

The study was evaluated and approved by the Ethics Committee of Sabahattin Zaim University Rectorate at its meeting dated 28.07.2023 and numbered 2023/07. The informed consent form was obtained from all participants who voluntarily agreed to participate in the study. The study was conducted under the Principles of the Declaration of Helsinki.

Statistical Analyses

The data obtained as a result of the research were evaluated by using the "The SPSS version 27 (IBM Inc., Chicago, IL, USA)" package program. Shapiro-Wilk Test, Independent Sample T-Test, Mann-Whitney U Test, and Spearman's Rank Difference Correlation Coefficient were used to compare the variables between the groups, and the statistical significance level was accepted as " $p < 0.05$ " for calculations and interpretations, and hypotheses were established as two-way.

Results

The demographic data of individuals, including 51 online and 51 face-to-face counselors, are shown in Table 1.

Table 1. Demographic findings of individuals according to nutrition counselling groups.

	Face-to-Face		Online		<i>p-value</i>
Gender	n	%	n	%	
Male	2	3.9	4	7.8	0.40 ^a
Female	49	96.1	47	92.2	
Age (years) ($\bar{X} \pm SS$)	31.35 $\pm$ 7.61		31.59 $\pm$ 6.50		0.62 ^b
Education Level					
Primary-Secondary Education	29	56.9	28	54.9	0.97 ^a
Bachelor	20	39.2	21	41.2	
Postgraduate	2	3.9	2	3.9	
Employment Status					
Employed	24	47.1	26	51.0	0.69 ^a
Unemployed	27	52.9	25	49.0	
Marital Status					
Married	37	72.5	37	72.5	1
Single	14	27.5	14	27.5	
Income Status					
Income less than expenses	6	11.8	6	11.8	0.16 ^a
Income equal to expenses	37	72.5	29	56.9	
Income more than expenses	8	15.7	16	31.3	

^a Pearson Chi-Square, ^b Mann Whitney U

The comparison of anthropometric measurement values before and after 12-week nutrition counseling program designed to support weight loss included in the study according to the study groups is given in Table 2. Pre-test and post-test results were compared in both groups and significant improvements were noted in all parameters ($p < 0.001$), particularly reductions in body weight, BMI, body fat percentage, and waist WC. Significant increases were also observed in muscle percentage and water percentage, while improvements in WC and HC were also noteworthy. There was no significant difference between the face-to-face and online groups ($p > 0.05$), indicating that similar results were obtained with both methods.

Table 2. Summary findings and comparison of anthropometric measurement pre-test - post-test values of individuals according to study groups.

	Face-to-Face		Online		
	$\bar{X} \pm SS$	Median (min-max)	$\bar{X} \pm SS$	Median (min-max)	<i>p2 value</i>
Body Weight (Pre-Test)	82.23±19.52	78.5 (44-140.7)	8.45±15.46	80.8 (56.9-124)	0.390
Body Weight (Post-Test)	73.77±17.52	70.8 (31.4-123.9)	75.22±13.20	73.5 (50.2-110.2)	0.399
W	W=-5.896		W=-5.746		
<i>p1 value</i>	<0.05^a		<0.05^a		
BMI (Pre -Test)	31.09±6.95	30.7 (15.2-49.1)	31.04±5.41	31 (21.9-49.72)	0.941
BMI (Post -Test)	27.91±6.43	27.4 (11.5-45.8)	27.93±4.26	27.5 (21-40.9)	0.710
T-W	T=10.595		W=-5.783		
<i>p1 value</i>	<0.05^b		<0.05^a		
Body Fat Percentage (Pre-Test)	39.64±6.90	39.2 (21-55)	38.25±5.97	38.6 (23.5-52.5)	0.281
Body Fat Percentage (Post-Test)	35.84±8.06	35.1 (21.1-64.6)	33.43±6.79	33.3 (15.2-48)	0.261
T-W	W=-5.521		T=13.895		
<i>p1 value</i>	<0.05^a		<0.05^b		
Body Muscle Percentage (PreTest)	57.24±6.49	57.7 (42.7-74.9)	58.63±5.67	58.3 (45.2-72.7)	0.253
Body Muscle Percentage (Post Test)	60.61±7.05	61.6 (44.6-74.9)	62.79±6.01	63.3 (49.4-80.6)	0.097
T	T=-5.979		T=-12.780		
<i>p1 value</i>	<0.05^b		<0.05^b		
Body Water Percentage (Pre-Test)	45.76±4.45	45.8 (35-60.1)	47.09±8.24	45.8 (36.7-98.4)	0.786
Body Water Percentage (Post-Test)	48.60±6.95	48.2 (37-88)	48.48±4.52	48.5 (40.8-65.9)	0.786
W	W=-5.362		W=-5.426		
<i>p1 value</i>	<0.05^a		<0.05^a		
Waist Circumference (Pre-Test)	98.92±17.60	98 (67-145)	97.67±14.61	96 (72-147)	0.763
Waist Circumference (Post-Test)	90.28±16.18	87 (67-138)	88.57±12.66	87 (68-129)	0.896
W	W=-6.206		W=-6.218		
<i>p1 value</i>	<0.05^a		<0.05^a		
Hip Circumference (Pre-Test)	112.74±14.57	111 (87-155)	112.52±11.34	112 (88-156)	0.733
Hip Circumference (Post-Test)	105.11±12.81	105 (84-146)	105.45±10.94	105 (84-143)	0.547
W	W=-5.608		W=-6.130		
<i>p1 value</i>	<0.05^a		<0.05^a		
Neck Circumference (Pre-Test)	33.44±3.18	33 (29-46)	34.36±3.27	34 (29-45)	0.072
Neck Circumference (Post-Test)	33.02±2.85	32 (29-44)	33.74±2.71	34 (29-43)	0.072
W	W=-3.243		W=-4.294		
<i>p1 value</i>	0.05^a		<0.05^a		

^a Wilcoxon Signed-Rank Test , ^b Dependent Sample T-Test, T: Test statistic obtained from a paired sample t-test; indicates the significance of the mean difference between two measurements , W: Test statistic obtained from Wilcoxon Signed-Rank Test indicates the significance of the difference between two measurements. p1 values indicate within-group changes before and after the nutritional counseling; p2 values represent between-group differences at the end of the 12 weeks.

Comparison of sub-factor and total scores of IES-2, YFAS, and NKLSA according to the study groups of individuals before and after 12 weeks of nutrition counseling presented in Table 3. Significant improvements were observed in pre-test and post-test comparisons in IES-2 and YFAS total scores and subgroups in both groups. In the NKLS

score, the face-to-face nutrition counseling group had statistically significantly higher scores than the online group. Also, it was found that the 12-week nutrition counseling had no significant effect on the NKLS score in both groups.

Table 3. Comparison of pre-test - post-test sub-factor and total scores of IES-2, YFAS, NKLSA according to the study groups of individuals.

	Face to Face		Online			
	$\bar{X} \pm SS$	Median (min-max)	$\bar{X} \pm SS$	Median (min-max)	t-U	<i>p2 value</i>
UPE – Pre-Test	3.10±0.75	3 (1.2-4.4)	3.00±0.76	3 (1-4.6)	t=0.681	0.498
UPE – Post-Test	3.36±0.56	3.4 (2-4.4)	3.11±0.42	3.2 (2.2-4)	U=936.5	0.014*
T-W	T=-2.336		W=-0.988			
<i>p1 value</i>	0.024 ^a		0.323 ^b			
EPR – Pre-Test	3.07±0.88	3 (1-5)	2.71±0.93	2.5 (1-4.5)	t=2.018	0.046*
EPR – Post-Test	3.42±0.53	3.4 (2.3-5)	3.75±0.46	3.9 (2.1-4.8)	U=767	<0.001***
T-W	T=-3.199		W=-5.231			
<i>p1 value</i>	0.05 ^a		<0.05 ^b			
RHSC – Pre-Test	3.03±0.96	3 (1-5)	2.88±0.90	3 (1-5)	t=0.815	0.417
RHSC – Post-Test	3.76±0.62	3.8 (2-5)	3.74±0.85	3.5 (2.7-8.7)	U=1121.5	0.228
W	W=-4.746		W=-4.544			
<i>p1 value</i>	<0.05 ^b		<0.05 ^b			
B-FCC – Pre-Test	3.07±1.11	3 (1-5)	2.72±0.87	3 (1-5)	U=1061.5	0.102
B-FCC – Post-Test	3.78±0.69	4 (2-5)	3.47±0.90	4 (1-5)	U=1054.5	0.078
W	W=-3.369		W=-3.858			
<i>p1 value</i>	<0.05 ^b		<0.05 ^b			
IES-2 Total – Pre-Test	3.06±0.51	3.1 (1.7-4.2)	2.83±0.49	2.8 (1.8-3.8)	t=2.387	0.019*
IES 2- Total – Post-Test	3.54±0.37	3.7 (2.7-4.3)	3.57±0.27	3.6 (3-4.5)	U=1287	0.928
T-W	T=-6.478		W=-5.768			
<i>p1 value</i>	<0.05 ^a		<0.05 ^b			
Consumption of food in excessive quantities and for a long time						
Pre-Test	0.57±0.85	0 (0-3)	0.55±0.88	0 (0-3)	1274.5	0.839
Post-Test	0.04±0.20	0 (0-1)	0.02±0.14	0 (0-1)	1275	0.560
W	-3.835		-3.835			
<i>p1 value</i>	<0.05 ^b		<0.05 ^b			
Persistent desire or repeated unsuccessful attempt to quit						
Pre-Test	1.24±0.71	1 (0-3)	1.41±0.90	1 (0-5)	1197	0.448
Post-Test	0.96±0.45	1 (0-2)	1.18±0.59	1 (0-3)	1071.5	0.045*
W	-2.198		-1.794			
<i>p1 value</i>	0.028 ^{*b}		0.073 ^b			
Much time/activity to obtain, use, recover						
Pre- Test	0.57±0.94	0 (0-3)	0.61±0.96	0 (0-3)	1248.5	0.680
Post- Test	0.04±0.20	0 (0-1)	0.04±0.20	0 (0-1)	1300.5	1.000
W	-3.469		-3.945			
<i>p1 value</i>	<0.05 ^b		<0.05 ^b			
Important social, occupational, or recreational activities given up or reduced						
Pre-Test	0.71±1.15	0 (0-4)	0.33±0.68	0 (0-2)	1132	0.145
Post-Test	0.12±0.52	0 (0-3)	-	-	1224	0.080

W	-3.624		-3.017			
p1 value	<0.05^b		<0.05^b			
Use continues despite knowledge of adverse consequences						
Pre-Test	0.29±0.46	0 (0-1)	0.24±0.43	0 (0-1)	1224	0.503
Post-Test	0.55±0.50	1 (0-1)	0.69±0.47	1 (0-1)	1122	0.156
W	-3.606		-3.888			
p1 value	<0.05^b		<0.05^b			
Tolerance (Observed increase in quantity and decrease in impact)						
Pre-Test	0.71±0.7	1 (0-2)	0.43±0.70	0 (0-2)	985.5	0.018*
Post-Test	0.80±0.66	1 (0-2)	0.57±0.57	1 (0-2)	1061.5	0.074
W	-0.892		-0.755			
p1 value	0.373^b		0.450^b			
Characteristic withdrawal symptoms; somehow the person attempts to relieve withdrawal						
Pre-Test	0.51±0.83	0 (0-3)	0.47±0.90	0 (0-3)	1218.5	0.502
Post- Test	0.02±0.14	0 (0-1)	-	-	1275	0.317
W	-3.898		-3.376			
p1 value	<0.05^b		<0.05^b			
The substance or behavior causes clinically significant impairment or distress						
Pre- Test	0.27±0.60	0 (0-2)	0.18±0.43	0 (0-2)	1238.5	0.531
Post-Test	-	-	0.04±0.28	0 (0-2)	1275	0.317
W	-2.889		-2.111			
p1 value	<0.05^b		0.03^b			
YFAS Total						
Pre- Test	4.86±3.50	4 (1-16)	4.22±3.20	3 (0-12)	1142	0.285
Post- Test	2.53±1.30	3 (0-6)	2.53±1.22	3 (0-5)	1299	0.992
W	-4.344		-2.995			
p1 value	<0.05^b		0.05^b			
NKLSA – Pre Test	51.14±8.30	51 (27-82)	47.59±8.75	48 (26-76)	U=935.5	0.014*
NKLSA – Post- Test	49.22±5.60	50 (36-72)	47.04±5.98	49 (31-55)	U=1098	0.174
W	W=-1.832		W=-0.055			
p1 value	0.067^b		0.956^b			

^a Dependent Sample T-Test, ^bWilcoxon Signed-Rank Test, T: Test statistic obtained from a paired sample t-test; indicates the significance of the mean difference between two measurements. W: Test statistic obtained from Wilcoxon Signed-Rank Test indicates the significance of the difference between two measurements. UPE: Unconditional Permission to Eat, EPR: Eating for Physical Rather Than Emotional Reasons, RHSC: Reliance on Hunger and Satiety Cues, B-FCC: Body–Food Choice Congruence. p1 values indicate within-group changes before and after the nutritional counseling; p2 values represent between-group differences at the end of the 12 weeks.

Correlation coefficients between IES-2 and YFAS sub-factor and total difference scores according to study groups of individuals are given in Table 4. Significant correlations were found between YFAS sub-groups and IES-2 scores in the face-to-face group. Also, a correlation was found between tolerance and IES-2 score in the online group.

Tablo 4. Correlation Coefficients Between YFAS Sub-Factor and Total Difference Scores and IES-2 Sub-Factor and Total Difference Scores According to Study Groups of Individuals.

		Face-to-Face					Online				
		UPE	EPR	RHSC	B-FCC	IES-2 Total	UPE	EPR	RHSC	B-FCC	IES-2 Total
Consumption of food in excessive quantities and for a long time	s	0.261	-0.423	-0.151	-0.211	-0.307	0.100	-0.130	-0.187	-0.182	-0.187
	<i>p</i> value	0.064	0.002*	0.291	0.137	0.029*	0.483	0.363	0.189	0.200	0.189
Persistent desire or repeated unsuccessful attempt to quit	s	-0.039	0.091	0.108	0.000	0.076	0.398	0.008	0.058	-0.095	0.152
	<i>p</i> value	0.788	0.525	0.452	0.999	0.595	0.004**	0.957	0.689	0.506	0.288
Much time/activity to obtain, use, recover	s	-0.091	-0.217	-0.221	-0.128	-0.316	0.387	-0.293	-0.147	0.040	-0.146
	<i>p</i> value	0.527	0.127	0.120	0.371	0.024*	0.005**	0.037*	0.302	0.781	0.306
Important social, occupational, or recreational activities given up or reduced	s	-0.088	-0.185	-0.330	-0.110	-0.384	-0.017	0.030	0.061	-0.126	0.018
	<i>p</i> value	0.538	0.193	0.018*	0.442	0.005**	0.908	0.836	0.671	0.378	0.901
Use continues despite knowledge of adverse consequences	s	0.064	0.360	0.150	0.111	0.379	0.329	0.245	0.053	0.023	0.236
	<i>p</i> value	0.653	0.009**	0.293	0.436	0.006**	0.019*	0.083	0.714	0.870	0.095
Tolerance (Observed increase in quantity and decrease in impact)	s	-0.260	0.418	0.269	0.203	0.369	0.340	0.424	0.053	0.041	0.441
	<i>p</i> value	0.065	0.002**	0.056	0.152	0.008**	0.015*	0.002**	0.710	0.774	0.001**
Characteristic withdrawal symptoms; somehow the person attempts to relieve withdrawal	s	0.027	-0.288	-0.237	-0.099	-0.328	0.272	-0.023	0.045	-0.118	0.111
	<i>p</i> value	0.853	0.040*	0.094	0.491	0.019*	0.054	0.871	0.756	0.411	0.437
The substance or behavior causes clinically significant impairment or distress	s	0.028	-0.406	-0.301	-0.080	-0.437	0.344	-0.067	-0.259	0.021	-0.035
	<i>p</i> value	0.847	0.003**	0.032*	0.575	0.001**	0.014*	0.639	0.067	0.886	0.805
YFAS Total	s	-0.085	-0.033	-0.176	-0.042	-0.162	0.562	0.081	0.001	-0.081	0.219
	<i>p</i> value	0.553	0.818	0.215	0.772	0.257	<0.001***	0.573	0.997	0.574	0.122

s: Spearman Rank Difference Correlation Coefficient, IES-2: Intuitive Eating Scale–2, EPR: Eating for Physical Rather Than Emotional Reasons, UPE: Unconditional Permission to Eat, RHSC: Reliance on Hunger and Satiety Cues, B-FCC: Body–Food Choice Congruence.

Discussion

Today, face-to-face and online nutrition counseling methods are widely used in nutrition and diet counseling. Comparing the effects of online and face-to-face nutrition counseling is important in terms of selecting the most appropriate and effective method for counselees. Since both methods have different advantages, determining the most

appropriate option according to the needs of individuals can increase the success of counseling processes.

In general, the majority of the participants were women and exhibited similar socioeconomic status, indicating that a certain equality was achieved between both methods of nutrition counseling. The results obtained from anthropometric measurements revealed that online and face-to-face nutrition counseling resulted in statistically significant reductions in weight, BMI, body fat, WC, HC, waist/hip ratio, and NC. Twelve weeks of nutrition counseling was effective in weight loss. However, there was no difference between the two methods. Al-Awadhi et al. also compared face-to-face and online personalized nutrition with a systematic review and reported significantly greater outcomes in the face-to-face groups¹⁷. On the contrary, Yang et al. stated in their systematic review and meta-analysis study that face-to-face and online nutrition counseling achieve preliminary success in promoting weight-related outcomes. In today's modern world, digitalization is increasing and becoming more widespread. Recent studies report that the results of online nutrition counseling including elements such as text messages (SMS), mobile applications, email, telephone counseling, websites, or social media are as effective as face-to-face interventions¹⁸.

Intuitive eating, EA, and nutritional knowledge are factors affecting the success of nutritional counseling. Results obtained from this study revealed that both face-to-face and online nutrition counseling improved IE behavior. Cheng et al. compared face-to-face and online IE interventions among women and reported that both methods improved body image and eating behaviors, but there were no differences between the methods¹⁹. Additionally, the results of the present study also showed that both face-to-face and online nutrition counseling positively improved YFAS subscores and total scores. Similarly, Yu et al. also revealed that both face-to-face and online nutrition counseling techniques for 12 weeks were equally effective on EA²⁰. In addition to all these findings, the results of this study showed that 12 weeks of online and face-to-face nutrition counseling had no effects on nutrition knowledge. Nutrition counseling is generally designed to increase individuals' nutritional knowledge, promote healthy eating habits, and change negative habits²¹. However, in today's modern world, social media can lead to information pollution that is difficult to notice, as well as developing positive and conscious eating behaviors and attitudes²².

Intuitive eating supports controlling hunger and satiety signals and can reduce the risk of EA. As given in Table 4, IE generally showed a negative correlation with EA. The cross-sectional survey studies indicate that IE positively correlates with improved dietary intake²³. Consistent with the literature, IE was associated with lower EA scores in our study.

This study also has some limitations. Even if the study period is three months, it may not adequately reflect long-term behavioral changes. Uncontrollable factors such as stress and social environment during the study may affect the results. The heterogeneity of the participant groups in terms of gender may also limit the generalisability of the results.

Conclusion

Twelve weeks of nutrition counseling improved anthropometric measurements; both methods were effective in weight loss. However, there were no differences between the methods. Nutrition counseling was found to statistically significantly improve IE behavior and food addiction for both face-to-face and online counseling. The level of nutritional knowledge was found to be poor in both groups, and no statistically significant change was observed at the end of the 12 weeks. The lack of effectiveness in increasing the knowledge level of nutrition counseling may be related to the short duration of the interview, insufficient individualization of the training, limited interaction of the method used, and insufficient strategies for reinforcing the knowledge. Therefore, it is important not only to extend the duration of the interview but also to structure the training content in accordance with the knowledge and learning level of the participants, to use repetition and practice-based methods, to support with digital materials, and to plan post-training follow-up processes. In addition, supporting the communication, motivation, and training skills of the dietitian providing counseling services may increase the impact of the training. An extended study period may be necessary to enhance knowledge levels effectively. In addition, a negative correlation was found between IE and food addiction. In conclusion, the results of this study suggest that the results of online nutrition counseling may be similar to those of face-to-face counseling. More studies are needed to contribute to the literature.

REFERENCES

1. Cadena-Schlam L, López-Guimerà G. Intuitive eating: an emerging approach to eating behavior. *Nutr Hosp.* 2014;31(3):995-1002. doi: 10.3305/nh.2015.31.3.7980.
2. Bas M, Karaca KE, Saglam D, et al. Turkish version of the Intuitive Eating Scale-2: Validity and reliability among university students. *Appetite.* 2017;114:391-397. doi: 10.1016/j.appet.2017.04.017.
3. Bruce LJ, Ricciardelli LA. A systematic review of the psychosocial correlates of intuitive eating among adult women. *Appetite.* 2016;96:454-472. doi: 10.1016/j.appet.2015.10.012.
4. Madden CE, Leong SL, Gray A, Horwath CC. Eating in response to hunger and satiety signals is related to BMI in a nationwide sample of 1601 mid-age New Zealand women. *Public Health Nutr.* 2012;15(12):2272-2279. doi: 10.1017/S1368980012000882.
5. Akırmak Ü, Bakiner E, Boratav HB, Güneri G. Cross-cultural adaptation of the intuitive eating scale-2: psychometric evaluation in a sample in Turkey. *Curr Psychol.* 2021;40(3):1083-1093. doi: 10.1007/s12144-018-0024-3.
6. Hauck C, Cook B, Ellrott T. Food addiction, eating addiction and eating disorders. *Proc Nutr Soc.* 2020;79(1):103-112. doi: 10.1017/S0029665119001162.

7. Ljubičić M, Matek Sarić M, Klarin I, et al. Emotions and food consumption: emotional eating behavior in a european population. *Foods*. 2023;12(4):872. doi: 10.3390/foods12040872.
8. Duralı Ö. Yetişkin Kadın Bireylerde Beslenme Bilgi Düzeyinin ve Deslenme Durumunun Saptanması. [Yüksek Lisans Tezi]. Edirne, Türkiye: Beslenme ve Diyetetik Anabilim Dalı, Trakya Üniversitesi Sağlık Bilimleri Enstitüsü; 2019.
9. Belegoli AM, Andrade AQ, Cançado AG, Paulo MN, Diniz MDFH, Ribeiro AL. Web-based digital health interventions for weight loss and lifestyle habit changes in overweight and obese adults: systematic review and meta-analysis. *J Med Internet Res*. 2019;21(1):e9609. doi: 10.2196/jmir.9609.
10. Sorgente A, Pietrabissa G, Manzoni GM, et al. Web-based interventions for weight loss or weight loss maintenance in overweight and obese people: A systematic review of systematic reviews. *J Med Internet Res*. 2017;19(6):e229. doi: 10.2196/jmir.6972.
11. Smith KJ, Kuo S, Zgibor JC, et al. Cost effectiveness of an internet-delivered lifestyle intervention in primary care patients with high cardiovascular risk. *Prev Med*. 2016;87:103-109. doi: 10.1016/j.ypmed.2016.02.036.
12. Tylka TL, Kroon Van Diest AM. The Intuitive Eating Scale-2: Item refinement and psychometric evaluation with college women and men. *J Couns Psychol*. 2013;60(1):137-153. doi: 10.1037/a0030893.
13. Gearhardt AN, Corbin WR, Brownell KD. Preliminary validation of the Yale Food Addiction Scale. *Appetite*. 2009;52(2):430-436. doi: 10.1016/j.appet.2008.12.003.
14. Buyuktuncer Z, Akyol A, Ayaz A, et al. Turkish version of the Yale Food Addiction Scale: Preliminary results of factorial structure, reliability, and construct validity. *J Health Popul Nutr*. 2019;38(1):42. doi: 10.1186/s41043-019-0202-4.
15. Batmaz H. Yetişkinler için beslenme bilgi düzeyi ölçeği geliştirilmesi ve geçerlik-güvenirlilik çalışması. [Yüksek Lisans Tezi]. İstanbul, Türkiye: Beslenme ve Diyetetik Anabilim Dalı, Marmara Üniversitesi Sağlık Bilimleri Enstitüsü; 2018.
16. Casadei K, Kiel J. Anthropometric Measurement. In: *StatPearls*. StatPearls Publishing; 2024.
17. Al-Awadhi B, Fallaize R, Zenun Franco R, Hwang F, Lovegrove JA. Insights into the delivery of personalized nutrition: evidence from face-to-face and web-based dietary interventions. *Front Nutr*. 2021;7. doi: 10.3389/fnut.2020.570531.
18. Yang M, Duan Y, Liang W, Peiris DLIHK, Baker JS. Effects of face-to-face and ehealth blended interventions on physical activity, diet, and weight-related outcomes among adults: a systematic review and meta-analysis. *Int J Environ Res Public Health*. 2023;20(2):1560. doi: 10.3390/ijerph20021560.
19. Cheng Z, Gao X, Yang C, Brytek-Matera A, He J. Effects of online and face-to-face intuitive eating interventions on body image and eating behaviors among women in China: A feasibility study. *Nutrients*. 2022;14(9):1761. doi: 10.3390/nu14091761.

20. Yu Z, Roberts B, Snyder J, et al. A pilot study of a videoconferencing-based binge eating disorder program in overweight or obese females. *Telemed J E-Health Off J Am Telemed Assoc.* 2021;27(3):330-340. doi: 10.1089/tmj.2020.0070.
21. Sánchez-Díaz S, Yanci J, Castillo D, Scanlan AT, Raya-González J. Effects of nutrition education interventions in team sport players. A systematic review. *Nutrients.* 2020;12(12):3664. doi: 10.3390/nu12123664.
22. Oran NT, Toz H, Küçük T, Uçar V. Medyanın kadınların beslenme alışkanlıkları, besin seçimi ve tüketimi üzerindeki etkileri. *Life Sci.* 2017;12(1):1-13.
23. Dyke NV, Drinkwater EJ. Review Article Relationships between intuitive eating and health indicators: Literature review. *Public Health Nutr.* 2014;17(8):1757-1766. doi: 10.1017/S1368980013002139.

Understanding Emotional Eating in Bipolar Disorder: Self-Reports vs. Objective Assessments

Pınar HAMURCU*

Abstract

Aim: Understanding emotional eating nuances in Bipolar Disorder (BD) is crucial for developing targeted interventions to effectively manage mental health and nutritional needs. This study aims to explore the relationship between BD with emotional eating behavior, as well as the disparities between self-reported appetite tendencies and objective measurements.

Method: This cross-sectional, descriptive study was conducted with 43 patients diagnosed with BD. The Information Form, Bipolar Depression Rating Scale (BDRS), Bipolar Disorder Functioning Questionnaire (BDFQ) and Emotional Eating Scale (EES) were administered through face-to-face interviews.

Results: Of the 43 BD patients, 58.1% were male, with a mean age of 26.93 ± 10.29 years and a mean body mass index (BMI) of 25.01 ± 6.06 kg/m². Gender, age, BMI, physical activity, or sleep duration were not significant factors for EES sub-dimensions in BD patients ($p > 0.05$). BD patients self-reported less eating tendency during negative emotions such as anxiety and depression and a higher tendency to eat during positive emotions like happiness. However, contrary to these self-reports, according to the BDRS, mixed symptoms (manic episodes) were positively correlated with "Control Against Stimuli" ($p = 0.003$) and "Eating when Nervous" was positively correlated with both somatic ($p = 0.002$) and psychological depression ($p = 0.005$).

Conclusion: This study highlights differences between self-reported and objective assessments of eating behaviors in BD patients. While patients reported reduced food intake during negative emotions and increased intake during positive ones, objective measures showed contrasting results. These findings emphasize the importance of using objective methods to assess eating behaviors linked to emotional states in individuals with bipolar disorder.

Keywords: Bipolar disorder, emotional eating, feeding behavior, feeding and eating disorders, obesity management.

Bipolar Bozuklukta Duygusal Yemeğin Anlaşılması: Öz-Bildirimler ve Objektif Değerlendirmeler

Öz

Amaç: Bipolar Bozukluk'ta (BB) duygusal yeme davranışlarının incelenmesi, ruh sağlığı ve beslenme ihtiyaçlarını etkili bir şekilde yönetmek için hedefe yönelik müdahaleler geliştirmek açısından önemlidir. Bu çalışma, BB ile duygusal yeme davranışı arasındaki ilişkiyi ve öz-bildirim ile nesnel ölçümler arasındaki farklılıkları araştırmayı amaçlamaktadır.

Yöntem: Kesitsel ve tanımlayıcı nitelikteki bu çalışma, BB tanısı almış 43 hasta ile gerçekleştirilmiştir. Bilgi Formu, Bipolar Depresyon Derecelendirme Ölçeği (BDDÖ), Bipolar Bozukluk İşlevsellik Ölçeği (BBİÖ) ve Duygusal Yeme Ölçeği (DYÖ) yüz yüze görüşme yöntemiyle uygulanmıştır.

Özgün Araştırma Makalesi (Original Research Article)

Geliş / Received: 27.06.2024 & **Kabul / Accepted:** 07.07.2025

DOI: <https://doi.org/10.38079/igusabder.1505802>

* Assoc. Prof. Dr., Department of Nutrition and Dietetics, Faculty of Health Sciences, Istinje University, Istanbul, Türkiye. E-mail: pinarham@gmail.com [ORCID https://orcid.org/0000-0002-7569-6984](https://orcid.org/0000-0002-7569-6984)

ETHICAL STATEMENT: Ethical approval for the research was obtained from the Uskudar University Non-Interventional Research Ethics Committee under protocol number 61351342/2020-115 and approval date of 29.02.2020, as well as from NPIstanbul Brain Hospital under protocol number 2020/602 and approval date of 05.03.2020.

Bulgular: Çalışmaya katılan 43 BB hastasının %58,1'i erkek olup, yaş ortalaması $26,93 \pm 10,29$ yıl ve Beden Kütle İndeksi (BKİ) ortalaması $25,01 \pm 6,06$ kg/m²'dir. Cinsiyet, yaş, BKİ, fiziksel aktivite veya uyku süresi, BB hastalarında DYÖ ve alt boyutları için ayırt edici faktörlerden değildir ($p > 0,05$). BB hastaları, kaygı ve depresyon gibi olumsuz duygular esnasında daha az yeme eğiliminde olduklarını ve mutluluk gibi olumlu duygular esnasında ise daha fazla yeme eğiliminde olduklarını beyan etmişlerdir. Ancak bu öz-bildirimlerin aksine, BDDÖ'ye göre karma belirtiler (manik dönemler) "Uyaran Karşısında Kontrol" ile pozitif korelasyon göstermiştir ($p = 0,003$) ve "Gerginlik Durumlarında Yeme" hem somatik depresif belirtiler ($p = 0,002$) hem de psikolojik depresif belirtiler ($p = 0,005$) ile pozitif korelasyon göstermiştir.

Sonuç: Bu çalışma, BB hastalarında yeme davranışlarının öz-bildirim değerlendirmeleri ile objektif değerlendirmeler arasındaki farklılıkları vurgulamaktadır. BB hastaları olumsuz duygular sırasında yeme eğilimlerinin azaldığını ve olumlu duygular sırasında yeme eğilimlerinin arttığını beyan etmiş olsalar da, nesnel ölçümler bu öz-bildirimlerin aksini göstermiştir. Bu bulgular, bipolar bozukluğu olan bireylerde duygusal durumlarla ilişkili yeme davranışlarını değerlendirmek için objektif yöntemlerin kullanılmasının önemini vurgulamaktadır.

Anahtar Sözcükler: Bipolar bozukluk, duygusal yeme, beslenme davranışı, beslenme ve yeme bozuklukları, obezite yönetimi.

Introduction

Bipolar Disorder (BD) is a mood disorder characterized by recurrent depressive, manic, hypomanic, or mixed episodes, resulting in significant impairments in occupational, familial, and social functioning¹. Functionality, a complex concept involving work capacity, independent living, leisure activities, and interpersonal relationships, is significantly impaired by BD, which persists throughout life, leading to a decline in quality of life². According to the Diagnostic and Statistical Manual of Mental Disorders-5 (DSM-5), BD is classified into several subtypes, including BD type I, BD type II, cyclothymic disorder, substance/medication-induced BD, BD due to another medical condition, specified and unspecified BD and related disorders³. The lifetime prevalence of BD was found to be 2.4% based on a community-based study conducted in 11 countries⁴ and affecting more than 1% of the population worldwide⁵. According to the Global Burden of Disease Study 2010, BD ranks 46th among 291 diseases and injuries worldwide in terms of disability and death⁶. Additionally, BD is often accompanied by somatic illnesses such as cardiovascular diseases, obesity, and metabolic syndrome, as well as psychiatric conditions including anxiety disorders, substance use disorders, personality/behavioral disorders, and eating disorders⁷.

Eating disorders are clinically significant mental health conditions characterized by abnormal eating behaviors, causing medical, psychological, and social issues and a negative impact on quality of life³. Eating attitudes of individuals are influenced not only by physiological factors but also by psychological factors⁸. Moreover, emotions are acknowledged to strongly influence food choices and eating behavior, while eating behavior can equally affect emotions⁹. Emotional eating, a response to emotional stimuli or mental fluctuations, is associated with adverse physiological and psychological outcomes. Specific emotions such as anger, fear, sadness, or happiness can influence an individual's eating response and eating behavior^{10,11}. Otherwise, the rising prevalence of obesity is a significant global health issue, especially in Western societies. Despite not being classified as a mental disorder, obesity is strongly linked to psychiatric syndromes, according to the DSM-5³, leading to significant social and economic burdens. The mutual relationship between depression and obesity is highlighted by research indicating that

depression increases the risk of obesity by 58%, while obesity increases the risk of depression by 55%. The mechanism through which depression increases the risk of obesity involves triggering emotional eating, leading to an increase in adipose tissue¹². Studies have indeed associated high levels of depressive symptoms with emotional eating behaviors¹³⁻¹⁷. Furthermore, the study demonstrated that mood fluctuations in BD may increase the risk of obesity and eating disorders¹⁸. Although the prevalence of obesity in BD is well-documented¹⁹, the specific mechanisms of emotional eating in this population remain largely unexplored. Understanding emotional eating nuances in BD is crucial for developing targeted interventions to effectively manage mental health and nutritional needs. This study investigates the relationship between BD and emotional eating, comparing self-reported and objective appetite measures.

Material and Methods

Study Design and Participants

This cross-sectional, descriptive study was conducted between September and December 2021 at NPIstanbul Brain Hospital. During this period, all patients diagnosed with Bipolar Disorder (BD) who met the inclusion criteria and were accessible within the clinical setting were invited to participate. A total of 43 patients voluntarily agreed and completed the study, forming the final sample. Participants were selected through a non-probability, voluntary response sampling method.

A formal power analysis was not conducted due to the exploratory nature of the study and the limited number of eligible patients available during the data collection timeframe. However, the sample size was considered sufficient for preliminary investigation, consistent with the sample sizes employed in comparable clinical studies under similar conditions.

Due to the COVID-19 pandemic measures, the study commenced in September 2021. Participants with BD were provided with detailed explanations regarding the purpose and scope of the study, and voluntary informed consent was obtained before data collection. Data collection instruments were administered through face-to-face interviews while ensuring patients' privacy and confidentiality. This study was conducted in accordance with the principles of the Helsinki Declaration and research and publication ethics.

The inclusion criteria for the study were being over 18 years of age and having a diagnosis of Bipolar I or II Disorder according to DSM-5 criteria³. Exclusion criteria included not meeting the inclusion criteria, being pregnant or lactating, and having a comorbid psychiatric diagnosis.

In the present study, the term “*self-reports*” refers to participants’ spontaneous and unstructured verbal statements provided during clinical interviews, including subjective reflections such as “I tend to eat more when I’m happy” or “I lose my appetite when I feel anxious”. These responses reflect individuals’ personal perceptions of their eating behaviors in the absence of standardized measurement tools. In contrast, “*objective assessments*” denote data collected using standardized, psychometrically validated instruments. Specifically, the Bipolar Depression Rating Scale (BDRS), Bipolar Disorder Functioning Questionnaire (BDFQ), and Emotional Eating Scale (EES) were utilized as

data collection instruments in this study. Each of these scales has demonstrated robust reliability and validity. Accordingly, the data obtained through these tools are classified as objective assessments within the scope of this research.

Data Collection Instruments

Information Form: Comprising 12 questions prepared by the researcher after reviewing the literature, this form queries demographic characteristics, anthropometric measurements, and dietary habits.

Bipolar Depression Rating Scale (BDRS): The scale, developed by Berk et al.²⁰ was adapted into Turkish by Batmaz et al.²¹. Due to its sensitivity to characteristic features of depressive episodes in bipolar disorder, such as mixed and atypical symptoms, it differs from classical depression scales. The scale consists of 20 items and 3 subscales: psychological depression (anhedonia, worthlessness, helplessness, and guilt), somatic depression (reduced concentration and activity, disrupted sleep, and appetite), and mixed symptoms (characterizing a period of excessive activity, energy, talkativeness, recklessness, and feeling powerful, which is indicative of a manic episode). Responses are measured on a four-point Likert scale. Scores on this scale can range from 0 to 60, with higher scores indicating more severe depressive episodes. The Cronbach's alpha coefficient for the scale is reported as 0.786.

Bipolar Disorder Functioning Questionnaire (BDFQ): Developed by the Scientific Study Unit of Mood Disorders of the Turkish Psychiatric Association in 2007²², the questionnaire has undergone validation and reliability testing. It is utilized to determine and assess the level of functioning exhibited by individuals with bipolar disorder across various domains. The questionnaire comprises 11 subfactors and consists of 52 items measured on a three-point Likert scale. A higher score on the scale indicates better functionality (Cronbach's alpha = 0.91).

Emotional Eating Scale (EES): Developed by Bilgen in 2018²³, the scale aims to assess individuals' emotional eating behaviors. The scale consists of 30 items, divided into four subscales. Responses are rated on a 5-point Likert scale. A higher score on the scale indicates a higher level of emotional eating behavior. The Cronbach's alpha value for the scale is 0.959.

Ethical Statement

Ethical approval for the research was obtained from the Uskudar University Non-Interventional Research Ethics Committee under protocol number 61351342/2020-115 and approval date of 29.02.2020, as well as from NPIstanbul Brain Hospital under protocol number 2020/602 and approval date of 05.03.2020.

Statistical Analysis

Descriptive statistics for categorical variables are presented as frequency and percentage. The normality of numerical variables was assessed using the Shapiro-Wilk test. Descriptive statistics for numerical variables were presented as mean ($\pm$) standard deviation for those showing normal distribution and median, minimum-maximum values for those not showing normal distribution. Independent two-group comparisons were conducted using the Independent Samples t-test when the data met the

assumptions of parametric tests and the Mann-Whitney U test when they did not. The relationships between scales were examined using Spearman's Rank Correlation Coefficient. Statistical analysis was performed using SPSS v26 (IBM Inc., Chicago, IL, USA) statistical software package.

Results

The study included 43 patients diagnosed with bipolar disorder (BD), of whom 58.1% were male, with a mean age of 26.93 ± 10.29 years and a mean BMI of 25.01 ± 6.06 kg/m². Approximately 46.5% of the patients engage in regular exercise according to World Health Organization and American Heart Association recommendations (>150 minutes/week). Walking (45.0%) and fitness activities (35.0%) are the most preferred types of exercise. The average daily sleep duration is 8.03 ± 1.63 hours, with 81.4% of patients consuming three main meals, while 51.2% do not consume any snacks. In the evaluation using the 0-10 point Visual Analog Scale (VAS), the mean appetite score of the patients was 5.93 ± 2.15 , and the mean score for perceiving adequate and balanced nutrition was 5.58 ± 1.99 (Table 1).

Table 1. Demographic characteristics and health behaviors of Bipolar Disorder Patients

Demographic Characteristics		n	%
Gender	Female	18	41.9
	Male	25	58.1
Age (Mean $\pm$ SD)		26.93 $\pm$ 10.29	
BMI (kg/m ²) (Mean $\pm$ SD)		25.01 $\pm$ 6.06	
BMI Class	Normal (18.5 – 24.9 kg/m ²)	24	55.8
	Overweight (25.0 – 29.9 kg/m ²)	9	20.9
	Obese (<30.0 kg/m ²)	10	23.3
Education	Middle School	6	14.0
	High School	17	39.5
	University and Above	20	46.5
Sleep Duration (hours/day) (Mean $\pm$ SD)		8.03 $\pm$ 1.63	
Physical Activity Status (>150 min/week)	Yes	20	46.5
	No	23	53.5
Number of Main Meals	2 meals	8	18.6
	3 meals	35	81.4
Number of Snacks	None	22	51.2
	1 snack	9	20.9
	2 snacks	5	11.6
	3 snacks	7	16.3
Skipping Meals Status	Yes	16	37.2
	No	25	58.1
	Sometimes	2	4.7
Appetite VAS Assessment (Mean $\pm$ SD)		5.93 $\pm$ 2.15	
Perception of Adequate and Balanced Nutrition VAS Assessment (Mean $\pm$ SD)		5.58 $\pm$ 1.99	

BMI: Body Mass Index; VAS: Visual Analog Scale

According to the evaluation of BD patients' BDRS, the average score for "Somatic Depression" is higher than the average scores for "Psychological Depression" and "Mixed Symptoms". According to the evaluation of BDFQ, patients' highest functional dimension is "Participation to Social Activities", while the lowest functional dimension is "Emotional Functioning". According to the evaluation of EES, patients' average scores for the sub-dimensions of "Eating when Nervous" and "Eating to Cope with Negative Emotions" higher than the average scores for "Self-Control" and "Control Against Stimuli" (Table 2).

Table 2. Assessment of data collection instruments scores in Bipolar Disorder Patients

	n	Min	Max	Mean	SD
BDRS					
Somatic Depression	43	0.00	21.00	7.74	5.50
Psychological Depression	43	0.00	18.00	5.02	5.19
Mixed Symptoms	43	0.00	12.00	5.21	3.67
BDFQ - Total	43	61.00	131.00	94.79	14.99
Emotional Functioning	43	3.00	8.00	5.12	1.42
Intellectual Functioning	43	4.00	10.00	7.16	1.63
Sexual Functioning	43	0.00	12.00	5.58	4.80
Feelings of Stigmatization	43	4.00	12.00	9.56	2.72
Social Withdrawal	43	3.00	9.00	6.33	1.89
Household Relations	43	6.00	18.00	12.35	3.89
Relations with Friends.	43	5.00	15.00	10.63	3.29
Participation to Social Activities	43	8.00	24.00	15.33	5.19
Daily Activities and Hobbies	43	8.00	22.00	13.37	3.60
Taking Initiative and Self Sufficiency	43	3.00	9.00	5.12	2.04
Occupation	43	0.00	12.00	4.26	3.48
EES					
Eating when Nervous	43	12.00	53.00	26.60	11.93
Eating to Cope with Negative Emotions	43	11.00	43.00	20.72	9.64
Self-Control	43	5.00	21.00	13.84	3.77
Control Against Stimuli	43	2.00	10.00	5.58	2.50

BDRS: Bipolar Depression Rating Scale; BDFQ: Bipolar Disorder Functioning Questionnaire; EES: Emotional Eating Scale

It was determined that gender, BMI, or physical activity were not significant factors for BDRS sub-dimensions in BD patients ($p>0.05$). On the other hand, as age increased, there was a 30.3% decrease in "Mixed Symptoms" score ($p=0.048$); as sleep duration increased, there was a 34.7% increase in "Somatic Depression" score ($p=0.023$) and a 32.2% increase in "Psychological Depression" score ($p=0.035$). With increasing age of BD patients, there was a 38.3% increase in BDFQ score ($p=0.011$) and as sleep duration increased, there was a 51.1% decrease in BDFQ score ($p=0.000$). Gender, age, BMI,

physical activity, or sleep duration were not significant factors for EES sub-dimensions in BD patients ($p>0.05$) (Table 3).

Table 3. Evaluation of data collection instruments scores according to some demographic variables of Bipolar Disorder Patients

	BDRS Somatic Depression	BDRS Psychological Depression	BDRS Mixed Symptoms	BDFQ-Total	EES Eating when Nervous	EES Eating to Cope with Negative Emotions	EES Self- Control	EES Control Against Stimuli
	Medyan (min-max)	Medyan (min-max)	X $\pm$ SS	X $\pm$ SS	Medyan (min- max)	Medyan (min- max)	X $\pm$ SS	Medyan (min- max)
Gender								
Female	7.5 (2-21)	5 (0-18)	5.56 $\pm$ 4.1	92.72 $\pm$ 14.31	25 (12-53)	16 (11-39)	14.28 $\pm$ 3.58	6 (2-10)
Male	6 (0-20)	3 (0-15)	4.96 $\pm$ 3.4	96.28 $\pm$ 15.58	23 (12-52)	17 (11-43)	13.52 $\pm$ 3.95	5 (2-9)
t - U	$U=187$	$U=178$	$t=0.520$	$t=-0.764$	$U=207$	$U=215.5$	$t=0.645$	$U=211.5$
p	$p=0.348$	$p=0.243$	$p=0.606$	$p=0.449$	$p=0.657$	$p=0.814$	$p=0.522$	$p=0.737$
Age	$s=-0.204$	$s=-0.208$	$s=-0.303$	$s=0.383$	$s=-0.002$	$s=0.060$	$s=0.076$	$s=-0.023$
	$p=0.190$	$p=0.181$	$p=0.048^*$	$p=0.011^*$	$p=0.991$	$p=0.702$	$p=0.630$	$p=0.882$
BMI	$s=-0.070$	$s=-0.053$	$s=-0.007$	$s=0.000$	$s=0.032$	$s=0.007$	$s=-0.043$	$s=0.043$
	$p=0.657$	$p=0.735$	$p=0.965$	$p=1.000$	$p=0.839$	$p=0.965$	$p=0.786$	$p=0.785$
Physical Activity								
Yes	6 (0-17)	2.5 (0-18)	3 (0-12)	102.5 $\pm$ 13.48	22.5 (12-53)	15 (11-38)	15.5 (5-21)	4 (2-10)
No	7 (0-21)	4 (0-18)	6 (2-12)	88.09 $\pm$ 13.08	24 (12-52)	19 (11-43)	13 (5-21)	6 (2-9)
t - U	$U=227.5$	$U=-1.191$	$U=-1.725$	$t=3.553$	$U=-0.659$	$U=-1.101$	$U=-1.394$	$U=-1.207$
p	$p=0.951$	$p=0.234$	$p=0.084$	$p=0.001^{**}$	$p=0.510$	$p=0.271$	$p=0.163$	$p=0.227$
Sleep Duration	$s=0.347$	$s=0.322$	$s=0.244$	$s=-0.511$	$s=0.009$	$s=-0.126$	$s=-0.149$	$s=0.060$
	$p=0.023^*$	$p=0.035^*$	$p=0.116$	$p=0.000^{***}$	$p=0.953$	$p=0.421$	$p=0.342$	$p=0.702$

BDRS: Bipolar Depression Rating Scale; BDFQ: Bipolar Disorder Functioning Questionnaire; EES: Emotional Eating Scale; BMI: Body Mass Index

t: Independent Sample T Test, U: Mann-Whitney U Test, s: Spearman's Rank Difference Correlation Coefficient, *: <0,05; **: <0,01; ***: <0,00

When examining the effects of emotions on appetite, it was found that 25.6% of BD patients reported eating less when feeling anxious, while 25.6% reported eating less when feeling depressed, and 32.6% reported eating more when feeling happy, based on patients' self-reports (Table 4).

Table 4. Mood effects on eating behavior among bipolar disorder patients: self-reported data

Effects of Mood on Eating Behavior		n	%
Sadness	Eat More	10	23.3
	Eat Less	10	23.3
	Not Sure/Unknown	23	53.4
Stress	Eat More	10	23.3
	Eat Less	10	23.3
	Not Sure/Unknown	23	53.4
Anxiety	Eat More	7	16.3
	Eat Less	11	25.6
	Not Sure/Unknown	25	58.1
Depression	Eat More	9	20.9
	Eat Less	11	25.6
	Not Sure/Unknown	23	53.5
Happiness	Eat More	14	32.6
	Eat Less	5	11.6
	Not Sure/Unknown	24	55.8

A moderate positive correlation ($r=0.457$; $p<0.01$) was found between "Somatic Depression" and "Eating when Nervous". Similarly, "Psychological Depression" showed a moderate positive correlation ($r=0.418$; $p=0.005$) with "Eating when Nervous", and a weak positive correlation ($r=0.337$; $p=0.027$) with "Control Against Stimuli". Additionally, "Mixed Symptoms" correlated moderately positively ($r=0.438$; $p=0.003$) with "Control Against Stimuli". Conversely, there was a weak positive correlation ($r=0.371$; $p<0.05$) between "Self-Control" in BDFQ and EES (Table 5).

Table 5. Correlation coefficients between data collection instruments

EES		BDRS Somatic Depression	BDRS Psychological Depression	BDRS Mixed Symptoms	BDFQ
Eating when Nervous	s	,457	,418	,255	-,170
	p	,002**	,005**	,099	,275
Eating to Cope with Negative Emotions	s	,249	,234	,215	-,019
	p	,107	,131	,167	,901
Self-Control	s	-,294	-,249	-,148	,371
	p	,056	,107	,343	,014*
Control Against Stimuli	s	,265	,337	,438	-,205
	p	,086	,027*	,003**	,187

BDRS: Bipolar Depression Rating Scale; BDFQ: Bipolar Disorder Functioning Questionnaire; EES: Emotional Eating Scale; s: Spearman's Rank Difference Correlation Coefficient; *: $<0,05$; **: $<0,01$; ***: $<0,001$

Discussion

Among the 43 patients diagnosed with BD (41.9% female), it was found that 4 out of every 5 patients consumed three main meals, while half of the cohort reported no consumption of snacks. In self-reported evaluations, BD patients indicated moderate levels for both appetite, with a mean score of 5.93 ± 2.15 , and perception of adequate and balanced nutrition, with a mean score of 5.58 ± 1.99 (Table 1). According to the BDRS (Bipolar Depression Rating Scale) assessment, the mean scores for somatic depression exceeded those for psychological depression and mixed symptoms (manic episode) (Table 2). No significant differences or correlations were identified between the emotional appetites of BD patients and demographic variables such as gender, age, BMI, physical activity status, or sleep patterns (Table 3). Similarly, no relationship was established between the emotional appetites of BD patients and variables such as gender, BMI²⁴, exercise, and dietary habits²⁵.

In the literature, there are studies reporting a higher tendency for emotional eating in positive mood states among healthy individuals^{15,16}, as well as studies indicating a greater inclination for emotional eating in negative mood states^{13,14}. Additionally, Hamurcu & Arslan's study suggests similarities in eating tendencies in both positive and negative mood states¹⁷. Consensus has not been reached in the literature regarding the augmenting or diminishing effects of positive or negative emotions on appetite. In this study, the majority of BD patients self-reported decreased eating in response to negative emotions, such as anxiety and depression, while indicating an increased tendency to overeat during periods of happiness (Table 4). However, contrary to these self-reported findings, analysis using the Emotional Eating Scale (EES) revealed positive correlations between somatic depression and psychological depression with Eating When Nervous. Additionally, psychological depression, along with mixed symptoms (manic episode—positive mood states), exhibited positive correlations with Control Against Stimuli, reflecting external eating behavior control (eating behavior triggered by visual, olfactory, or environmental cues) and hedonic hunger control (the ability to resist the urge to eat driven by the sensory appeal of food rather than physiological energy needs) such as resisting the urge to consume a food item triggered by visual or olfactory cues. Although not statistically significant, self-control (cognitive restriction of food intake—consciously limiting how much food a person eats, usually to control weight or follow a diet) demonstrated a negative correlation with all dimensions of the BDRS, encompassing both positive and negative mood states (Table 5). In other words, emotional eating behavior correlates with heightened uncontrolled eating, particularly in the presence of negative mood states among BD patients. Additionally, the study reveals that BD patients experience a decrease in their ability to control food intake as emotional eating behavior intensifies. Consequently, increased emotional eating undermines patients' capacity to resist the urge to eat. This observation aligns with the outcomes of Tuncer and Duman's study, indicating that patients with severe mental disorders are susceptible to emotional eating behavior²⁵. These findings suggest that, contrary to the self-reported behaviors of patients with BD, overeating behavior increases in response to negative mood, while external eating behavior decreases in the presence of both negative and positive moods. Additionally, BD patients avoid cognitive restriction of food intake, regardless of

positive/negative emotional states. Highlighting the observation that the average scores of the patients' Eating when Nervous and Eating to Cope with Negative Emotions sub-dimensions were higher compared to the mean scores of Self-Control and Control Against Stimuli, as per the EES assessment, further corroborates this evaluation (Table 2). In Tuncer and Duman's study, patients with severe mental disorders declared that negative emotions, distressing thoughts, inability to manage leisure time, and initiating factors served as triggers for their emotional eating²⁵. These findings collectively underscore the intricate interplay between mood states and eating behaviors in BD patients. The controlled response to external stimuli (such as visual or olfactory food cues) irrespective of depressive or manic episodes could be interpreted as their relationship with food is more associated with emotions than with hedonic hunger. Additionally, according to BDFQ (Bipolar Disorder Functioning Questionnaire), this discovery is reinforced by the observation that the highest functional dimension was Participation in Social Activities, whereas the lowest functional dimension was Emotional Functioning (Table 2).

A key and conceptually significant finding of the present study is the notable contradiction between participants' subjective self-reports and their scores on the Emotional Eating Scale (EES). During clinical interviews, many participants expressed a tendency to eat less when experiencing negative emotional states such as sadness, anxiety, or distress. These spontaneous verbalizations reflected a pattern of appetite suppression during emotional downturns. However, in contrast to these narratives, scores obtained from the EES revealed a marked increase in emotional eating associated with negative emotions. This divergence suggests a potential disconnection between individuals' perceived and actual eating behaviors in the context of bipolar disorder. It may reflect limited emotional insight, difficulties in affective self-monitoring, or underlying cognitive distortions—phenomena commonly reported in bipolar populations. From a clinical perspective, this misalignment highlights the risk of relying solely on patient narratives when assessing emotional eating tendencies. It underscores the importance of incorporating standardized, validated instruments alongside qualitative evaluations to achieve a more accurate and comprehensive understanding of behavioral patterns. Furthermore, this inconsistency represents a novel contribution to the literature, emphasizing that self-perception and objective behavior may not always align in mood disorders. To our knowledge, no previous studies have directly examined the specific contradiction between self-reported and objectively assessed emotional eating within a bipolar disorder sample. Although emotional eating has been investigated in individuals with mood disorders, including BD, most studies have relied exclusively on self-reported data. For example, a 2022 narrative review highlights emotional eating tendencies in this population but does not address potential discrepancies between subjective reports and psychometric assessments²⁶. Similarly, studies such as Tuncer and Duman²⁵ have documented elevated emotional eating in individuals with severe mental illness; however, they primarily reflect perceived behaviors without validation through standardized tools. The present study contributes uniquely by directly comparing self-perceived appetite changes with scores from a validated scale—the Emotional Eating Scale (EES). This approach revealed a notable mismatch between participants' subjective accounts and objective findings, potentially indicating limited emotional insight. These

results underscore the importance of integrating both qualitative and quantitative methods in the assessment of eating behaviors in BD and suggest the presence of a cognitive-affective disconnection that may not be captured through self-report alone.

The results of the self-assessment of appetite in positive/negative moods (patients' attention) and the results of the analyses using scales that have validity and reliability studies (patients' attitude) point to different findings that could be explained by the proposal in the study by Keng et al., where the attentional and attitudinal components of awareness were suggested to be negatively associated²⁷. Similarly, just as individuals with anorexia nervosa often possess knowledge levels about nutrition far above average (attentional aspect), yet may struggle to translate this knowledge into behavior (attitudinal aspect), the discrepancy observed between the self-reported mood-related eating behaviors of patients and the findings from the EES in this study could potentially be attributed to the incongruence of the attentional and attitudinal components in BD patients, likely influenced by chronic depressive and manic episodes. This is corroborated by the significant positive correlation between functioning and EES-Self-Control which attitude-oriented eating behavior, representing cognitive restraint in eating behavior.

Appetite changes are among the diagnostic criteria for major depression. While a decrease in appetite is typically observed, excessive appetite increase, often associated with emotional eating, is frequently seen in cases accompanied by eating disorders²⁸. The findings of this study highlight the emotional appetite and eating attitudes in BD patients who experience alternating periods of major depressive and manic episodes (both positive and negative mood states) continuously. This contributes to the literature not only by demonstrating how individuals' eating attitudes are influenced by psychological factors, in addition to physiological factors such as ghrelin and leptin, but also by revealing variations within the same individuals in depressive negative mood states or manic episodes, akin to positive mood states. According to Macht, emotions have an influence of approximately 30% to 48% on appetite, indicating a significant impact of emotional states on food choices and eating behavior⁸. This suggests a bidirectional relationship where not only emotions affect eating behavior, but eating behavior also exerts a substantial influence on emotions (Table 5).

Conclusion

This study reveals discrepancies between self-reported eating behaviors and objective assessments among BD patients. While patients reported reduced food intake during negative emotions and increased intake during positive emotions, objective measures yielded contrasting results. These findings underscore the necessity for employing more objective methods to determine eating behaviors aligned with the emotional states of individuals with BD.

Given the observed discrepancy between self-reported and objectively assessed emotional eating, it is recommended that mental health professionals and dietitians working with BD patients employ a dual-assessment approach. This combined method facilitates a more precise identification of emotional eating patterns, including unconscious behaviors that may be overlooked through self-report alone.

Overall, addressing emotional eating behaviors in BD patients has the potential to enhance treatment outcomes and improve quality of life for this vulnerable population. Further research and clinical efforts are warranted to effectively address the complex interplay between BD and emotional eating behavior and to develop evidence-based interventions tailored to the unique needs of BD patients.

Limitations

This study has several limitations that should be considered when interpreting the results. First, the sample size was relatively small (n=43 BP patients), which may limit the generalizability of the findings. Second, the cross-sectional design prevents any causal inferences from being drawn regarding the relationships observed. Third, although standardized and validated scales were used for objective assessments, some data relied on self-reports, which may be subject to recall bias or subjective interpretation. These limitations call for larger, long-term studies using more objective measures to better understand eating behaviors in BD.

Statements & Declarations

Ethical Considerations: Numbered 61351342/2020-115 and dated 29.02.2020 was obtained from the Uskudar University Non-Interventional Research Ethics Committee as well as from NPIstanbul Brain Hospital under protocol number 2020/602 and approval date of 05.03.2020. This research was conducted in accordance with the "Helsinki Declaration Principles" and "Research and Publication Ethics".

Acknowledgement: The author would like to thank Mr. AÇ for performing the statistical analyses of the study and all patients who participated in this study.

Competing Interests: The author has no relevant financial or non-financial interests to disclose.

Conflict of Interest: No potential conflict of interest was reported by the author.

Data Availability: The datasets generated during the current study are available from the author on reasonable request.

Consent to Participate: Informed consent was obtained from all individual participants included in the study.

Funding: This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

REFERENCES

1. Bauer M, Andreassen OA, Geddes JR, et al. Areas of uncertainties and unmet needs in bipolar disorders: Clinical and research perspectives. *Lancet Psychiatry*. 2018;5:930-939. doi: 10.1016/S2215-0366(18)30253-0.
2. Işık E, Işık U, eds. *Depressive and Bipolar Disorders in Children, Adolescents, Adults and the Elderly*, 1th ed. Ankara: Rota Tıp; 2013.
3. American Psychiatric Association. *Diagnostic and Statistical Manual of Mental Disorders (DSM-5)*. 5th ed. Washington, DC: American Psychiatric Association Publishing; 2013.

4. Merikangas KR, Jin R, He JP, et al. Prevalence and correlates of bipolar spectrum disorder in the world mental health survey initiative. *Arch Gen Psychiatry*. 2011;68(3):241-251. doi: 10.1001/archgenpsychiatry.2011.12.
5. Grande I, Berk M, Birmaher B, et al. Bipolar disorder. *Lancet*. 2016;387(10027):1561-1572. doi: 10.1016/S0140-6736(15)00241-X.
6. Murray CJ, Vos T, Lozano R, et al. Disability-adjusted life years (DALYs) for 291 diseases and injuries in 21 regions, 1990-2010: a systematic analysis for the Global Burden of Disease Study 2010. *Lancet*. 2012;380(9859):2197-2223. doi: 10.1016/S0140-6736(12)61689-4.
7. Schaffer A, Isometsä ET, Tondo L, et al. Epidemiology, neurobiology and pharmacological interventions related to suicide deaths and suicide attempts in bipolar disorder: Part I of a report of the International Society for Bipolar Disorders Task Force on Suicide in Bipolar Disorder. *Aust N Z J Psychiatry*. 2015;49(9):785-802. doi: 10.1177/0004867415594427.
8. Macht M. How emotions affect eating: A five-way model. *Appetite*. 2008;50(1):1-11. doi: 10.1016/j.appet.2007.07.002.
9. Levitan RD, Davis C. Emotions and eating behavior: Implications for the current obesity epidemic. *University of Toronto Quarterly*. 2010;79(2):783-99. doi: 10.3138/utq.79.2.783.
10. Economy AM. Exploring the association between emotions and eating behavior. Capstone Project, Winona State University, 2013.
11. Desmet P, Schifferstein H. Sources of positive and negative emotions in food experience. *Appetite*. 2008;50(2-3):290-301. doi: 10.1016/j.appet.2007.08.003.
12. Luppino FS, de Wit LM, Bouvy PF, et al. Overweight, obesity, and depression: A systematic review and meta-analysis of longitudinal studies. *Arch Gen Psychiatry*. 2010;67(3):220-229. doi: 10.1001/archgenpsychiatry.2010.2.
13. Cecchetto C, Aiello M, Gentili C, et al. Increased emotional eating during COVID-19 associated with lockdown, psychological and social distress. *Appetite*. 2021;160:105122. doi: 10.1016/j.appet.2021.105122.
14. Al-Musharaf S. Prevalence and predictors of emotional eating among healthy young Saudi women during the COVID-19 pandemic. *Nutrients*. 2020;12(2923):1-17. doi: 10.3390/nu12102923.
15. Kornacka M, Czepczor-Bernat K, Napieralski P, et al. Rumination, mood, and maladaptive eating behaviors in overweight and healthy populations. *Eating and Weight Disorders: EWD*. 2021;26(1):273-285. doi: 10.1007/s40519-020-00857-z.
16. Alalwan TA, Hilal SJ, Mahdi AM, et al. Emotional eating behavior among University of Bahrain students: A cross-sectional study. *Arab Journal of Basic and Applied Sciences*. 2019;26(1):424-432. doi: 10.1080/25765299.2019.1655836.

17. Hamurcu P, Arslan M. The relationship between mood, life satisfaction and emotional appetite: A study on university students. *Gevher Nesibe Journal of Medical and Health Sciences*. 2022;7(17):119-130. doi: 10.46648/gnj.367.
18. Romo-Nava F, Blom T, Guerdjikova A, et al. Evening chronotype, disordered eating behavior, and poor dietary habits in bipolar disorder. *Acta Psychiatrica Scandinavica*. 2020;142(1):58-65. doi: 10.1111/acps.13179.
19. Zhao Z, Okusaga OO, Quevedo J, et al. The potential association between obesity and bipolar disorder: A meta-analysis. *J Affect Disord*. 2016;202:120-123. doi: 10.1016/j.jad.2016.05.059.
20. Berk M, Malhi GS, Cahill C, et al. The Bipolar Depression Rating Scale (BDRS): Its development, validation and utility. *Bipolar Disorders*. 2007;9(6):571-579. doi: 10.1111/j.1399-5618.2007.00536.x.
21. Batmaz S, Ozdel K, Kocbiyik S, et al. The validity and reliability of the Turkish version of the Bipolar Depression Rating Scale. *Comprehensive Psychiatry*. 2014;55(6):1448-1454. doi: 10.1016/j.comppsy.2014.04.020.
22. Aydemir Ö, Eren İ, Savaş H, et al. Development of a questionnaire to assess inter-episode functioning in bipolar disorder: bipolar disorder functioning questionnaire. *Turkish Journal of Psychiatry*. 2007;18:344-352.
23. Bilgen SŞ. Development, Validity and Reliability Study Of Turkish Emotional Eating Scale [master's thesis]. İstanbul, Türkiye: Üsküdar University Institute of Social Sciences; 2018.
24. Martin K, Woo J, Timmins V, et al. Binge eating and emotional eating behaviors among adolescents and young adults with bipolar disorder. *J Affect Disord*. 2016;195:88-95. doi: 10.1016/j.jad.2016.02.030.
25. Tuncer GZ, Duman ZÇ. An examination of emotional eating behavior in individuals with a severe mental disorder. *Archives of Psychiatric Nursing*. 2020;34(6):531-536. doi: 10.1016/j.apnu.2020.10.002.
26. Koning E, Vorstman J, McIntyre RS, Brietzke E. Characterizing eating behavioral phenotypes in mood disorders: a narrative review. *Psychological Medicine*. 2022;52, 2885-2898. doi: 10.1017/S0033291722002446.
27. Keng SL, Smoski MJ, Robins CJ. Effects of mindfulness on psychological health: A review of empirical studies. *Clin Psychol Rev*. 2011;31(6):1041-1056. doi: 10.1016/j.cpr.2011.04.006.
28. Sevinçer GM, Konuk N. Emotional eating. *Journal of Mood Disorders*. 2013;3(4):171- 178. doi: 10.5455/jmood.20130926052526.

Experiences of Academicians at a Faculty of Health Sciences Regarding Students of Generation Z: A Phenomenological Research

Funda ÇİTİL CANBAY*, Elif Tuğçe ÇİTİL GÜLDÜ**

Abstract

Aim: The research was conducted to examine the experiences of academics at a health sciences faculty regarding Generation Z students.

Method: This qualitative phenomenological study was conducted at the faculty of health sciences of a public university in Türkiye with 25 academicians with academic experience ranging from 5 to 35 years. The interviews were semi-structured, face-to-face, in-depth interviews. Colaizzi content analysis was applied in the analysis.

Results: Four themes, nine main categories, and thirty-seven subcategories were discovered from the experiences: Problems Experienced in Activities, Perceived Advantages in Activities, Experience of Anxiety and Stress, and Strategies to Cope with Challenges. Academicians agreed that students had difficulty in educational activities due to their Generation Z characteristics. While academicians appreciated some positive characteristics of students, they complained about students' adaptation, generation gap and style problems, and low academic achievement/productivity. Despite the difficulties, anxiety, and stress, academicians made an effort to understand and support students.

Conclusion: The study concluded that academics generally have difficulty interacting with Generation Z students. Academics working in the health field need to develop appropriate coping strategies to increase educational efficiency and manage anxiety/stress. In addition, positive interactions should be provided with education and supportive approaches appropriate to the characteristics of Generation Z.

Keywords: Academicians, generation Z, health education, students, Faculty of Health Sciences.

Sağlık Bilimleri Fakültesi Akademisyenlerinin Z Kuşağı Öğrencilerine İlişkin Deneyimleri: Fenomenolojik Bir Araştırma

Öz

Amaç: Araştırma, bir sağlık bilimleri fakültesi akademisyenlerinin Z kuşağı öğrencilerine ilişkin deneyimlerini incelemek amacıyla yapılmıştır.

Yöntem: Bu nitel desendeki fenomenoloji araştırması; Türkiye'de bir kamu üniversitesinin sağlık bilimleri fakültesinde, akademik deneyimleri 5-35 yıl arasında değişen 25 akademisyenle gerçekleştirilmiştir. Görüşmeler yarı yapılandırılmış olarak, yüz yüze derinlemesine görüşme tekniğiyle gerçekleştirilmiştir. Analizde Colaizzi içerik analizi uygulanmıştır.

Bulgular: Deneyimlerden dört tema, dokuz ana kategori ve otuz yedi alt kategori keşfedildi: Etkinliklerde Yaşanan Sorunlar, Etkinliklerde Algılanan Avantajlar, Kaygı ve Stres Deneyimi ve Zorluklarla Başa Çıkma Stratejileri. Akademisyenler öğrencilerin Z Kuşağına özgü özellikleri nedeniyle eğitim faaliyetlerinde

Özgün Araştırma Makalesi (Original Research Article)

Geliş / Received: 22.07.2024 & **Kabul / Accepted:** 07.07.2025

DOI: <https://doi.org/10.38079/igusabder.1519782>

* Corresponding Author, Asst. Prof. Dr., PhD., Department of Midwifery, Faculty of Health Sciences, Atatürk University, Erzurum, Türkiye. E-mail: Midwifeelif23@gmail.com ; funda.citil@atauni.edu.tr [ORCID https://orcid.org/0000-0001-7520-4735](https://orcid.org/0000-0001-7520-4735)

** Asst. Prof. Dr., PhD., MD., Department of Midwifery, Faculty of Health Sciences, Kütahya Health Sciences University, Kütahya, Türkiye. E-mail: midwifeelif23@gmail.com ; elifugce.citil@ksbu.edu.tr [ORCID https://orcid.org/0000-0003-2815-7010](https://orcid.org/0000-0003-2815-7010)

ETHICAL STATEMENT: This study was carried out with the approval of the Ethics Committee of Kütahya Health Sciences University, dated 18/01/2022 and numbered 2022/01 A signed subject consent form in accordance with the Declaration of Helsinki was obtained from each participant.

zorlandıkları konusunda hemfikirdi. Akademisyenler öğrencilerin bazı olumlu özelliklerini takdir ederken, öğrencilerin uyum, kuşak çatışması ve üslup sorunlarından ve akademik başarı/verim düşüklüğünden şikâyetçi olmuşlardır. Zorluklara, kaygıya ve strese rağmen akademisyenler öğrencileri anlama ve destekleme konusunda gayret göstermişlerdir.

Sonuç: Araştırmada akademisyenlerin Z kuşağı öğrencileriyle etkileşimde genelde zorluk yaşadıkları sonucuna varılmıştır. Sağlık alanında çalışan akademisyenlerin eğitim verimliliğini arttırmaya ve kaygı/stres yönetimine yönelik uygun başa çıkma stratejileri geliştirmeleri gerekmektedir. Ayrıca Z kuşağının özelliklerine uygun eğitim ve destekleyici yaklaşımlarla olumlu etkileşimler sağlanmalıdır.

Anahtar Sözcükler: Akademisyenler, öğrenciler, sağlık eğitimi, Z kuşağı, Sağlık Bilimleri Fakültesi.

Introduction

Students of each generation exhibit different patterns of learning behavior that distinguish them from student groups of a previous generation. Understanding intergenerational learning diversity and updating educational approaches entails adapting generation-specific approaches into educational activities^{1,2}. Generation Z students in the fields of health and medicine use technology actively, have entrepreneurial characteristics, experience concerns about the future, and do not prefer to work under stress in a tight timeframe^{2,3}. It is important to update the educational framework to support student preferences to facilitate learning for different generations in health education^{4,5}.

Considering the age groups of students in universities in recent years, most individuals are known to be of Generation Z. Accordingly, new challenges and problems specific to Generation Z arise in educational activities³. These challenges are mainly challenges regarding adaptation problems, expected success, and efficiency. In this context, adaptation may be facilitated by taking into account effective consultancy services for Generation Z individuals receiving and to receive health education, voluntary orientation activities of academicians, different learning environments, and student expectations¹. In addition, educators are required to act strategically to increase students' success in online or formal education applications⁶.

One study examined the different teaching approaches of three generations of health science educators to Generation Z students⁷. According to this study,⁷ Generation Y educators were described as “disciplined empathic,” Generation X educators as “flexible,” and Generation Z educators as “innovative.” Although generational differences affect learning, according to academics' experiences, what is known about Generation Z students is limited⁷⁻⁹. In researches conducted, it was understood that Z Generation students experienced conflict of generations with academicians and had communication difficulties^{3,8-10}. As far as it is known, even though Generation Y and Z students share similar traits, conflicts between students arise due to their differences as well. The effects of intergenerational conflict can be limited by building a bridge with students from different generations over similar characteristics, as well as adapting technology to learning activities³. Research observed an increase in the work efficiency of Generation Z students who were able to make decisions during hospital practice, were given sufficient time to complete a task, received feedback, and received sufficient social support². As can be seen, research on Generation Z focused on exploring the needs, perspectives, and experiences of students in the field of health and medicine^{5,6,11,12}. As far

as is known, there is no existing research in Türkiye on the experiences of Generation Z students and academicians in health sciences in educational activities. We anticipate that the results of the findings of this study will provide information to the literature in terms of limiting intergenerational conflicts and perceived difficulties. We carried out this qualitative research to describe the experiences of academicians at the faculty of health sciences at a state university in western Türkiye regarding their Generation Z students. With this purpose, the research seeks answers to the following questions: (I) What are the feelings, opinions, and perceptions of academicians about Generation Z students? (II) What are academicians' experiences with Generation Z students?

Material and Methods

Research Design

Phenomenological qualitative design allows for a deep exploration of the nature of the realities of individuals who experience a situation or event. In this study, the opinions of academics who experienced one-on-one education and training processes with Generation Z students were investigated¹³. A phenomenological qualitative research design was adopted to explore Turkish academicians' experiences and current educational activities of Generation Z students at the faculty of health sciences. The method is inductive. This method enables the description of the details of emotions and perceptions¹³.

Research Location and Date

The research was conducted between February 15, 2022 and December 15, 2022 with academicians working at the faculty of health sciences at a state university in western Türkiye.

This research was conducted in a single center. The research location is preferred because the university is a health sciences university, and academics from different branches in the field of health sciences are concentrated in this university.

Study Sample

In this research, purposive sampling was used to reach a wide range of different perceptions. In triangulation, interviews were planned according to gender and department experiences with maximum diversity¹⁴. Academicians were invited to interviews based on the distribution of the number of academician staff in the departments and their working experiences. Participant inclusion criteria; (a) Academicians who have 5 or more academic experience; (b) have taught for at least two semesters; (c) are willing and willing to participate in research. Table 1 shows the characteristics of academicians.

Table 1. Descriptive description of the academicians

Coder	Gender	Generation	Experience	All department worked
A1	Male	Y	Junior	Physical Therapy and Rehabilitation
A2	Female	X	Senior	Physical Therapy and Rehabilitation
A3	Female	Y	Junior	Nursing
A4	Female	Y	Junior	Ergo Therapy
A5	Male	Y	Junior	Ergo Therapy
A6	Female	Y	Junior	Language Speech Therapy
A7	Female	X	Senior	Nursing
A8	Female	Y	Junior	Ergo therapy
A9	Male	Y	Junior	Physical Therapy and Rehabilitation
A10	Female	X	Senior	Physical Therapy and Rehabilitation
A11	Female	X	Senior	Nursing
A12	Female	Y	Senior	Physical Therapy and Rehabilitation
A13	Female	Y	Senior	Midwifery
A14	Female	Y	Senior	Midwifery
A15	Female	Y	Senior	Nursing
A16	Female	Y	Senior	Nursing
A17	Female	Y	Senior	Nursing
A18	Female	X	Senior	Midwifery
A19	Male	X	Senior	Physical Therapy and Rehabilitation
A20	Female	X	Senior	Nursing
A21	Male	Y	Senior	Physical Therapy and Rehabilitation
A22	Female	Y	Senior	Nursing
A23	Female	Y	Junior	Nutrition and Dietetics
A24	Female	Y	Junior	Nutrition and Dietetics
A25	Female	Y	Junior	Language Speech Therapy

Academician: A, Junior (more than 5 years, less than 10 years), Senior (more than 10 years)

Data Collection Process

The interview guide is a structured form. Researchers made use of literature information to ensure the validity and reliability of the interview form^{5,6,15-17}. Later, the guide was revised after the recommendations of four experts in the field of midwifery and nursing. A pilot interview was held with five Generation Z students from each department at the Faculty of Health Sciences to ensure validity. However, the data analyzed from the pilot interview were not included in the results of the research. Semi-structured interview questions are shown in detail in Table 2.

Table 2. Interview Questions

No	Question
1	Tell us a little more about yourself, please. Based on your experience, how would you generally describe your Generation Z students? Why?
2	Please provide information about your work (education, training, practice, laboratory, and internship) and activities (club, seminar, research, social events) with Generation Z students.
3	Based on your observations and experiences, how do you interact with your Generation Z students? What positive and negative aspects do you notice during your work and activity experiences?
4	What problems and obstacles do you encounter? What were your strategies for dealing with these obstacles and problems?
5	What do you think are the main differences between you and Generation Z students compared to individuals in your generation?
6	How do the attitudes of Generation Z students of the faculty of health sciences affect you?
7	Are you satisfied with the Generation Z students at the Faculty of Health Sciences? Why?
8	Based on all your statements, what are your concerns and expectations, if any, regarding Generation Z students?

Appointments were made for all participants, and no academicians left the research. Since the participant academicians were selected from the faculty, in-depth interviews were conducted using a structured interview form in their offices, where they felt safest or in a suitable room within the faculty. No one other than the interviewer and the participant was present during the interviews. The first female researcher conducted the interviews in Turkish. The average duration of the interviews was 38 minutes (33-62 minutes). The interviews were digitally recorded and all statements were converted into documents within 48 hours after the interview. Short notes were taken during the interviews in case of any disruptions in the recordings. Two female researchers have doctoral degrees in midwifery and are experienced and trained in qualitative research. In the deciphered texts, body language expressions and speech tone were noted to support the data. Interviews were continued until the saturation point of answers to the interview questions^{13,18}. Data saturation was achieved in interview number 20, but 5 more interviews were conducted for data security. 25 interviews were conducted, once with each participant, and the data were verified^{18,19}.

Ethical Statement

The research was approved by the Kütahya Health Science University Non-Interventional Ethics Committee Review Board (Number: 2022/01; Date: 18.01.2022). Participants were informed about the research and signed the informed consent statements. Data were collected anonymously by researchers. Records regarding the identity of volunteers are protected in a manner that respects confidentiality rules.

Statistical Analysis Method

The deciphered texts were coded to create the themes. Researchers obtained data through Colaizzi content analysis separately¹³ (Table 3). Researchers negotiated to avoid disagreement and reach a consensus. The contact numbers of all participants are kept

(to contact them when necessary) by the first female author. No software programs were used in the analysis.

Table 3. Colaizzi's phenomenological seven-step framework

Step no	Data analysis framework
1	For familiarization, the data were read carefully, line by line, and iteratively.
2	For identifying significant statements, important statements related to the research question were examined, underlined and identified.
3	For formulation meanings repeated meaning expressions were coded and the discovered meanings were classified.
4	For the clustering themes the developed meanings were divided into theme clusters and thematic prototypes were created.
5	For developing a detailed description the phenomenon under investigation was explained in detail.
6	For producing the fundamental structure similar themes and subthemes were explained in detail in determining the basic framework.
7	For verification data was given back to participants, confirming their experiences.

Study Rigor

The COREQ criteria list and SRQR 2.0 checklist was used in reporting this qualitative research^{20,21}. This checklist contains 32 suggestions and highlights what information should be written in a qualitative article, step by step. Well-designed qualitative research requires meticulousness and care in reporting studies investigating complex phenomena. The checklist encourages complete, clear and understandable reporting of qualitative research. On the other hand, using this checklist improves the criteria for meticulousness, comprehensiveness and reliability of studies²⁰. The research meets the criteria for reliability, credibility, transferability, and confirmability²². Only interview questions were asked to ensure validity and reliability in the interviews. An independent experienced researcher checked the data to ensure reliability. For confirmability, three researchers reviewed the analysis results. Triangulation method and participant verification were performed in reliability. For trustworthiness, only interview questions were asked in the interviews. Reliability was ensured through participant verification and participant diversity. Finally, transferability was achieved by defining the data collection and analysis processes in detail²³.

Results

Four themes, nine categories, and 37 subcategories that were considered essential were discovered (Table 4). These four themes are problems experienced in activities, advantages experienced in activities, experience of anxiety and stress, and strategies for coping with difficulties.

Table 4. Themes, main categories, and subcategories explaining academicians' perceptions of and experiences with Generation Z students

Theme and Main Categories	Sub-category
Problems Experienced in Activities	
Problems experienced in theoretical activities caused by perceived negative characteristics	Focus problem Decrease in efficiency Digital addiction Poor academic performance Lack of communication
Problems experienced in application areas due to perceived negative characteristics	Adaptation difficulties Passive performance Decreased empathy Egocentrism Fear
Advantages Experienced in Activities	
Advantages thought to be resulting from perceived positive characteristics	Inquisitive perspective Openness to change Confidence
Gains from positive experiences	Ease of accessing information Technological competencies Information integration Alternative approaches
Experience of Anxiety and Stress	
Consequences thought to be triggered by perceived negative characteristics	Boredom and inability to cope Defying authority Insensitivity Intergenerational conflict
Consequences triggered by negative experiences	Loneliness, Incompatible teamwork, Being free-rider Respect problem (politeness, tone) Communication problems
Strategies for Coping with Difficulties	
Developing an adaptation area for students	Participating in volunteer orientation activities Social support Increasing internal and external motivation sources Awareness of needs
Updating teaching approaches	Adapting Generation Z-specific approaches into activities Diversifying education and training activities Active use of technology
Considering expectations	Allowing sufficient time to complete tasks Being accessible Being empathetic Supporting and appreciating positive traits

Theme 1: Problems Encountered in Activities

The problems experienced by the participants in teaching activities were defined in two categories: 'Problems experienced in theoretical activities caused by perceived negative characteristics' and 'Problems experienced in application areas due to perceived negative characteristics'. Participants acknowledged that the problems they experienced in educational environments were related to the perceived negative characteristics specific to Generation Z students. Participants' perceptions stemmed from negative experiences in theoretical and practical (laboratory and hospital) environments. Academicians explained the components of lack of communication and digital addiction experienced in theoretical activities based on perceived negative characteristics with the following statements:

"I have a hard time in verbal communication, they are very closed off. I try to communicate through official channels, mostly by writing." (A1)

"They are glued to their phones. They seem to be getting stressed because they can't turn their phones on during class. The phone and the internet are like a part of them now... (sarcastic laugh)." (A5)

"They can't even find their way without GPS (he laughs), they can't read the handwriting on the claims. They do not use wristwatches. They mostly count the pulse with a phone meter. Bla Bla..." (A11)

In the section on the problems experienced in theoretical activities caused by the perceived negative characteristics of this theme, academicians complained of focusing problems, decreased productivity, and poor academic performance of Generation Z students. One academician expressed his experience when talking about negative characteristics and the resulting disappointment:

"They have problems in focusing. Most of the time, I cannot get the results I want from classes. Contrary to their behavior, their academician performance is not sufficient... (deep sigh)." (A11)

In the category of problems experienced in application areas related to perceived negative characteristics, academicians reported that Generation Z students' had adaptation difficulties, passive performance, egocentrism, fear, and decreased empathy for changing situations during laboratory and hospital applications. Three participants shared the following experiences related to perceived characteristics:

"They cannot understand the needs of patients due to the weakness of their empathy skills." (A1)

"I'm not sure they can improve themselves, especially as they are afraid of making mistakes. There is no undo or pause button in life like in games." (A11)

"They seem confident on the surface, but when it is their turn to practice, their breathing accelerates and they shake. They have difficulty adapting, especially in hospital practices." (A14)

Another academician made a similar statement, emphasizing egocentrism:

"They only think about themselves and the grade they will get. This fear causes them to remain passive in their practice areas." (A9)

Theme 2: Advantages Experienced in Activities

This theme includes two categories: 'gains from positive experiences' and 'advantages thought to be resulting from perceived positive characteristics'. In their statements, some of the participants conveyed the positive characteristics of their Generation Z students with positive emotions. Academicians appreciated the inquisitive perspective, openness to change, and self-confidence of Generation Z students in the category of gains from positive experiences, mostly in theoretical courses.

"They are open to change and self-confident, and I think they follow the developments in the world closely through social media and question everything." (A3)

"They can express themselves better in theoretical courses that interest them." (A7)

While conveying the gains from positive experiences, some academicians appreciated the Generation Z-specific characteristics and stated that different approaches were discovered with ease of access to information, technological competencies, and information integration. Two academicians shared the following experiences:

"They have a strong knowledge of technology and do not have difficulty accessing information." (A17)

"The majority knows how to use information. They have quick and alternative approaches to some situations." (A9)

Theme 3: Experience of Anxiety and Stress

This theme covers two categories: 'consequences thought to be triggered by perceived negative characteristics' and 'consequences triggered by negative experiences'. The general opinion among academicians was that some Generation Z-specific characteristics triggered negative outcomes and that negative experiences developed as a result of these characteristics. Based on academicians' observations, students were characterized as easily bored, resistant to authority, and indifferent to events. The majority of academicians stated their intergenerational conflict through these characteristics. Generation Z attitudes and characteristics in theoretical and practical fields are a source of stress for academicians. The stress experienced by academicians has become an increasingly ongoing problem. According to the answers given by three participants with tension and grimace:

"I believe they think they can do anything because they were raised as free spirits. Therefore, they are in constant conflict with authority. Many of them do not realize that they threaten the freedom of others..." (A18)

"They get bored of everything. They are quite insensitive even when discussing important social issues and public health issues. I get stressed and anxious about losing control in classes." (A13)

"They do not spend much effort on practical and theoretical tasks. They tend to give up quickly. This situation makes me exhausted." (A6)

During the interviews, various emotional reactions were received from academicians about the consequences triggered by negative experiences. Academicians reported their negative experiences with Generation Z students using common terms such as 'incompatible teamwork', 'loner', 'being a free-rider', 'respect problems', and

'communication problems'. Two academicians frowned and shared their negative experiences as follows:

"Their best friends are their phones. They cannot act in coordination in teamwork and hospital practices. They want everything to come to them ready." (A7)

"I think they don't pay any attention to their behaviors and actions. I have serious problems with tone and politeness." (A13)

Other academicians, shaking their heads in a strained tone, noted similarly:

"They definitely don't listen...(pupils widened). They are very distracted, they just want to talk, it seems like other people's opinions do not matter." (A22)

"They are disrespectful by sleeping in class. For example, some students play with their phones during my class. They do not even feel the need to lower the volume of the phone." (A19)

Theme 4: Strategies for Coping with Difficulties

The last theme covers three categories: "developing an adaptation area for students", "updating teaching approaches", and "considering expectations". Academicians developed different strategies to solve the problems experienced. Academicians tried to overcome negative experiences with multidimensional strategies. It was understood that academicians participated in voluntary orientation activities, made an effort to provide social support when needed, increased students' motivation resources, and understood student needs in the category of increasing students' adaptation to the university. Academicians defined the facilitating factors in developing students' adaptation areas as follows:

"Adaptation must be ensured from the first years, so I organize a volunteer orientation program for students every year, starting from the first year." (A21)

"I help them access social support resources. This generation loves to be appreciated. Using this feature, I do my best to help them reach motivational sources." (A13)

"I sometimes conduct surveys to understand students' expectations and needs. Sometimes I use the brainstorming technique." (A23)

The second coping strategy for academicians to deal with difficulties is to update their teaching approaches to agree with students in the same way. Academicians thought that the internet and technology were integral parts of the lives of Generation Z students. According to the academicians' statements, they took precautions to adapt Generation Z-specific approaches to their activities, diversify their teaching activities, and actively use technology:

"Since they actively use technology, I started to use technology more often in lessons." (A12)

"I researched activities that would attract the attention of Generation Z and applied alternative teaching techniques integrated with technology in lessons." (A16)

Finally, it was understood from the academicians' statements that they took some precautions in their teaching approaches by taking student expectations into account. Academicians stated that they gave students enough time for routine homework/tasks,

tried to be accessible, be empathetic, support positive traits, and appreciate positive attitudes:

"I'm trying to understand them. I try to develop empathy to keep an open communication, even if sometimes things don't suit me." (A18)

"I make myself accessible to them. Thus, I try to communicate more effectively." (A15)

"I constantly remind them of their homework, but when the due date comes, they keep saying that they have forgotten the homework. I'm stretching the time." (A6)

"I support and reward their positive traits if it will improve them." (A22)

Discussion

Academician and student interactions in the field of health can affect the quality of educational activities²⁴. Therefore, pedagogy updates should be carefully planned according to the characteristics and preferences of each generation^{5,25}. However, the limited number of qualitative studies focused on the expectations and needs of Generation Z students^{1-3,5,11,12}. In this context, contrary to the evidence obtained in Shorey et al.⁵ research, we focused on academician experiences in meeting the expectations appropriate to the learning and teaching styles of each generation in the findings of this study. This research provides information to the literature about the experiences of Turkish academicians at a faculty of health sciences towards Generation Z students during their educational activities and how to update the pedagogy.

In our results, based on the perceptions of academicians, we discovered the difficulties experienced by the characteristics of Generation Z during all activities in the first theme. The reason for these difficulties may be academicians' not being able to cooperate with result-oriented students in complex courses. Ensuring cooperation between Generation Z students and academicians as well as identifying the educational environment that will attract the attention of Generation Z can facilitate encouraging learning^{4,26}. In the theoretical activities, we revealed in the findings of this study, academicians' complaints about the components of focus problems, low productivity, and poor academic performance, especially digital addiction were compatible with statements of students in other qualitative studies. The students in these researches reported to have experienced the same or similar problems in the courses as well^{1,5,12,24}. Two studies determined the negative effects of digital addiction on academic success and sleep comfort in Generation Z nursing students^{27,28}. Another research emphasized the poor communication styles as well as mental problems due to digital addiction in Generation Z²⁹. According to these results, academicians can support awareness studies in preventing digital addiction. Additionally, activities suitable for Generation Z characteristics can be organized such that they do not disrupt theoretical activities in order to increase efficiency, interaction, and academic success.

Other components of difficulty that academicians complained about were mainly adaptation problems and passive performance in application areas. These problems were probably related to students' self-centeredness, decreased empathy, and fear of failure coming to light due to grade anxiety. Decreased empathy, adaptation problems, and

future anxiety of Generation Z students receiving health education were discovered in two studies^{1,3,6}. Adaptation problems in the work environment were also detected in a research conducted on newly graduated Generation Z nurses³⁰. In two other similar studies, students were less productive than expected and had difficulty adapting to practice areas^{5,24}. It has been understood that the most preferred application activities suitable for the learning styles of Generation Z students are auditorily/ visually enriched videos, simulations, case studies, and games. According to the students, these activities facilitated fast, interesting, effective, and permanent learning in gaining application skills⁴. In this context, in order to increase compliance and competence, simulation/model techniques and application videos can be used predominantly in laboratory applications before going to hospital applications.

In the second theme of the findings of this study, the advantages thought to be resulting from perceived positive characteristics by the academicians and the gains from the positive experiences arising from these advantages were defined. The majority of academicians experienced the inquisitive perspective, self-confidence, and openness to change of Generation Z students not in the assigned tasks, but in the students' active learning styles in theoretical courses. These perceptions may have arisen from the positive experiences of Generation X and Y academicians that facilitate learning for Generation Z. The behavior and learning styles expected from Generation Z have shaped education in the field of health^{2,24,31}. Generation Z students are generally known as natives of the digital age³¹. Similar to the observations of the academicians in the findings of this study, some studies identified the technological competencies and entrepreneurial characteristics of students in the health/medical field^{2,3}. The advantages perceived by the academicians in the findings of this study overlapped with the positive Generation Z students-specific characteristics in another research^{17,32}. In various studies, it was discovered that appreciating and supporting the positive characteristics of the generation in the fields of health and medicine would strengthen professional commitment^{2,32,33}. In this context, supporting positive characteristics and providing positive feedback can facilitate student development in teaching activities in the field of health.

In other theme, the reactions to the negative characteristics perceived about Generation Z students were psychological and cognitive. The anxiety was probably caused by stress triggered by the challenges. In the findings of this study, academicians complained about students' boredom and inability to cope, defying authority and insensitivity. On the other hand, academicians frequently experienced conflicts with Generation Z students who opposed authority. In the studies, Generation Z students conflicted with the authority in their field of practice (health professionals, practice mentors, academicians, etc.)^{3,8,10}. In a research, it was understood that Generation Z nursing students generally had short attention spans and were prone to boredom³¹. In two other studies, it was understood that students did not want to work under stress^{2,3}. In the context of these results, preventive support approaches suitable for academician and student expectations can be used to prevent intergenerational conflict.

In the second category of the third theme, academicians' negative experiences were a source of stress and anxiety. The loner patterns, the inability to adapt to teamwork, and the free-rider nature of Generation Z students were problematic. Additionally, the

academicians in the findings of this study complained about the students' disrespectful attitudes and communication problems. In one research, it was stated that nursing students preferred independent learning in assigned tasks, and therefore academicians should try different ways of contact with students to encourage student participation, taking into account Generation Z learning styles⁶. As for being free-riders, one research found that what is known about how being a free-rider affects Generation Z undergraduate nursing students' turnover intention is limited³⁴. In another research, the communication problems of newly graduated Generation Z nurses stood out³⁰. Based on this information, current pedagogical approaches may be effective in improving the adaptation and communication skills of future health professionals. It is clear that more studies are needed on this subject.

The final theme from the interviews was challenge-coping strategies. The limited number of studies in the literature focused mostly on the reactions to the difficulties experienced by Generation Z students.⁵⁻⁷ However, the effective coping strategies experienced by the academicians in the findings of this study were similar to the expectations of the students in these studies^{1,2,5-7}. In one research, the pedagogical approaches to challenges (orientation activities, individualized support, counseling, and awareness of needs) of healthcare academicians of different generations were similar to the strategies of the academicians in the findings of this study⁷. In the findings of this study, the majority of academicians organized volunteer orientation activities, provided social support, and researched motivation sources and student needs in order to prevent the difficulties that Generation Z students would experience. The aim of these efforts was generally to develop an adaptation area for Generation Z students. In studies, Generation Z students suffered from adaptation problems, and their motivation and social support systems were limited^{6,33}. For this reason, researches recommended orientation activities in line with student expectations, effective social support, and activating motivational resources in the educational guidelines for academicians in the field of health^{1,2,6,7}. In the majority of research, it was found that the effectiveness and expected efficiency of education increased in case of the identification of the needs of Generation Z students and careful planning of courses appropriate to their learning styles^{5,25}.

Another effective intervention was for academicians to update their teaching approaches with challenge-coping strategies. Academicians adapted Generation Z-specific activities, organized different activities, and tried to use technology actively. In order to cope with the challenges of the new generation of students in the field of health, some studies often suggested adapting teaching approaches to the learning styles of Generation Z in facilitating learning^{2,5}. This recommendation was similar to the effective pedagogical approaches and characteristics of Generation X, Y, and Z academicians in a research⁷. In a research, it was understood that developing nursing students' leadership skills was effective in preventing conflict during clinical decision-making¹⁰. In this context, approaches of academicians from different generations can be integrated into health education.

In this study, academicians in Generation X took student expectations into consideration. For this purpose, they kept the time flexible for each task, were more accessible, more empathetic, and supported the positive characteristics of the students.

In general, in a research examining the learning styles of Generation Z students in the literature, students expected to receive feedback and be given sufficient time for the tasks^{2,5,11,12}. In a research, innovative positive characteristics were defined such as the flexibility of Generation X academicians, the empathic skills of Generation Y academicians, and the technological competencies of Generation Z academicians⁷. According to these data, education activities planned in collaboration with academicians from different generations may be effective in the academic success of students in the field of health.

Limitations

This was a qualitative research conducted with a phenomenological approach at a state university in Türkiye. Therefore, academicians' teaching experiences regarding Generation Z students may vary in other regions. This research can be repeated in other studies examining the experiences of academicians and Generation Z students. More studies are needed to explore a global perspective and increase the positive experiences of academicians interacting with Generation Z students.

Conclusion

This research clarified the teaching experiences of academicians at the faculty of health sciences through their perspectives on Generation Z students. Academicians appreciated the limited number of perceived positive characteristics of the students in this research, while they thought that other Generation Z-specific characteristics caused some problems. According to the results, although academics appreciated some positive characteristics of Generation Z, they experienced difficulties that triggered stress in theoretical activities and application areas due to the unfamiliar characteristics of Generation Z. Academics mostly saw intergenerational incompatibilities as a disadvantage and thought that caring about student expectations and updating teaching approaches were priorities in order to provide harmony with students. Academicians developed effective coping strategies to prevent and solve problems. According to the experiences of academicians from different generations regarding Generation Z students, alternative approaches are required to be developed in all activities. In this context, activities in the field of health sciences should be discussed interactively in collaboration with students and faculty members. When choosing student-centered educational activities, Generation Z-specific characteristics should be taken into account. Academicians should carefully plan alternative techniques and technological interaction methods in updating educational activities.

REFERENCES

1. Plochocki JH. Several ways generation Z may shape the medical school landscape. *J Med Educ Curric Dev*. 2019;31(6):2382120519884325.
2. DiMattio MJK, Hudacek SS. Educating generation Z: Psychosocial dimensions of the clinical learning environment that predict student satisfaction. *Nurse Educ Pract*. 2020;49:102901.

3. Shatto B, Erwin K. Teaching millennials and generation Z: Bridging the generational divide. *Creat Nurs*. 2017;23(1):24-28.
4. Hampton D, Welsh D, Wiggins AT. Learning preferences and engagement level of generation Z nursing students. *Nurse Educ*. 2020;45(3):160-164.
5. Shorey S, Chan V, Rajendran P, et al. Learning styles, preferences and needs of generation Z healthcare students: Scoping review. *Nurse Educ Pract*. 2021;57:103247.
6. Chunta K, Shellenbarger T, Chicca J. Generation Z students in the online environment: Strategies for nurse educators. *Nurse Educ*. 2021;46(2):87-91.
7. Reyes A, Galvan R Jr, Navarro A, et al. Across generations: Defining pedagogical characteristics of generation x, y, and z allied health teachers using q-methodology. *Med Sci Educ*. 2020;30(4):1541-1549.
8. Kavaklı Ö. The investigation of relationship between proactive personality features and approach to conflict resolution in the interns of nursing students. *J Educ Res Nurs*. 2018;15(1):9-15.
9. Yanikkerem E, Topsakal Ö, Çetinkaya A. Experience and perceptions of nurse academicians on generation Y nursing students: 'Difficult students'. *Gümüşhane University Journal of Health Sciences*. 2021;10(3):444-457.
10. Alnajjar H, Abou Hashish E. Exploring the relationship between leadership and conflict management styles among nursing students. *Nurs Manag*. 2022;29(3):25-31.
11. Hayashi M, Karouji Y, Nishiya K. Ambivalent professional identity of early remedial medical students from Generation Z: A qualitative study. *BMC Med Educ*. 2022;22:501.
12. Liu Y, Sun X, Zhang P, et al. Generation Z nursing students' online learning experiences during COVID-19 epidemic: A qualitative study. *Heliyon*. 2023;9(4):e14755.
13. Merriam SB, Tisdell EJ. *Qualitative Research: A Guide to Design and Implementation*. John Wiley & Sons; 2015.
14. Patton MQ. *Qualitative Research and Evaluation Methods*. Thousand Oaks, CA: Sage Publications; 2022.
15. Foley VC, Myrick F, Yonge O. A phenomenological perspective on preceptorship in the intergenerational context. *Int J Nurs Educ Scholarsh*. 2012;9(1):1-23.
16. Foley VC, Myrick F, Yonge O. Intergenerational conflict in nursing preceptorship. *Nurse Educ Today*. 2013;33(9):1003-1007.
17. Williams CA. Nurse educators meet your new students: Generation Z. *Nurse Educ*. 2019;44(2):59-60.
18. Streubert HJ, Carpenter DR. *Qualitative Research In Nursing: Advancing The Humanistic Imperative*. Lippincott Williams & Wilkins; 2011.
19. Elo S, Kyngäs H. The qualitative content analysis process. *J Adv Nurs*. 2008;62(1):107-15.

20. Tong A, Sainsbury PJ. Craig Consolidated criteria for reporting qualitative research (COREQ): A 32-item checklist for interviews and focus groups. *Int J Qual Health Care*. 2007;19(6):349–357.
21. Dossett LA, Kaji AH, Cochran A. SRQR and COREQ reporting guidelines for qualitative studies. *JAMA Surg*. 2021;156(9):875–876.
22. Guba EG, Lincoln YS. Epistemological and methodological bases of naturalistic inquiry. *ECTJ*. 1982;30(4):233–252.
23. Tobin GA, Begley CM. Methodological rigour within a qualitative framework. *J Adv Nurs*. 2004;48(4):388–396.
24. Zhuhra RT, Wahid MH, Mustika R. Exploring college adjustment in first-year gen Z medical students and its contributing factors. *Malays J Med Sci*. 2022;9(1):126–137.
25. Christodoulou E, Kalokairinou A. Net generation's learning styles in nursing education. *Stud Health Technol Inform*. 2015;213:119–121.
26. Chicca J, Shellenbarger T. Generation Z: Approaches and teaching-learning practices for nursing professional development practitioners. *J Nurses Prof Dev*. 2018;34(5):250–256.
27. Rathakrishnan B, Bikar Singh SS, Kamaluddin MR, et al. Smartphone addiction and sleep quality on academic performance of university students: An exploratory research. *Int J Environ Res Public Health*. 2021;18(16):8291.
28. Yaman Aktaş Y, Karabulut N, Arslan B. Digital addiction, academic performance, and sleep disturbance among nursing students. *Perspect Psychiatr Care*. 2022;58(4):1537–45.
29. Loleska S, Pop-Jordanova N. Is smartphone addiction in the younger population a public health problem? *Pril (Makedon Akad Nauk Umet Odd Med Nauki)*. 2021;42(3):29–36.
30. Serafin L, Danilewicz D, Chyla P, et al. What is the most needed competence for newly graduated generation Z nurses? Focus groups study. *Nurse Educ Today*. 2020;94:104583.
31. Schmitt CA, Lancaster RJ. Readiness to practice in generation Z nursing students. *J Nurs Educ*. 2019;58(10):604–606.
32. Isaacs AN, Scott SA, Nisly SA. Move out of Z way Millennials. *Curr Pharm Teach Learn*. 2020;12(12):1387–1389.
33. Holzer BM, Ramuz O, Minder CE, et al. Motivation and personality factors of generation Z high school students aspiring to study human medicine. *BMC Med Educ*. 2022;22:31.
34. Kim J, Chae D, Yoo JY. Reasons behind generation Z nursing students' intentions to leave their profession: A cross-sectional study. *Inquiry*. 2021;58.

The Impact of Altitude on Sleep Quality, Daily Living Activities, and Quality of Life in Elderly Residents of Turkish Nursing Homes: A Cross-Sectional Analysis*

Mustafa Özkan FIRAT**, Berrak VARHAN***

Abstract

Aim: This study aims to assess the influence of altitude on sleep quality, daily living activities, and quality of life among elderly residents in nursing homes located in distinct altitudinal regions within Türkiye.

Method: A cross-sectional investigation encompassed 92 voluntary elderly participants residing in nursing homes situated in both the eastern and western regions of Türkiye during the period spanning from July 2020 to January 2021. Cognitive function was evaluated through the Mini Mental State Test (MMST), while the quality of life was gauged using the World Health Organization Quality of Life Scale for the Elderly Model (WHOQOL-OLD). Daily living activities were quantified via the Barthel Index test, and daytime sleepiness was assessed using the Epworth Sleepiness Scale (ESS). The Pittsburgh Sleep Quality Index (PSQI) was employed to appraise sleep quality over a one-month period. Statistical analyses entailed Chi-square, Shapiro-Wilk, Mann-Whitney U, and Spearman tests.

Results: The data reveal a statistically significant variance in the Pittsburgh Sleep Quality Index scores among elderly residents dwelling at distinct altitudes ($p < 0.05$). The mean PSQI scores of elderly inhabitants in the eastern region were notably higher compared to their counterparts in the western region. Additionally, a statistically significant contrast was discerned in the Quality of Life Scale (WHOQOL-OLD) among elderly individuals residing at varying altitudes ($p < 0.05$). The mean WHOQOL-OLD scores for elderly residents in the eastern region were notably lower than those observed in the western region.

Conclusion: This study ascertained that elderly residents inhabiting lower-altitude regions experienced superior sleep quality compared to their counterparts in higher-altitude areas.

Keywords: Altitude, daily living activities, elderly, sleep quality, quality of life.

Türkiye'deki Huzurevlerinde Kalan Yaşlılarda Rakımın Uyku Kalitesi, Günlük Yaşam Aktiviteleri ve Yaşam Kalitesi Üzerindeki Etkisi: Kesitsel Bir Analiz

Öz

Amaç: Bu çalışmanın amacı, Türkiye'nin farklı rakım bölgelerinde bulunan huzurevlerinde ikamet eden yaşlı bireylerde rakımın uyku kalitesi, günlük yaşam aktiviteleri ve yaşam kalitesi üzerindeki etkisini sistematik olarak değerlendirmektir.

Yöntem: Bu kesitsel araştırma, Temmuz 2020 ile Ocak 2021 tarihleri arasında Türkiye'nin doğu ve batı bölgelerinde yer alan huzurevlerinde yaşayan 92 gönüllü yaşlı bireyi kapsamaktadır. Bilişsel işlevler Mini

Özgün Araştırma Makalesi (Original Research Article)

Geliş / Received: 05.02.2024 & **Kabul / Accepted:** 07.03.2025

DOI: <https://doi.org/10.38079/igusabder.1628440>

*This study has been derived from the master's thesis titled "Evaluation of elderly people living in nursing homes in Agri and Istanbul in terms of sleep, activities of daily living and quality of life", which was accepted in 2021 at Halic University, Institute of Health Sciences, Department of Physiotherapy and Rehabilitation and prepared by Mustafa Özkan FIRAT under the consultancy of Asst. Prof. Berrak VARHAN.

** (Corresponding Author) Lecturer, Agri Ibrahim Cecen University, Vocational School of Health Services, Health Care Services Aged Care Program, Agri, Türkiye. E-mail: mustafaozkanfrt@gmail.com [ORCID https://orcid.org/0000-0001-6556-7575](https://orcid.org/0000-0001-6556-7575)

*** Dr., Istinye University, Physiotherapy and Rehabilitation Department, Physiotherapy and Rehabilitation Program, Istanbul, Türkiye. E-mail: berrak.varhan@istinye.edu.tr [ORCID https://orcid.org/0000-0002-4874-9868](https://orcid.org/0000-0002-4874-9868)

ETHICAL STATEMENT: This study was carried out with the approval of the Ethics Committee of Halic University, dated 26/06/2020 and numbered 115-01 A signed subject consent form in accordance with the Declaration of Helsinki was obtained from each participant.

Mental Durum Testi (MMST) ile değerlendirilmiştir. Yaşam kalitesi Dünya Sağlık Örgütü Yaşlılar İçin Yaşam Kalitesi Ölçeği (WHOQOL-OLD), günlük yaşam aktiviteleri Barthel İndeksi, gündüz uyku durumu Epworth Uyku Kalitesi Ölçeği (ESS), uyku kalitesi ise son bir ayı kapsayacak şekilde Pittsburgh Uyku Kalitesi İndeksi (PUKİ) ile ölçülmüştür. İstatistiksel analizlerde Ki-kare, Shapiro-Wilk, Mann-Whitney U ve Spearman testleri kullanılmıştır.

Bulgular: Elde edilen veriler, farklı rakımlarda yaşayan yaşlı bireylerin PUKİ puanlarında istatistiksel olarak anlamlı farklılık bulunduğunu göstermektedir ($p < 0,05$). Doğu bölgesinde yaşayan bireylerin ortalama PUKİ puanları, batı bölgesindekilere göre belirgin şekilde daha yüksek bulunmuştur. Benzer şekilde, WHOQOL-OLD puanları açısından da istatistiksel olarak anlamlı farklılık saptanmıştır ($p < 0,05$); doğu bölgesinde yaşayan bireylerin yaşam kalitesi puanları batı bölgesindekilere kıyasla daha düşüktür.

Sonuç: Bu çalışma, daha düşük rakımlı bölgelerde yaşayan yaşlı bireylerin daha yüksek rakımlı bölgelerde yaşayanlara kıyasla daha iyi uyku kalitesine sahip olduğunu ortaya koymuştur. Ayrıca, huzurevlerinde yaşayan yaşlı bireylerin genel olarak ortalamanın altında bir uyku kalitesi sergilediği belirlenmiştir.

Anahtar Sözcükler: Yükseklik, günlük yaşam aktiviteleri, yaşlılar, uyku kalitesi, yaşam kalitesi.

Introduction

Aging, an intrinsic and inevitable process, is often regarded as one of the most challenging phases of human life. With advancing age, individuals experience a decline in functional capacity, structural alterations, exhaustion, and phenotypic changes. This period is marked by a deteriorating state of body structures and systems, accompanied by a diminishing overall capacity¹. Aging, characterized as a pathological progression, signifies a degenerative phase marked by an increase in physiological disorders.

Significant alterations occur across various bodily systems with aging, including the pulmonary, urinary, cardiovascular, endocrine, neurological, musculoskeletal, gastrointestinal, and integumentary systems. It has been observed that shifts in sleep patterns accompany these physiological changes, resulting in reduced sleep quality and an increased prevalence of insomnia complaints among older individuals²⁻³. While sleep issues affect all age groups, they are particularly prevalent in the elderly, owing to a constellation of physical, social, psychological, economic, and environmental factors that tend to accumulate with age. Studies report that sleep disorders affect 30-60% of the elderly population⁴, with over half of elderly individuals experiencing sleep-related problems and approximately two-thirds of nursing home residents affected by such issues⁵. Given that sleep constitutes a third of one's life, it is profoundly influenced by high altitudes.

Poor sleep quality experienced by individuals residing at high altitudes can lead to cognitive and emotional disturbances as well as daytime dysfunction^{6,7}. Altitudes below 500 meters are generally considered sea level, while altitudes at or above 1000 meters are categorized as high altitude. Physiological effects on the body are typically observed at altitudes exceeding 1500 meters⁸. Factors such as frequent awakenings during sleep and reduced oxygen availability have been cited as contributing to decreased sleep quality in high-altitude areas^{6,9}. Moreover, the heightened prevalence of sleep disorders among the elderly further compounds the impact on physical activity and quality of life^{10,11}.

Quality of life is a subjective measure encapsulating an individual's overall well-being, encompassing their physical health, emotional state, cognitive function, perceptions, and

symptoms. In evaluating the quality of life among the elderly, it is imperative to underscore symptoms commonly experienced in this demographic, such as nocturia (frequent urination at night), shuffling gait, orthostatic hypotension, and daytime drowsiness^{12,13}. In a study by Hayashino et al. conducted in Japan with 3403 participants, poor sleep quality was found to be associated with the mental health component of the quality of life scale¹⁴. The majority of elderly individuals contend with health-related complaints and irreversible declines in physical and functional capabilities¹⁵.

Activities of daily living (ADL) encompass the assessment of an individual's functional and physical independence, comprising basic activities such as personal hygiene, mobility, physical activity, nutrition, bathing, toileting, walking, transferring, and ambulation. More intricate activities, including housework, financial management, and driving, constitute instrumental activities of daily living¹⁶. Age-related weakening of muscle strength and bone structure results in diminished balance and motor coordination control, which, in turn, contributes to increased difficulty in performing ADLs and heightened dependency levels¹⁷. Research has indicated that poor sleep quality negatively impacts performance and select ADLs among the elderly, leading to social and cognitive issues and ultimately exacerbating the decline in quality of life^{18,19}.

Upon reviewing the existing literature, no prior study was identified that concurrently assessed sleep quality, quality of life, and ADLs in individuals aged 65 and above residing in nursing homes across various regions and altitudes within Türkiye. Our study seeks to address this gap by evaluating sleep quality, ADLs, and quality of life with respect to altitude variations in elderly individuals residing in nursing homes located in both the eastern and western regions of Türkiye, encompassing two distinct cities.

Material and Methods

Study Design

This cross-sectional study was conducted in two nursing homes in two different districts between July 2020 and January 2021. Our study was conducted in the Nursing Home and Rehabilitation Centre in Ağrı province and the privately owned Nursing Home Elderly Care and Rehabilitation Centre in Maltepe district of Istanbul province. A total of 92 participants were included, comprising 46 individuals from each facility who voluntarily agreed to participate and achieved a Mini Mental Test score of 24 or higher.

Data Collection

Data were collected using Sociodemographic Information Form, Mini Mental State Examination (MMSE), World Health Organization Quality of Life Scale Elderly Model (WHOQOL-OLD), Activities of Daily Living Assessment (Barthel Index), Epworth Sleepiness Scale (ESS), and Pittsburgh Sleep Quality Index (PSQI). By explaining the purpose of the research, the data were collected by the researchers after obtaining written permission from those who voluntarily agreed to participate in the research.

Sociodemographic Information Form: Developed by the researcher, this form gathered introductory information about the participants. It covered age, gender, weight, height, body mass index, duration of residency in the nursing home, roommate status, and comfort level within the facility.

Mini Mental State Examination (MMSE): The MMSE is a widely used cognitive assessment tool developed by Folstein et al. in 1975. It comprises 30 points, with scores below 24 indicative of dementia or cognitive impairment, while scores of 24 and above are considered normal. The MMSE evaluates various cognitive domains including attention, language, memory, orientation, visual function, copying, drawing, and reading²⁰. It possesses validated Turkish reliability and validity²¹.

World Health Organization Quality of Life Scale Elderly Model (WHOQOL-OLD): This instrument was employed to assess the quality of life among elderly individuals. Comprising 24 items divided into six sections—social participation, past, present, and future activities, emotional functions, independence, death and dying, and closeness—it elicits responses on a five-point Likert scale, with scores ranging from 1 to 5. Higher scores denote a higher quality of life²². The WHOQOL-OLD scale has been validated and exhibits reliability in Turkish²³.

Activities of Daily Living Assessment (Barthel Index): The Barthel Index was adapted for Turkish patients by Küçükdeveci in 1999 and is employed to evaluate the dependency levels of individuals in performing activities of daily living. It consists of ten main items, encompassing nutrition, wheelchair-to-bed and bed-to-wheelchair transfers, self-care, toileting, bathing, walking on a smooth surface (if applicable), climbing stairs, dressing and undressing, bowel care, and bladder care. The total score ranges from 0 to 100, with classifications as follows: 0-20 points signify full dependence, 21-61 points denote high dependence, 62-90 points indicate moderate dependence, 91-99 points suggest mild dependence, and 100 points represent full independence²⁴.

Epworth Sleepiness Scale (ESS): The ESS is a widely used scale designed to assess daytime sleepiness in adults. It comprises eight items that address typical daily situations, with each item rated on a scale of 0-3. A consistent scoring approach is applied across all questions, where 0 indicates never sleepy, 1 denotes moderately sleepy, and 3 signifies highly likely to fall asleep. The total score falls within the range of 0-24, with scores of 0-10 considered within the normal range for sleep propensity²⁵. The ESS, developed by Johns in 1991, is a self-report-based scale that qualitatively and quantitatively measures daytime sleepiness. Its Turkish validity and reliability have been established²⁶.

Pittsburgh Sleep Quality Index (PSQI): In our assessment of sleep quality, we employed the PSQI, a questionnaire developed by Buysse et al. in 1989, renowned for its reliability and validity²⁷. The PSQI is a comprehensive tool comprised of 19 items designed to evaluate both the quality and quantity of sleep experienced over the preceding month. It encompasses seven domains: subjective sleep quality (1 item), sleep duration (1 item), use of sleep medications (1 item), sleep latency (2 items), daytime functional impairment (2 items), habitual sleep efficiency (3 items), and sleep disturbances (9 items). Each question within these domains is rated on a scale from 0 to 3, where 0 signifies "very good," 1 denotes "quite good," 2 indicates "quite bad," and 3 represents "very bad." The total score can range from 0 to 21. In accordance with previous research²⁸, a PSQI score of 5 or higher was considered indicative of poor sleep quality. The scale was previously adapted into Turkish by Ağargün et al. ²⁶ in 1996.

Ethical Statement

The study adhered to ethical guidelines, and necessary approvals were obtained from the Halic University Non-Interventional Clinical Research Ethics Committee (Approval date: June 26, 2020; Approval number: 05). The principle of voluntary participation was upheld when selecting individuals for the study, and throughout the research process, the Helsinki Declaration of Human Rights was diligently observed to safeguard individual rights.

Data Analysis

In this study, data were subjected to statistical analysis using the IBM SPSS (v.23) package. Descriptive statistics were employed to present the data, including mean with standard deviation ($\bar{X} \pm SD$) for continuous variables and frequency with percentages (n%) for categorical variables. Normality of the data distribution was assessed using the Shapiro-Wilk test, which revealed non-normal distribution characteristics. Consequently, the Mann-Whitney U test was employed to compare data between two groups. The Spearman correlation test was utilized to explore relationships between numerical variables, while the chi-square test was employed to compare categorical variables. Statistical significance was defined at the $p < 0.05$ threshold.

Limitations and Challenges of the Study

The global outbreak of the COVID-19 pandemic, which coincided with the data collection period of our research, significantly impacted the recruitment process. Since the data were collected through face-to-face interviews, strict public health measures, social distancing protocols, and participants' concerns about close contact led to a reduced willingness to participate. Consequently, this resulted in a limited number of participants in the study.

Results

The participants were divided into 2 groups according to the cities they stayed in; those staying in nursing homes in Istanbul (n=46) and those staying in nursing homes in Eastern province (n=46). The p-values for the Age, Height, Weight, and BMI variables were found to be greater than 0.05 for both cities where the study participants resided. In other words, there is no significant difference between the elderly individuals living in the provinces of Ağrı and Istanbul with respect to these variables (Table 1).

Table 1. Physical characteristics of the participants (n= 92).

	Province	n	Mean	SD	p
Age	Eastern	46	70.67	5.906	0.080
	Western	46	75.15	8.052	
Height (m)	Eastern	46	1.67	0.068	0.690
	Western	46	1.67	0.078	
Weight (Kg)	Eastern	46	77.48	9.545	0.460
	Western	46	75.82	9.231	
Body Mass Index	Eastern	46	27.51	3.330	0.357
	Western	46	27.01	3.037	

P < 0,05*, **SD: Standard Deviation, Mann-Whitney U Test

Table 2 presents the demographic data of the participants. In the Eastern Region, 54.3% of the participants were male, and 45.7% were female, while in the Western Region, 28.3% were male, and 71.7% were female. In the East, 23.9% of the participants were married, 67.4% were single, and 8.7% were divorced. In the West, 15.2% were married, and 84.8% were single. In the East, the highest proportion of participants (41.3%) had been residing in a nursing home for less than 1 year, whereas in the West, the highest proportion (69.6%) had been in a nursing home for 1-5 years. The percentage of individuals with roommates was 65.2% in the East and 71.7% in the West. Regarding comfort in the nursing home, 71.7% in the East and 73.9% in the West reported feeling comfortable.

Table 2. Demographic data of the participants.

		Province				
		Eastern		Western		
		n	%	n	%	p
Gender	Male	25	54.30	13	28.30	0.019*
	Female	21	45.70	33	71.70	
Marital Status	Married	11	23.90	7	15.20	0.055
	Single	31	67.40	39	84.80	
	Divorced	4	8.70	-	-	
Length of Stay in Nursing Home	0-1 Year	19	41.30 30.40 28.30	10	21.70	0.001*
	1-5 Years	14		32	69.60	
	More than 5 Years	13		4	8.70	
Roommate	Yes	30	65.20	33	71.70	0.654
	No	16	34.80	13	28.30	
Comfort Level in the Nursing Home	Yes	33	71.70	34	73.90	0.990
	No	13	28.30	12	26.10	

p < 0,05 *, **Chi-Square Test

Table 3 presents the Comparison of Sleep Quality. According to the data obtained, there is a statistically significant difference in the PSQI between the elderly individuals living at different altitudes. Accordingly, the average PSQI values of the elderly living in eastern province are higher than those of the elderly living in western. However, there is no significant difference between the elderly living at different altitudes in the Epworth Sleepiness Scale

Table 3. Comparison of sleep quality

	Province	n	Mean	SD	p
PSQI	Eastern	46	7.04	3.602	0.018*
	Western	46	5.28	2.663	
ESS	Eastern	46	8	4.953	0.664
	Western	46	7.84	3.353	

p<0.05*, **SD: Standard Deviation, PSQI: Pittsburgh Sleep Quality Index, ESS: Epworth Sleepiness Scale, Mann Whitney U Test

Table 4 presents the Comparison of Quality of Life. According to the data obtained, a statistically significant difference exists in the Quality of Life Scale among the elderly individuals living at different altitudes. Notably, the average WHOQOL-OLD values of the elderly residing in Ağrı province are lower than those of their counterparts living in Istanbul.

Table 4. Comparison of quality of life.

	Province	n	Mean	SD	p
WHOQOL-OLD	Eastern	46	60.89	10.764	0.001*
	Western	46	71.13	11.271	

$p < 0,05^*$, *WHOQOL-OLD: World Health Organization Quality of Life Scale for the Elderly Model, Mann Whitney U Test

For a more detailed exploration of participants' daily living activity status, please refer to Table 5, which presents the Comparison of Participants' Daily Living Activity Status. According to the data obtained, there is no statistically significant difference between the Daily Living Activity Status of the elderly living at different altitudes.

Table 5. Comparison of participants' activities of daily living status

Province		n	Mean	SD	p
Barthel Index	Eastern	46	79.45	16.337	0.350
	Western	46	76.08	16.895	

$p < 0.05^*$; *Mann Whitney U Test

Discussion

Sleep, a fundamental component comprising one-third of human life, undergoes profound alterations in high-altitude regions. Poor sleep quality experienced at elevated altitudes can precipitate cognitive and emotional imbalances and result in daytime dysfunction²⁹. Roughly 250 million individuals across the globe reside at altitudes exceeding sea level^{30,31}. In the eastern region of our study area, the altitude is 1640 meters, whereas the western region's altitude is merely 120 meters.

In this study, a significant difference was observed in PSQI scores among elderly individuals living at different altitudes, whereas ESS scores did not show a significant variation. This may be attributed to reduced oxygen levels at higher altitudes, which can negatively affect sleep quality without necessarily increasing daytime sleepiness. Additionally, environmental and socioeconomic differences across regions may influence perceived sleep quality (PSQI) more than daytime sleepiness (ESS).

Sakamoto et al.³² conducted a study investigating the influence of high altitude on the sleep quality of elderly individuals residing in high-altitude regions, specifically in the settlement zone ranging from 2800 to 4200 meters in the Kashmir region of India. The study encompassed 112 individuals, and their sleep quality was assessed using the Insomnia Severity Index (ISI). The study results concurred with our findings, revealing that high altitude detrimentally affected sleep quality. A study in Islamabad evaluated sleep quality in the elderly using PSQI and found a high prevalence of poor sleep quality,

particularly among women, though it did not compare different altitudes³³. Sleep disturbances are estimated to afflict 10-50% of the elderly population, and research has shown a significant association between the total ISI score and total PSQI score^{1,34}. Despite differences in participant numbers, altitude levels, and sleep assessment tools, our findings align with these previous observations.

Research in Colombia indicated that living at higher altitudes negatively affected overall quality of life in older adults, impacting physical and psychological health but without specifying a direct link to poorer sleep quality³⁵. In a study with elite swimmers, sleep quality appeared unaffected during a 14-day training camp at moderate altitude (1,500 meters), suggesting that moderate altitude may not significantly impact subjective sleep assessments despite changes in sleep patterns³⁶. The lack of impact on sleep quality in elite swimmers may be due to their higher cardiorespiratory adaptability to altitude. In contrast, elderly individuals have reduced physiological reserves, making them more susceptible to altitude-related effects on sleep quality. Additionally, environmental and psychosocial factors may further influence subjective sleep perception in non-athletic older populations.

Gupta et al.³⁷ conducted an investigation into the effect of altitude on subjective sleep quality among populations dwelling at high and low altitudes in the Himalayan and sub-Himalayan regions of India across three different altitude zones (400 meters, 1,900-2,000 meters, and 3,200 meters). The study generally reported that individuals participating in the research experienced poor sleep quality, with higher reports of poor-quality sleep at high altitudes compared to low altitudes. This study's findings align with this observation, as we observed lower sleep quality among participants residing in nursing homes in the eastern region of Türkiye.

A study examining patients with obstructive sleep apnea (OSA) found that while both PSQI and ESS scores were relevant in assessing sleep quality and daytime sleepiness, the association between them was not strong. The study highlighted that polysomnographic measures, such as hypoxia levels, were more strongly linked to subjective sleep quality in this population than ESS scores³⁸. While the PSQI primarily assesses nighttime sleep quality, the ESS gauges the propensity to fall asleep in various daytime situations. Furthermore, the relationship between polysomnography and ESS was also noted as weak and inconsistent. Our study, too, revealed inconsistencies between PSQI sleep scale scores and ESS scores, reinforcing these previous observations.

It is well-established that individuals residing in high-altitude areas frequently experience deteriorations in sleep quality, attributable to factors such as frequent nocturnal awakenings and reduced oxygen levels⁸. This research unveiled higher mean PSQI scores for elderly individuals in nursing homes in the eastern region compared to those in the western region, with no statistically significant variance in ESS scores. These findings underscore the adverse impact of high altitude on the sleep quality of elderly individuals.

A case study on sleep disturbances at high altitudes reported that sleep quality progressively declined as altitude increased⁹. Despite our study's focus on nursing home settings, we observed analogous outcomes. Sleep disorders tend to be more prevalent among the elderly population, contributing to issues such as depression, compromised

attention, heightened fall risk, diminished activities of daily living, and a reduced quality of life^{39,40}.

In this investigation, we observed a noteworthy disparity in the mean WHOQOL-OLD scores between elderly individuals residing in the eastern and western regions of Türkiye. Specifically, the elderly in the eastern region reported significantly lower scores compared to their western counterparts. This study findings elucidate that the adverse effects of high altitude extend beyond sleep quality and extend to a substantial degradation in the quality of life for individuals experiencing poor sleep.

Supporting our research outcomes, Liu et al.⁵ conducted a comprehensive comparative analysis examining sleep disorders and their connection to the quality of life among older adults inhabiting nursing homes situated in both high and low-altitude regions. Their study yielded the conclusion that sleep quality among elderly individuals residing in high-altitude nursing homes was notably compromised, and sleep disorders exerted a substantial detrimental impact on their overall quality of life. These findings harmonize with a broader body of literature, reinforcing the notion that diminished sleep quality tends to erode the quality of life, especially in individuals dwelling in high-altitude locales.

Notably, our study did not discern any statistically significant discrepancies in the activities of daily living among elderly individuals residing in nursing homes located at various altitudes across the eastern and western regions of Türkiye. Despite the contrast in altitudinal conditions, our research suggests that altitude per se does not exert a significant influence on the performance of daily living activities.

In a study conducted embarked on an extensive geriatric assessment involving 393 elderly mountaineers in Qinghai, China, aged 60 years and older, who resided in Haiyan County. This assessment encompassed an evaluation of activities of daily living, quality of life, and metabolic syndrome. Intriguingly, the study findings indicated that Tibetan elderly highlanders in Qinghai exhibited lower scores in basic activities of daily living in comparison to their Han or Mongolian highlander counterparts. The researchers attributed these observed differences in activities of daily living to the distinct lifestyles of elderly individuals in different regions⁴¹. Nevertheless, it is important to note that these findings deviate from the conclusions drawn from our study. Existing research has consistently documented the adverse impact of compromised sleep quality on activities of daily living^{42,43}.

Conclusion

This study discerned a notable divergence in the sleep quality experienced by elderly individuals residing in provinces at varying altitudes. Specifically, elderly individuals living in low-altitude provinces exhibited superior sleep quality compared to their counterparts in high-altitude provinces.

The comprehensive evaluation of sleep quality, activities of daily living, and quality of life among elderly individuals inhabiting nursing homes necessitates a thorough consideration of their residing environment. To enhance the quality of life, promote activities of daily living, and ameliorate sleep quality among this demographic, strategic

interventions and lifestyle modifications are imperative. These measures should encompass optimizing exposure to natural daylight, incorporating physiotherapy rehabilitation programs, and fostering positive lifestyle changes.

The integration of these interventions can serve as a pivotal strategy for enhancing the overall well-being of elderly individuals within nursing homes. By addressing their sleep quality, activities of daily living, and quality of life in the context of their living environment, we can aspire to achieve more effective outcomes in the pursuit of improved health and well-being for this vulnerable population.

Acknowledgments

The authors thank all the participants who volunteered to participate the study.

Funding Information

This study has not received any funding.

REFERENCES

1. Lee J, Kim HJ. Normal aging induces changes in the brain and neurodegeneration progress: Review of the structural, biochemical, metabolic, cellular, and molecular changes. *Frontiers in Aging Neurosci.* 2022;14:931536.
2. Spira AP, Kaufmann CN, Stone KL. *Sleep, Circadian Rhythms, and Aging: Advancing Knowledge to Promote Older Adults' Health.* Oxford University Press US, 2023.
3. Drăgoi CM, Nicolae AC, Ungurianu A, Margină DM, Grădinaru D, Dumitrescu IB. Circadian rhythms, chrononutrition, physical training, and redox homeostasis—molecular mechanisms in human health. *Cells.* 2024;13(2):138.
4. Gordon NP, Yao JH, Brickner LA, Lo JC. Prevalence of sleep-related problems and risks in a community-dwelling older adult population: A cross-sectional survey-based study. *BMC Public Health.* 2022;22(1):2045.
5. Liu S, Chow IH, Lu L, et al. Comparison of sleep disturbances between older nursing home residents in high-and low-altitude areas. *J. Geriatr. Psychiatry Neurol.* 2020;33(6):370-376.
6. Kong F. *Updates in Sleep Neurology and Obstructive Sleep Apnea: Sleep Disorder at High Altitude.* IntechOpen; 2021.
7. Qin Z, Kang D, Feng X, Kong D, Wang F, Bao H. Resting-state functional magnetic resonance imaging of high altitude patients with obstructive sleep apnoea hypopnoea syndrome. *Sci. Rep.* 2020;10(1):15546.
8. Xie Y, Wang N. The eye and high altitude. *Integrative Ophthalmology.* 2020:95-100.
9. Srivali N, Tobias L. 1037 Central sleep apnea due to high altitude periodic breathing. *Sleep.* 2023;46(Supplement_1):A455-A455.
10. Christodoulou E, Pavlidou E, Mantzorou M, et al. Depression is associated with worse health-related quality of life, lower physical activity levels, and inadequate

sleep quality in a Greek elderly population. *Psychol Health Med.* 2023;28(9):2486-2500.

11. Seol J, Lee J, Nagata K, et al. Combined effect of daily physical activity and social relationships on sleep disorder among older adults: Cross-sectional and longitudinal study based on data from the Kasama study. *BMC Geriatrics.* 2021;21:1-10.
12. Awade AR, Ibrahim NAEF, Abd El Moniem MM. The Relationship between nocturia, sleep quality and daytime energy among community dwelling older adults. *Alex. Sci. Nurs. J.* 2020;22(1):81-91.
13. Kim N, Park J, Hong H, Kong ID, Kang H. Orthostatic hypotension and health-related quality of life among community-living older people in Korea. *QLife Res.* 2020;29:303-312.
14. Hayashino Y, Yamazaki S, Takegami M, Nakayama T, Sokejima S, Fukuhara S. Association between number of comorbid conditions, depression, and sleep quality using the Pittsburgh Sleep Quality Index: Results from a population-based survey. *Sleep Med.* 2010;11(4):366-371.
15. Dagnino AP, Campos MM. Chronic pain in the elderly: Mechanisms and perspectives. *Front. Hum. Neurosci.* 2022;16:736688.
16. Ran L, Jiang X, Li B, et al. Association among activities of daily living, instrumental activities of daily living and health-related quality of life in elderly Yi ethnic minority. *BMC Geriatrics.* 2017;17:1-7.
17. Wu R, Ditroilo M, Delahunt E, De Vito G. Age related changes in motor function (II). Decline in motor performance outcomes. *Int J Sports Med.* 2021;42(03):215-226.
18. Leng M, Yin H, Zhang P, et al. Sleep quality and health-related quality of life in older people with subjective cognitive decline, mild cognitive impairment, and Alzheimer disease. *The J Nerv Ment Dis.* 2020;208(5):387-396.
19. Petrovsky D, Varasse M, Hodgson N. Relationship between sleep and quality of life in older adults with mild cognitive impairment. *Innov. Aging.* 2020;4(Suppl 1):619.
20. Gluhm S, Goldstein J, Loc K, Colt A, Van Liew C, Corey-Bloom J. Cognitive performance on the mini-mental state examination and the montreal cognitive assessment across the healthy adult lifespan. *Cogn Behav Neurol.* 2013;26(1):1-5.
21. Gungen C. Standardize Mini Mental Test'in Türk toplumunda hafif demans tanısında geçerlik ve güvenilirliği. *Türk Psikiyatri Derg.* 2002;13:273-281.
22. Gobbens RJ, van Assen MA. Psychometric properties of the Dutch WHOQOL-OLD. *HQOL.* 2016;14:1-9.
23. Eser S, Saathı G, Eser E, Baydur H, Fidaner C. The reliability and validity of the Turkish version of the World Health Organization Quality of Life Instrument-Older Adults Module (WHOQOL-Old). *Türk. Psikiyatri Derg.* 2010;21(1).

24. Young Y, Fan MY, Hebel JR, Boulton C. Concurrent validity of administering the functional independence measure (FIM) instrument by interview. *American Journal of Phys Med Rehabil.* 2009;88(9):766-770.
25. Smith TG, Robbins PA, Ratcliffe PJ. The human side of hypoxia-inducible factor. *British Journal of Haematology.* 2008;141(3):325-334.
26. Ağargün MY, Çilli AS, Kara H, et al. Epworth Uyku Ölçeği'nin geçerliği ve güvenilirliği. *Türk Psikiyatri Derg.* 1999;10(4):261-267.
27. Buysse D. The Pittsburgh sleep quality index: A new instrument for psychiatric practice and research. *Psychiatry.* 2003;18:498.
28. Ağargün MY. Pittsburgh uyku kalitesi indeksinin geçerliği ve güvenilirliği. *Türk Psikiyatri Derg.* 1996;7:107-115.
29. Pinto Leite CM, Mariano-Neto E, Rocha PLBd. Biodiversity thresholds in invertebrate communities: The responses of dung beetle subgroups to forest loss. *PLoS One.* 2018;13(8):e0201368.
30. Gao C, Ciren J, Wang D, Zhang Z, Ge R, Yan Le. Assessment of psychological and social fitness in healthy adults permanently living at very high altitude. *International Journal of Int. J. Environ. Res. Public Health.* 2023;20(3):2013.
31. Tremblay JC, Ainslie PN. Global and country-level estimates of human population at high altitude. *Proc. Natl. Acad. Sci.* 2021;118(18):e2102463118.
32. Sakamoto R, Okumiya K, Norboo T, et al. Health and happiness among community-dwelling older adults in Domkhar valley, Ladakh, India. *Geriatr Gerontol Int.* 2017;17(3):480-486.
33. Siddiqui N, Farooq R, Saadat S, et al. Poor sleep quality: A wake-up call for the elderly at a tertiary care centre in Islamabad, Pakistan. *Sleep.* 2020;3:6.
34. Alqahtani JS, AlRabeeh SM, Aldhahir AM, et al. Sleep quality, insomnia, anxiety, fatigue, stress, memory and active coping during the COVID-19 pandemic. *Int. J. Environ. Res. Public Health.* 2022;19(9):4940.
35. Pinzón-Rondón AM, Botero JC, Mosquera-Gómez LE, Botero-Pinzon M, Cavellier JE. Altitude and quality of life of older people in Colombia: A multilevel study. *J. Appl. Gerontol.* 2022;41(6):1604-1614.
36. Vitale JA, Ieno C, Baldassarre R, et al. The impact of a 14-day altitude training camp on olympic-level open-water swimmers' sleep. *Int. J. Environ. Res. Public Health.* 2022;19(7):4253.
37. Gupta R, Ulfberg J, Allen RP, Goel D. Comparison of subjective sleep quality of long-term residents at low and high altitudes: SARAHA study. *J Clin Sleep Med.* 2018;14(1):15-21.
38. Kania A, Polok K, Celejewska-Wójcik N, et al. Clinical and polysomnographic features associated with poor sleep quality in patients with obstructive sleep apnea. *Medicina.* 2022;58(7):907.
39. Olatunde K, Patton S. Insufficient sleep and health care utilization: A scoping review. *Innov Aging.* 2021;5(Suppl 1):832.

40. Putekova S, Martinkova J, Hutkova M. Sleep disturbances in seniors with parkinson's disease. *Clinical Social Work and Health Intervention*. 2020;11(4):68 – 77.
41. Lin S. Functional disability among middle-aged and older adults in China: The intersecting roles of ethnicity, social class, and urban/rural residency. *Int. J. Aging Hum. Dev.* 2023;96(3):350-375.
42. Ganidagli S, Ozturk E, Ozturk ZA. Risk factors of poor sleep quality in older adults: An analysis based on comprehensive geriatric assessment. *Curr Med Res Opin.* 2023;39(5):701-706.
43. Hu Z, Zhu X, Kaminga AC, Zhu T, Nie Y, Xu H. Association between poor sleep quality and depression symptoms among the elderly in nursing homes in Hunan province, China: A cross-sectional study. *BMJ Open.* 2020;10(7):e036401.

Strategies for Coping with Loneliness of Older Individuals whose Spouses Have Passed Away: Isparta Case Qualitative Research*

Hatice Ceyda CANTÜRK**, Özlem ÖZGÜR***, Fatma Sıla AYAN****, Gülüşan ÖZGÜN BAŞIBÜYÜK*****

Abstract

Aim: This research aims to examine the processes of coping with loneliness of older individuals aged 60 and over whose spouses have passed away.

Method: This study was conducted using the interview technique, one of the qualitative research methods. Within the scope of the research, in-depth interviews were held with a total of 20 participants, 10 female and 10 male participants from Isparta city center.

Results: Analyzes were made using MAXQDA 24. As a result of the interviews, a total of 258 sentences were coded. A total of 4 basic areas were created while coding. These general areas are: "Changes After Loss" (f= 97, 36.60% of all statements), "Daily Life Activities and Instrumental Life Activities" (f= 59, 22.87% of all statements), "Social and Professional Support" (f= 32, 12.40% of all statements), "Strategies for Coping with Loneliness" (f= 70, 27.13% of all statements). A total of 42 special sub-domains within the general sub-domains were created.

Conclusion: According to the results obtained from the research, individuals whose spouses have passed away should aim to benefit from services that will help manage this process, such as counseling and support groups, in order to cope with loneliness.

Keywords: Old age, spousal bereavement, loneliness, coping with.

Eşleri Vefat Eden Yaşlı Bireylerin Yalnızlıkla Başa Çıkma Stratejileri: Isparta Örneği Nitel Araştırma

Öz

Amaç: Bu araştırma, eşleri vefat etmiş 60 yaş ve üzeri yaşlı bireylerin yalnızlıkla başa çıkma süreçlerini incelemeyi amaçlamaktadır.

Yöntem: Araştırma, nitel araştırma yöntemlerinden mülakat tekniği ile gerçekleştirilmiştir. Isparta il merkezinden 10 kadın ve 10 erkek katılımcı olmak üzere toplam 20 kişiyle derinlemesine görüşmeler yapılmıştır. Veri toplamak için demografik bilgiler için tam yapılandırılmış, araştırma soruları için ise yarı yapılandırılmış görüşme formu kullanılmıştır. Katılımcılardan aydınlatılmış onam formu alınmıştır.

Bulgular: MAXQDA 24 ile yapılan analizler sonucunda toplam 258 cümle kodlanmıştır. Kodlama sırasında 4 temel alan belirlenmiştir: "Kayıp Sonrası Yaşanan Değişimler" (f=97, %36,60), "Günlük Yaşam Aktiviteleri

Özgün Araştırma Makalesi (Original Research Article)

Geliş / Received: 17.02.2025 & **Kabul / Accepted:** 22.07.2025

DOI: <https://doi.org/10.38079/igusabder.1641318>

* This study has been prepared inspired by the Bachelor's Thesis of Hatice Ceyda Cantürk from the Department of Gerontology at Akdeniz University.

** Gerontologist, E-mail: hccanturk32@gmail.com [ORCID https://orcid.org/0009-0005-4369-5978](https://orcid.org/0009-0005-4369-5978)

*** Res. Asst., Akdeniz University, Faculty of Health Sciences, Department of Gerontology, Antalya, Türkiye.

E-mail: ozlemozgur@akdeniz.edu.tr [ORCID https://orcid.org/0000-0001-5330-0902](https://orcid.org/0000-0001-5330-0902)

**** (Corresponding Author) Asst. Prof., Istanbul Gelisim University, Faculty of Health Sciences, Department of Gerontology, Istanbul, Türkiye. E-mail: fsayan@gelisim.edu.tr [ORCID https://orcid.org/0000-0003-0576-1338](https://orcid.org/0000-0003-0576-1338)

***** Prof. Dr., Akdeniz University, Faculty of Health Sciences, Department of Gerontology, Antalya, Türkiye.

E-mail: gozgun@akdeniz.edu.tr [ORCID https://orcid.org/0000-0002-2801-6157](https://orcid.org/0000-0002-2801-6157)

ETHICAL STATEMENT: This study has received ethical approval from the Mediterranean University Medical Scientific Research Ethics Committee (Approval Number: TBAEK-42, dated 25.01.2024).

ve Enstrümental Yaşam Aktiviteleri” (f=59, %22,87), “Sosyal ve Profesyonel Destek” (f=32, %12,40), ve “Yalnızlıkla Başa Çıkma Stratejileri” (f=70, %27,13). Bu genel alanlar içinde toplamda 42 özel alt alan oluşturulmuştur.

Sonuç: Araştırmadan bulgularına göre, eş kaybı yaşayan bireylerin yalnızlıkla başa çıkmak için danışmanlık ve destek grupları gibi hizmetlerden faydalanmaları teşvik edilmelidir.

Anahtar Sözcükler: Yaşlılık, yalnızlık, eş kaybı, başa çıkma.

Introduction

Aging is a chronological concept that refers to the lifelong process culminating in old age, rather than just the later stages of life¹. Bereavement in old age carries unique psychosocial implications compared to other life stages. The loss of a spouse often leads to disruptions in social roles, emotional companionship, and daily routines—particularly as older adults tend to experience a shrinking of social networks. Unlike younger individuals, who may rely on diverse social and professional ties, older adults frequently identify their spouse as their primary source of emotional support. Hence, bereavement at this stage entails deeper loneliness and functional decline, demanding tailored coping strategies and supportive social policies. Expressing emotions, sharing with close ones, and seeking professional help can ease the grieving process². While coping takes time, pain gradually lessens, allowing individuals to refocus on life. Engaging in social activities and building new relationships play a key role in improving quality of life and strengthening social connections in old age³. Community participation, education, and the use of digital technologies also help older individuals maintain social engagement and reduce isolation⁴⁻⁶.

This study examines the coping strategies of individuals aged 60 and above who have lost a spouse within the past decade, focusing on their emotional responses, cognitive processes, social interactions, and changes in physical well-being.

Material and Methods

Participants

This study employed a basic qualitative research method with a phenomenology design. The aim was to evaluate the experiences, challenges, and needs of older individuals (aged 60 and above) going through loneliness, particularly after spousal loss, and to develop recommendations based on these findings.

The snowball sampling method was used, where the first participant was identified, and subsequent participants were selected based on their connection to the initial individual, helping form a representative sample. The study was conducted in the center of Isparta, involving 20 participants (10 women and 10 men) aged 60 and above. In-depth, face-to-face interviews lasting at least 20 minutes per participant were conducted.

An informed consent form was prepared for participants, and a semi-structured interview form with seven open-ended questions was created based on a literature review. All interviews were audio recorded with the participants' consent. Data collection was concluded once data saturation was reached. The data were analyzed using descriptive analysis, grouping common themes for interpretation.

Ethical Statement

This study was approved by the Clinical Research Ethics Committee of Akdeniz University Faculty of Medicine (Approval No: 39, Date: January 29, 2024). The research was conducted in accordance with the ethical standards of the institutional and national research committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards. Written informed consent was obtained from all participants prior to data collection.

Results

To maintain the confidentiality of participants' identities, the groups were labeled with the letters K and E. The women's group was coded as W, while the men's group was coded as M.

Sociodemographic Characteristics of Participants

The study involved 20 participants aged 60 and above from the central district of Isparta—10 women and 10 men. The youngest female was 60, the youngest male 69, while the oldest female was 78 and the oldest male was 87. The average age was 70.7 years for women and 78.1 years for men. Most participants had completed primary school, were either housewives or retirees, and had lost their spouses.

Participants' Experiences

Questions posed to participants focused on their lives, the reasons for their spouses' deaths, their feelings after the loss, what they did to feel better during the grieving process, their lives before the loss, and the most significant changes in their lives after losing their spouses. These topics are detailed below.

Table 1. Sociodemographic characteristics of participants.

Participant	Age	Gender	Marital Status	Education Level	Occupation	Social Security	Chronic Illness	Children	Residence
W1	75	Female	Widowed	Primary school graduate	Housewife	Yes	Yes	2	Home owner
W2	78	Female	Widowed	Primary school graduate	Housewife	Yes	Yes	3	Home owner
W3	68	Female	Widowed	Primary school graduate	Housewife	Yes	No	3	Living with child
W4	78	Female	Widowed	Primary school graduate	Housewife	Yes	Yes	1 (adopted)	Rental
W5	74	Female	Widowed	Primary school graduate	Housewife	Yes	Yes	3 (1 deceased)	Rental
W6	78	Female	Widowed	Dropped out of associate degree	Retired	Yes	Yes	4	Home owner
W7	62	Female	Widowed	Primary school graduate	Farmer	Yes	Yes	2	Home owner
W8	66	Female	Widowed	Literacy campaign attendee	Housewife	Yes	Yes	3	Home owner

W9	68	Female	Widowed	Primary school graduate	Housewife	Yes	Yes	-	Rental (with sibling)
W10	60	Female	Widowed	Primary school graduate	Housewife	Yes	Yes	2	Home owner (with father)
M1	75	Male	Widowed	Primary school graduate	Retired	Yes	Yes	4	Home owner (with son)
M2	80	Male	Widowed	Primary school graduate	Retired	Yes	Yes	4	Home owner
M3	73	Male	Widowed	Primary school graduate	Retired	Yes	Yes	5	Home owner (with daughter and grandchild)
M4	87	Male	Widowed	High school graduate	Retired	Yes	Yes	5	Home owner
M5	75	Male	Widowed	University graduate	Retired	Yes	Yes	2	Home owner
M6	83	Male	Widowed	Primary school graduate	Retired	Yes	Yes	2	Rental (with daughter)
M7	87	Male	Widowed	Dropped out of primary school	Retired	Yes	Yes	3 (1 deceased)	Home owner
M8	78	Male	Widowed	High school graduate	Retired	Yes	No	2	Living with children
M9	74	Male	Widowed	Primary school graduate	Retired	Yes	No	0	Rental (with sibling)
M10	69	Male	Widowed	Vocational school graduate	Retired	Yes	Yes	2	Home owner

Analysis

The data were analyzed using the MAXQDA 24 Qualitative Data Analysis software. A total of 258 sentences were coded based on the interviews. Four primary categories were identified during the coding process:

1. Changes Experienced After Loss (f=97, 36.60% of all statements)
2. Daily Living Activities and Instrumental Living Activities (f=59, 22.87% of all statements)
3. Social and Professional Support (f=32, 12.40% of all statements)
4. Strategies for Coping with Loneliness (f=70, 27.13% of all statements)

In addition to these general categories, a total of 42 specific subcategories were identified. The general categories and specific subcategories are detailed in Table 2.

Table 2. General and specific subfields table.

General Areas	Specific Sub-Areas	Number of Sentences	%
1. CHANGES EXPERIENCED AFTER LOSS		97	37.6
1.1 Emotional – Mood Changes		65	25.2
	1.1.1. Sadness	18	6.98
	1.1.2. Loneliness	16	6.20
	1.1.3. Dependency	8	3.10
	1.1.4. Sense of Deficiency	7	2.71
	1.1.5. Longing	6	2.33
	1.1.6. Feeling of Emptiness	5	1.94
	1.1.7. Sense of Pain	5	1.94
	1.1.8. Stress	2	0.78
1.2 Illnesses		15	5.81
	1.2.1. Forgetfulness	5	1.94
	1.2.2. Insomnia	4	1.55
	1.2.3. Illness	4	1.55
	1.2.4. Psychological Discomfort	2	0.78
1.3 Living Space		9	3.49
1.4 Social Life		8	3.10
2. ADL AND IADL		59	22.87
2.1 Activities of Daily Living (ADL)		40	15.51
	2.1.1. Eating	20	7.75
	2.1.2. Cleaning	18	6.98
	2.1.3. Personal Hygiene	2	0.78
2.2 Instrumental Activities of Daily Living (IADL)		19	7.36
	2.2.1. Shopping	13	5.04
	2.2.2. Paying Bills	3	1.55
	2.2.3. Phone and Internet	3	1.55
3. SOCIAL AND PROFESSIONAL SUPPORT		32	12.40
3.1 Social Support		28	10.85
	3.1.1. Child Support	11	4.26
	3.1.2. Friend Support	7	2.71
	3.1.3. Neighbor Support	6	2.33
	3.1.4. Sibling Support	4	1.55
3.2 Professional Support		4	1.55
4. STRATEGIES FOR COPING WITH LONELINESS		70	27.13
4.1 Worship		23	8.91
4.2 Sports		6	2.33

4.3 Visiting Spouse's Grave		3	1.16
4.4 Creating Occupation/Hobby		38	14.73
	4.4.1. Reading Books	14	5.43
	4.4.2. Watching Television	13	5.04
	4.4.3. Gardening	6	2.33
	4.4.4. Knitting	4	1.55
	4.4.5. Solving Puzzles	1	0.39
Total		258	100

Findings Related to Changes Experienced After Loss

Statements regarding changes experienced after loss (f=97, 37.60%) have been examined under the headings of emotional-state changes, illnesses, living space, and social life. A total of 12 specific subcategories have been created regarding these changes. When the statements about changes experienced after loss were examined, it was determined that “Emotional-State Changes” (f=65, 25.19%) were mentioned the most, while “Social Life” (f=8, 3.10%) was mentioned the least.

Findings Related to Emotional-State Changes Experienced After Loss

When statements about emotional-state changes after loss (f=65, 25.19%) were examined, it was observed that sentences related to 15 specific subcategories could be evaluated within this context. Among these subcategories, “Sadness” (f=18, 6.98%) was mentioned the most, while “Social Life” (f=8, 3.10%) was mentioned the least. Examples of statements reflecting sadness include: “We were sad, but life goes on” (W6, 78), “At first, I couldn’t even look at their photo; I would cry” (W8, 66), “A life dies. My world was shattered, of course” (W9, 68), “Two years, listen, two years—this is not easy to say—I didn’t go a single day without crying at least five times. Two years. No less, maybe more. There’s a basement at the back. I would go there and scream and scream so no one would hear me. I’d close the door, and no one heard me” (M1, 75), “After they passed away, my morale was very low. When my wife died, half my world was gone” (M8, 78).

Findings Related to Illnesses Experienced After Loss

When examining illnesses experienced after loss (f=15, 5.81%), it was observed that sentences related to 4 specific subcategories could be evaluated within this context. Among these subcategories, “Forgetfulness” (f=5, 1.94%) was mentioned the most, while “Psychological Disorders” (f=2, 0.78%) was mentioned the least. Examples of statements about forgetfulness include: “... my forgetfulness increased because of the loss” (W1, 75), “After my spouse and daughter-in-law passed away, my forgetfulness began—I think it’s due to the pain” (W8, 66). An example statement related to the subcategory of psychological disorders is: “My psychology is very bad. I use a lot of medication”, “I also received psychological support and used heavy depression medication” (W4, 78).

Findings Related to Living Space Changes Experienced After Loss

Statements about changes in living spaces after loss (f=9, 3.49%) were identified. Some examples of these statements include: “After my spouse passed away, my sibling stayed with me and supported me. I also stayed at my children’s houses” (W1, 75), “I stayed with

my daughter in Antalya for about 1.5-2 months" (W6, 78), "I couldn't live alone, so I moved in with my sibling for mutual support. I couldn't stay on my own" (W9, 68), "After they passed away, I stayed with my children" (W3, 68), "My life changed. The city I lived in changed" (M6, 83), "I couldn't live alone, so I started staying with my children. My son said, 'We're going,' and so did my daughter-in-law. Since I couldn't live alone, I went. My neighbors also encouraged me to go" (M8, 78).

Findings Related to Social Life Changes Experienced After Loss

Statements about changes in social life after loss (f=8, 3.10%) were identified. Some examples of these statements include, "After they passed away, I no longer engage in any activities. I only take care of my household chores" (M5, 75), "During the day, I either watch television or go to the coffeehouse to spend time" (M9, 74), "I didn't lose contact with my friends and acquaintances. Thankfully, they were very supportive during this process. I tried to stay social. I didn't shut myself off from the world" (M10, 69), "I moved in with my children. I spent more time with my grandchildren. By frequently going to my daughter's shop, I learned her business. When she had to leave, I would manage it" (W3, 68).

Findings Related to Activities of Daily Living and Instrumental Activities of Daily Living

Statements related to activities of daily living and instrumental activities of daily living (f=59, %22.87) were examined under the headings of daily living activities and instrumental activities of daily living. A total of 6 specific subcategories were created for these statements. When the statements related to daily living activities and instrumental activities of daily living were examined, it was found that "Activities of Daily Living" (f=40, %15.51) was mentioned the most, while "Instrumental Activities of Daily Living" (f=19, %7.36) was mentioned the least.

Findings Related to Activities of Daily Living

When the statements related to activities of daily living (f=59, 22.87%) were examined, it was observed that sentences related to 3 specific subcategories could be evaluated in this context. Among these subcategories, "Eating" (f=20, 7.75%) was mentioned the most, while "Personal Hygiene" (f=2, 0.78%) was mentioned the least. Example sentences related to the Eating subcategory are as follows: "I try to make my bread and food myself as much as I can" (W4, 78), "My daughter used to cook and send food. For 2 or 3 months, she sent food. My son went and brought it, I went and brought it. I saw it wasn't working. He also has his job after all. He gets sick, too. He has children. They don't have time to spare for me. I told myself (saying her own name), 'Do your work, reduce the burden on the child'. Didn't I burn my hand, didn't I cut my hand trying to cook?" (M1, 75), "My sister comes sometimes, stays. I tell her, 'Can you make us some soup?' She says, 'God bless my brother! I don't even cook my food, but I hired a woman.' She doesn't help much. My daughter comes to help with cooking and cleaning twice a week" (M2, 80), "My daughter who lives here comes every day, does my food and cleaning, and leaves" (M4, 87).

Findings Related to Instrumental Activities of Daily Living

When the statements related to instrumental activities of daily living (f=19, 7.36%) were examined, it was observed that sentences related to 3 specific subcategories could be evaluated in this context. Among these subcategories, "Shopping" (f=13, 5.04%) was mentioned the most, while "Bill" and "Phone and Internet" (f=3, 1.55%) were mentioned the least. Example sentences related to the Shopping subcategory are as follows: "I have a nurse daughter, she comes and we do the shopping together, then she leaves" (M2, 80), "My children told me to order online for shopping, but I didn't accept it. I'll walk and take care of my own business" (W10, 60). Example sentences related to the Bill and Phone and Internet subcategories are as follows: "My children pay my bills" (W2, 78).

Findings Related to Social and Professional Support

Statements related to social and professional support (f=32, 12.40%) were examined under the headings of social support and professional support. A total of 4 specific subcategories were created for these statements. When the statements related to social and professional support were examined, it was found that "Social Support" (f=28, 10.85%) was mentioned the most, while "Professional Support" (f=4, 1.55%) was mentioned the least.

Findings Related to Social Support

When the statements related to social support (f=28, 10.85%) were examined, it was observed that sentences related to 4 specific subcategories could be evaluated in this context. Among these subcategories, "Child Support" (f=11, 4.26%) was mentioned the most, while "Sibling Support" (f=4, 1.55%) was mentioned the least. Example sentences related to the Child Support subcategory are as follows: "I live with my son. I visit the children, they also come to visit me" (M1, 75), "After I lost my husband, my children paid a lot of attention to me, thank God... My grandchildren and children kept me going" (W8, 66), "My daughters are always there for me, they make sure I don't miss anything" (M3, 73).

Findings Related to Professional Support

Statements related to professional support (f=4, 1.55%) were observed. Some example sentences related to professional support are as follows: "I am receiving psychological support" (W4, 78), "I also received psychological support; I used to take heavy depression medication" (W9, 68), "My neighbor's husband was a psychology doctor, he was in the hospital. He set up a special place here. He loved us a lot, and we loved him too. He would come to our house, to my wife. He would talk to her gently. After my wife passed away, I couldn't sleep. I called him and said, 'Could you come?' He came, thank God. He gave me medicine and said, 'You will do this, you will use that.'"

Coping Strategies for Loneliness

Statements related to coping strategies for loneliness (f=70, 27.13%) were examined under the headings of worship, exercise, visiting the spouse's grave, and creating an occupation/hobby. A total of 5 specific subcategories were created for these statements. When the statements related to coping strategies for loneliness were examined, it was

found that "Creating an Occupation/Hobby" (f=38, 14.73%) was mentioned the most, while "Visiting the Spouse's Grave" (f=3, 1.16%) was mentioned the least.

Findings Related to Worship

Statements related to worship (f=23, 8.91%) were observed. Some example sentences related to worship are as follows: "I turned to worship" (W7, 62), "I worshipped" (W10, 60), "...my daughter, I didn't stop praying" (W1, 75).

Findings Related to Exercise

Statements related to exercise (f=6, 2.33%) were observed. Some example sentences related to exercise are as follows: "When I get stressed, I walk. Whenever I feel like it, I take a walk" (W10, 60), "My doctor told me, 'You should walk every day.' 'At least half an hour, walk at a steady pace without running.' I never miss it. Then I rest for a bit" (M6, 83), "I walked" (W10, 60).

Findings Related to Visiting the Spouse's Grave

Statements related to visiting the spouse's grave (f=3, 1.16%) were observed. Some example sentences related to visiting the spouse's grave are as follows: "I go to his grave every day, that's how it is" (M5, 75), "When I reach Ereğli, I visit his grave every Friday. I still carry his memory. I never took off the ring" (M6, 83), "I visited his grave often. When I couldn't trust myself, I started going with a friend. It used to make me very sad, but going there also made me feel better" (M8, 78).

Findings Related to Creating an Occupation/Hobby

Statements related to creating an occupation/hobby (f=38, 14.73%) were examined, and it was found that these could be evaluated under 5 specific subcategories. Among these subcategories, "Reading Books" (f=14, 5.43%) was mentioned the most, while "Solving Puzzles" (f=1, 0.39%) was mentioned the least. Example sentences related to the Reading Books subcategory are as follows: "I read books" (M4, 87), "I read books, but sometimes the TV gets in the way" (K6, 78), "I read books occasionally" (M10, 69).

Discussion

Hobfoll's Conservation of Resources Theory, having a partner or a companion, is considered one of the valued resources. According to the theory, any threat to, direct loss of, or failure to gain the resources one values causes psychological stress. Therefore, the loss of a spouse is considered the loss of an important resource⁷. Wallin⁸ in their study, emphasizes the significance of depressive symptomatology in the impact of spousal loss on older individuals. Emotional distress, sadness, insomnia, and anhedonia are among the most common psychological responses to such major losses. Bennet⁹ supports this by showing that older individuals who have recently lost a spouse report more depression, distress, and hopelessness compared to peers who have not experienced a spousal loss. Participants in the study reported emotional changes most significantly after losing their spouse.

Uygun¹⁰ observed that the loss of a spouse in older women affects their health. Some older women's health problems increased after the loss of their spouse or a family member. Similarly, a decline in physical health was observed in older individuals after the loss of their spouse. Participants with various illnesses stated that after the death of

their spouse, they experienced issues such as forgetfulness, insomnia, illness, and psychological distress.

Akan¹¹ in her study, highlighted two general solutions to the older housing problem. The first involves the older individual continuing to live in their familiar home with the support of services provided within their accustomed social and structural environment, while the second involves moving to an institutional older living space suitable for their conditions. Many older individuals prefer to stay in their own homes for the comfort and familiarity they provide, while others opt for institutional living to combat loneliness, feel secure, and manage future uncertainties.

The death of a spouse often causes older individuals to experience difficulties in daily tasks, which is more likely due to age-related limitations¹². Bozkurt and colleagues¹³ found that when examining sociodemographic characteristics, advanced age, female gender, low education level, and being unemployed and widowed make older individuals more dependent on performing daily living activities. In this regard, no correlation was found. Female participants usually perform daily activities (cooking, cleaning, and personal hygiene) independently, while some male participants receive assistance from their children or hire help.

Yan and Bonanno¹⁴ suggest that individuals who develop themselves are less likely to perceive social isolation, despite reporting less loneliness. They also state that personal growth is positively related to the social functionality ratings of friends and relatives. Collectively, these findings support the argument that those who engage in self-development may experience less loneliness, at least in terms of coping with aging. Participants reported receiving the most support from their children and other family members after the loss of their spouse. Some participants also received support from their neighbors and friends.

These therapies involve various techniques such as walking meditations, mindful reading, body scanning, and breathing exercises to increase the awareness of older individuals. This helps them experience a calmer state of mind by accepting their momentary experiences without judgment¹⁵. In this context, some participants reported receiving psychological support, which was found to be beneficial in coping with the period after the loss of a spouse.

For older individuals, spirituality is an essential aspect of life, and they form the age group most closely connected to spirituality and religion in the United States¹⁶. Research has shown that religion and spirituality have a positive impact on both the physical and mental health of older individuals¹⁷.

Encouraging physical activity is one of the most effective interventions to improve the general health, including psychosocial health, of communities¹⁸. It is important to increase the physical activity levels of older individuals through daily walks, home and garden activities, swimming, and dancing¹⁹.

Conclusion

Spousal loss in older adults brings emotional and social changes, making support and understanding essential. Many face difficulties in daily activities, increasing loneliness. Social connections, support networks, and services like grief counseling help alleviate

these challenges. Coping strategies include sharing experiences, engaging in meaningful activities, and relying on religious and social support. Professional gerontological services play a key role in managing post-loss loneliness.

Ethical Declaration

This study was approved by the Clinical Research Ethics Committee of Akdeniz University Faculty of Medicine (Approval No: 39, Date: January 29, 2024). The research was conducted in accordance with the ethical standards of the institutional and national research committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards. Written informed consent was obtained from all participants prior to data collection.

Conflict of Interest

The authors declare that they have no conflicts of interest regarding the publication of this paper.

Acknowledgments

The authors would like to thank all participants who generously shared their time and experiences. No other individuals or institutions contributed to the preparation of this article.

Funding

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

REFERENCES

1. World Health Organization. *World Report on Ageing and Health*. Geneva: World Health Organization; 2015.
2. Tufan İ. *Gerontoloji I*. Antalya: Akdeniz Üniversitesi Yayınları; 2017.
3. Tufan İ. Yaşlanan dünyada bir delikanlı: Türkiye. *Toplum ve Sosyal Hizmet*. 2001;12(3):27-49.
4. Arpacı F. *Farklı Boyutlarıyla Yaşlılık*. Ankara: Türkiye İşçi Emeklileri Derneği Eğitim ve Kültür Yayınları; 2005.
5. Canatan A. Toplumsal değerler ve yaşlılar. *Yaşlı Sorunları Araştırma Dergisi*. 2008;1(1):62-71.
6. Ural A, Kılıç İ. *Bilimsel Araştırma Süreci ve SPSS ile Veri Analizi*. Ankara: Detay Yayıncılık; 2011.
7. Öksüzler B. Eş Kaybının Yaşlı Bireyler Üzerindeki Psikolojik Etkileri: Kaynakların Korunması Kuramı kapsamında bir inceleme [master's thesis]. Bursa, Türkiye: Uludağ Üniversitesi Sosyal Bilimler Enstitüsü; 2015.
8. Wallin M. The Loss Of a Spouse in Late Life: A Model of Bereavement, Meaning, and Growth [dissertation]. Malibu, CA: Pepperdine University; 2007.
9. Bennett KM. A longitudinal study of wellbeing in widowed women. *Int J Geriatr Psychiatry*. 1997;12:61-66.

10. Uygun MÖ. Yalnız Yaşayan Yaşlı Kadınların Gündelik Hayat Deneyimleri ve Başa Çıkma Stratejileri: Çorum ili örneği [master's thesis]. İzmir: İzmir Kâtip Çelebi Üniversitesi Sosyal Bilimler Enstitüsü; 2022.
11. Akan E. Toplumun yaşlanması ve yaşlılıkta barınma problemi bağlamında kurumsal yaşlı yaşam alanları tasarımı. *Senectus*. 2023;1(2):145-184.
12. Ceylan S, Özdiçiner NS. Yaşlıların yaşayacağı iletişim sorunlarının yaş grubu açısından değerlendirilmesi: Denizli örneği. In: Kalınkara V, Akın G, eds. 4. Ulusal Yaşlılık Kongresi Bildirileri. Ankara: Yaşlı Sorunları Araştırma Derneği; 2007:246-255.
13. Lund DA, Caserta MS, Dimond MF. The course of spousal bereavement in later life. In: Stroebe MS, Stroebe W, Hansson RO, eds. *Handbook of Bereavement: Theory, Research, and Intervention*. Cambridge: Cambridge University Press; 1993:240-254.
14. Bozkurt C, Karalar BC, Hoşaf S, Karadakovan A. Yaşlı bireylerin günlük yaşam aktiviteleri ile düşme riski arasındaki ilişkinin incelenmesi. *JCME*. 2022;31(3):219-222.
15. Demir Erbil D, Hazer O. Yaşlıların günlük yaşam aktivitelerinin ve sosyal ağlarının başarılı yaşlanmaya etkisi. *Elektronik Sosyal Bilimler Dergisi*. 2021;20(80):1846-1857.
16. Yan OH, Bonanno GA. How self-enhancers adapt well to loss: The mediational role of loneliness and social functioning. *J Posit Psychol*. 2015;10(4):370-382.
17. Demir-Çelebi Ç. Farkındalık ve kabullenme temelli terapiler. In: Canel AN, ed. *Terapide Yeni Ufuklar 1*. İstanbul: Pinhan Yayıncılık; 2014:71-96.
18. Hodge DR, Bonifas RP, Chou R. Spirituality and older adults: Ethical guidelines to enhance service provision in social work practice. *Adv Soc Work*. 2010;11(1):1-16.
19. Horozcu Ü. Tecrübi araştırmalar ışığında dindarlık ve maneviyat ile ruhsal ve bedensel sağlık arasındaki ilişki. *Milel ve Nihal*. 2010;7(1):209-240.

The Relationship between Health Beliefs and their Adaptation to Drug Use in Patients with Chronic Disease

Esra ÖZER*, Nuray ŞAHİN ORAK**

Abstract

Aim: This study was conducted to evaluate the relationship between health beliefs about medication use and treatment adherence of individuals who applied to the family health center and had hypertension, diabetes, or COPD.

Method: The study sample consisted of 210 patients. Data were collected using the Introductory Information Form, the Drugs Use Health Belief Scale, and the Medication Adherence and Prescription Renewal Scale. Frequency, percentage, mean, standard deviation, Pearson correlation test, and one-way ANOVA were used to analyze the data.

Results: When health beliefs regarding medication use were compared according to the type of chronic disease, no difference was found between the groups. When treatment adherence was compared, statistically significant differences were found between hypertension and COPD patients at very high level ($p<0.001$) and between diabetes and COPD patients at a high level ($p<0.01$). There was a significant negative correlation between patients' perceptions of health beliefs and their compliance with treatment at a good level for diabetes patients, a moderate level for hypertension patients, and a weak level for COPD patients.

Conclusions: It was determined that patients' adherence to treatment increased with improvement in their perception of health beliefs. The level of treatment adherence of COPD patients was higher than the other groups. Further studies examining the effect of education and counseling interventions to improve patients' health belief perceptions positively and to increase adherence to treatment are recommended.

Keywords: Hypertension, COPD, diabetes, patient compliance, drug.

Kronik Hastalığa Sahip Hastaların İlaç Kullanmaya İlişkin Sağlık İnançları ile Tedaviye Uyumluları Arasındaki İlişki

Öz

Amaç: Bu çalışma, aile sağlığı merkezine başvuran ve hipertansiyon, diyabet veya KOAH hastalıklarından birine sahip bireylerin ilaç kullanımına yönelik sağlık inançları ile tedaviye uyumluları arasındaki ilişkiyi değerlendirmek amacıyla gerçekleştirildi.

Yöntem: Araştırmanın örneklemini 210 hasta oluşturdu. Veriler Tanıtıcı Bilgi Formu, İlaç Kullanmaya İlişkin Sağlık İnanç Ölçeği ve İlaç Uyum ve Reçete Yazdırma Ölçeği kullanılarak toplandı. Verilerin analizinde sıklık, yüzde, ortalama, standart sapma, Pearson korelasyon testi ve One-way ANOVA kullanıldı.

Bulgular: Kronik hastalık türüne göre ilaç kullanımına ilişkin sağlık inançları karşılaştırıldığında gruplar arasında fark bulunmadı. Tedaviye uyumluları karşılaştırıldığında; hipertansiyon ve KOAH hastaları arasında çok yüksek düzeyde ($p<0.001$), diyabet ve KOAH hastaları arasında ise yüksek düzeyde ($p<0.01$) istatistiksel olarak anlamlı farklar bulundu. Hastaların sağlık inanç algıları ile tedaviye uyumluları arasında diyabet

Özgün Araştırma Makalesi (Original Research Article)

Geliş / Received: 11.03.2025 & **Kabul / Accepted:** 07.07.2025

DOI: <https://doi.org/10.38079/igusabder.1655318>

* Res. Asst., Istanbul Gelisim University, Istanbul, Türkiye. E-mail: esozzer@gelisim.edu.tr

ORCID <https://orcid.org/0000-0002-2381-6315>

** Asst. Prof. Dr., Istanbul Arel University, Istanbul, Türkiye. E-mail: nuraysahinorak@arel.edu.tr

ORCID <https://orcid.org/0000-0002-9356-2971>

ETHICAL STATEMENT: Approval was obtained from the Ethics Committee of from the Non-Interventional Clinical Research Ethics Committee of a state university on January 8, 2018 (Decision No: 24).

hastaları için iyi, hipertansiyon hastaları için orta, KOAH hastaları için zayıf düzeyde negatif yönde anlamlı ilişki saptandı.

Sonuç: Hastaların sağlık inanç algılarının iyileşmesiyle tedaviye uyumlarının arttığı belirlendi. KOAH hastalarının tedaviye uyum düzeyi diğer gruplardan yüksekti. Hastaların sağlık inanç algılarını olumlu yönde geliştirmeye ve tedaviye uyumu artırmaya yönelik eğitim ve danışmanlık girişimlerinin etkisini inceleyen ileri çalışmaların yapılması önerilmektedir.

Anahtar Sözcükler: Hipertansiyon, KOAH, diyabet, hasta uyumu, ilaç.

Introduction

According to the World Health Organization 2021, chronic diseases are responsible for approximately 75% of deaths worldwide, and this rate is expected to increase further in the next decade. In Türkiye, the severity of the situation is more pronounced, as chronic illnesses are responsible for approximately 89% of all deaths¹. Among these chronic conditions, cardiovascular diseases, cancer, chronic respiratory illnesses, and diabetes occur most frequently. Hypertension, in particular, is a major risk factor for cardiovascular diseases and ranks among the leading causes of premature death worldwide^{2,3}.

In Türkiye, the prevalence of hypertension is increasing due to factors such as an aging population, sedentary lifestyle, obesity, and high sodium consumption⁴. Diabetes is also one of the rapidly rising chronic diseases globally; the International Diabetes Federation (IDF) predicts a significant increase in the number of people with diabetes by 2045^{5,6}. Adherence to treatment is crucial in managing chronic conditions like diabetes and hypertension, as non-adherence can result in premature mortality and increased healthcare costs.

According to data from the Burden of Obstructive Lung Disease (BOLD) program, the prevalence of COPD among individuals aged 40 years and older was reported as 8.5% in women, 11.8% in men, and an overall prevalence of 10.1%⁷. Additionally, the Global Burden of Disease (GBD) study identified COPD as the sixth most prevalent disease worldwide among both men and women⁸.

Health behaviors of patients are essential in managing chronic diseases. One of the theoretical models used to understand and modify these behaviors is the Health Belief Model (HBM). HBM aims to improve health behaviors and treatment adherence based on individuals' perceptions about health⁹.

This study aimed to assess the relationship between medication-related health beliefs and treatment adherence in patients who visited a family health center and had one of the following chronic diseases: hypertension, diabetes, or COPD.

Material and Methods

Research design

The study was conducted using a descriptive design to evaluate the relationship between medication-related health beliefs and treatment adherence among patients who visited a family health center and had only one of the following chronic diseases: hypertension, diabetes, or chronic obstructive pulmonary disease (COPD).

Research Questions

For patients with chronic diseases (Hypertension, Diabetes, COPD):

Is there a difference between the groups' health beliefs related to medication use?

Is there a difference between the groups' medication adherence and prescription renewal behaviors?

Is there a relationship between the groups' health beliefs related to medication use and medication adherence, and prescription renewal behavior?

Population and sample for research

The study population consisted of patients with hypertension, diabetes, or COPD who were receiving treatment at a Family Health Center in Istanbul between June 15 and September 15, 2018. The study sample was determined by simple random sampling at a 95% confidence level and 80% power for the Health Beliefs Scale Related to Medication Use (using the NCSS program), resulting in n=59 for each disease group. To test the validity of the Medication Adherence and Prescription Renewal Scale, the sample was expanded to include 70 participants from each group (hypertension, diabetes, and COPD), for a total of 210 participants.

Inclusion Criteria:

Age between 18 and 65

Receiving treatment at Family Health Center

Having only one of the following diseases: hypertension, diabetes, or COPD

Exclusion Criteria:

Having another chronic disease besides hypertension, diabetes, or COPD

Having a psychiatric diagnosis

Data Collection Tools

To assess the sociodemographic characteristics of patients with chronic diseases "Introductory Information Form", to measure participants' beliefs regarding medication use "Health Beliefs Scale Related to Medication Use", and to assess their adherence to medication regimens, the "Adherence to Refills and Medications Scale" was used.

Introductory Information Form: The Descriptive Information Form, which was prepared by reviewing the literature, consisted of 28 questions covering demographic characteristics, health history, and medication habits^{10,11}.

Drugs Use Health Belief Scale: Developed in line with the Health Belief Model by Çiçek and Erci for female patients at a family health center, the Drugs Use Health Belief Scale measures patients' health beliefs about medication use. The scale comprises 36 items grouped into six subdimensions: Perceived Susceptibility, Perceived Severity, Health Motivation, Perceived Benefit, Perceived Barriers, and Self-Efficacy. Each item is rated on a 5-point Likert scale ranging from 1 to 5; "strongly disagree" corresponds to 1 point, and "strongly agree" corresponds to 5 points. Items 23, 24, 25, 26, 27, and 28 are reverse-scored. The scale ranged from a minimum of 59 to a maximum of 151 points. Higher scores on the scale indicate strong health beliefs regarding conscious and

prescribed medication use. The overall Cronbach's alpha reliability coefficient for the scale was 0.91, while subdimensions range from 0.80 to 0.93¹⁰. In this study, Cronbach's alpha reliability coefficient for the scale was 0.98, while subdimensions range from 0.87 and 0.90.

Adherence to Refills and Medications Scale (ARMS-7): Originally developed as the "Adherence to Refills and Medications Scale (ARMS-7)" by Dr. Kripalani and colleagues in 2009¹², the Turkish validity and reliability study was conducted by Gökdoğan and Kes in 2016¹³. The original seven-item scale has two subdimensions: "Taking Medication" and "Refilling Medication." It is designed to assess how well patients with chronic diseases adhere to their medication and manage prescription refills. Responses are measured on a four-point Likert scale: 1 (never), 2 (sometimes), 3 (often), and 4 (always). While the first six items follow this scoring method, the seventh item is reverse-scored. The total score ranges from 7 to 28¹³, with a lower total score indicating better medication adherence. In the study by Kripalani and colleagues, the Cronbach's alpha coefficient was reported as 0.75, and the item-total score correlations ranged between 0.32 and 0.59^{12,13}. In this study, the Cronbach's alpha reliability coefficient for scale was 0.89, while it was 0.80 for both sub-dimensions.

Data Collection Method and Process

The Introductory Information Form and scales were given to patients who met the study's inclusion criteria. Data were collected through face-to-face interviews after obtaining the patients' consent. Each interview lasted an average of 10 minutes.

Ethical Statement

Approval was obtained from the Ethics Committee of from the Non-Interventional Clinical Research Ethics Committee of a state university on January 8, 2018 (Decision No.: 24). A signed subject consent form in accordance with the Declaration of Helsinki was obtained from each participant. Permission was obtained from the scale owners via email for the scales to be used in the study. Written institutional permission was obtained. In compliance with confidentiality principles, the identities of the patients who participated in the study were not disclosed.

Data Analysis

Statistical analyses were conducted using SPSS 24.0. Descriptive statistics, including frequency, percentage, mean, and standard deviation, were utilized to evaluate the data. The Kolmogorov-Smirnov test confirmed that the data followed a normal distribution. Accordingly, parametric tests were applied for analysis, specifically the independent samples t-test, Pearson correlation analysis, and one-way ANOVA. A p-value of <0.05 was considered statistically significant for all tests.

Results

The average age of the patients who participated in the study was 54.00±7.30 years. It was determined that 59% of participants were women, 41.9% were primary school graduates, 98.1% had social security, 60.5% reported that their income and expenses were balanced, and 91.9% did not live alone (Table 1).

Table 1. Individual characteristics of the patients (n=210)

Variables	X	SD
Age (min:34, max:65)	54.00	7.30
	n	%
Gender		
Female	124	59.0
Male	86	41.0
Education Level		
Illiterate	8	3.8
Primary School	88	41.9
Middle School	47	22.4
High School	59	28.1
Higher Education	8	3.8
Social Security Status		
Yes	206	98.1
No	4	1.9
Employment Status		
Employed	58	27.6
Unemployed	152	72.4
Income Status		
Income < Expenses	53	25.2
Income = Expenses	127	60.5
Income > Expenses	30	14.3
Living Situation		
Mother-Father	5	2.4
Spouse-Children	188	89.5
Living Alone	17	8.1

X: Mean, **SD:** Standard Deviation, **n:** Frequency

It was determined that 36% of the patients stated that they had been diagnosed with a chronic disease for 5-9 years, 58.5% occasionally forgot to take their medication, 34.3% took their medication when they remembered, 21.4% could not take their medication on time, and 2.9% took two medications in the next dose. 56.2% of the participants (n=118) stated that they preferred a state hospital polyclinic for the treatment of chronic diseases. It was determined that 30.5% (n=64) of the patients did not use their medications regularly due to reasons such as not having time, having problems going to the family doctor, not having financial independence, not feeling the need, not being able to buy their own medications, not being able to read or write, and being embarrassed to use medications at school/work. It was found that 32.9% of the patients did not go to regular check-ups for medication treatment.

No statistically significant difference was found between the mean scores on the HBSRMU its subdimensions by patients' chronic disease ($p>0.05$) (Table 2).

Table 2. Comparison of the mean scores on the HBSRMU and its subdimensions by patients' chronic disease

Scale and Its Subdimensions		Chronic Disease	n	X	SD	F*	p
HBSRMU		Hypertension	70	121.15	33.52	0.249	0.78
		Diabetes	70	121.07	30.13		
		COPD	70	118.02	25.38		
Subdimensions	Perceived Susceptibility	Hypertension	70	20.45	8.06	0.01	0.98
		Diabetes	70	20.55	7.15		
		COPD	70	20.34	5.39		
	Perceived Severity	Hypertension	70	19.84	7.8	0.532	0.58
		Diabetes	70	20.75	8.17		
		COPD	70	19.51	5.99		
	Health Motivation	Hypertension	70	19.75	5.19	1.285	0.27
		Diabetes	70	20.17	4.17		
		COPD	70	20.98	4.40		
	Perceived Benefit	Hypertension	70	15.32	3.50	1.471	0.23
		Diabetes	70	15.10	3.04		
		COPD	70	14.47	2.55		
	Perceived Barriers	Hypertension	70	20.58	7.47	1.289	0.27
		Diabetes	70	19.54	7.36		
		COPD	70	18.60	7.11		
	Self-Efficacy	Hypertension	70	25.18	6.32	0.710	0.49
		Diabetes	70	24.94	5.13		
		COPD	70	24.11	5.19		

n: Frequency, **X:** Mean, **SD:** Standard Deviation, *One-Way ANOVA

When treatment adherence was compared based on the chronic diseases patients had, a statistically significant difference was found among the groups ($p < 0.05$). In pairwise comparisons, the difference in mean scores on both the ARMS-7 scale and its subdimensions was found to be highly significant ($p < 0.001$) between hypertension and COPD patients, and significantly high ($p < 0.01$) between diabetes and COPD patients. It was observed that COPD patients had higher treatment adherence than those with hypertension or diabetes (Table 3).

Table 3. Comparison of the mean scores on the ARMS-7 and its subdimensions by patients' chronic disease

Scale and Its Subdimensions		Chronic Disease	n	X	SD	F	p	Difference
ARMS-7		Hypertension (a)	70	13.22	3.79			c<a
		Diabetes(b)	70	13.11	4.55	8.32	<0.001	c<b
		COPD (c)	70	10.90	2.87			
Subdimensions	Taking Medication	Hypertension (a)	70	6.54	2.65			c<a
		Diabetes(b)	70	6.51	2.86	3.60	0.02	c<b
		COPD (c)	70	5.57	1.6			
	Refilling Medication	Hypertension (a)	70	6.68	1.31			c<a
		Diabetes(b)	70	6.60	1.79	16.30	<0.001	c<b
		COPD (c)	70	5.32	1.56			

n: Frequency, **X:** Mean, **SD:** Standard Deviation, *One-Way ANOVA

When the relationship between patients' health belief perceptions and treatment adherence was evaluated separately for each disease group, a statistically significant negative correlation was found strong for diabetes patients ($r=-0.755$, $p=0.001$), moderate for hypertension patients ($r=-0.602$, $p=0.001$), and weak for COPD patients ($r=-0.389$, $p=0.001$). It was determined that patients' health belief perceptions and treatment compliance increased together.

Discussion

Medication use and treatment adherence in chronic diseases have a critical impact on health outcomes. The findings of this study indicate a significant negative correlation between the health beliefs of individuals with chronic diseases and their adherence to treatment. Specifically, the relationship was strong among patients with diabetes, moderate among those with hypertension, and weak among those with COPD. These findings align with similar results reported in the literature¹⁴.

The medication adherence level of patients with hypertension was found to be moderate. The literature indicates that non-adherence to hypertension therapy is widespread globally, with approximately half of patients not continuing treatment regularly¹⁵. Low health beliefs, inadequate awareness of the disease, and insufficient education regarding lifestyle modifications are cited as the primary reasons for this issue¹⁶.

High medication adherence among diabetic individuals may stem from their increased awareness of the severity of the disease and the regular patient education they receive, as noted in the literature. According to the 2022 report by the International Diabetes Federation (IDF), patient education plays a critical role in diabetes management, and regular patient education sessions enhance treatment adherence^{5,17}.

Although COPD patients showed low health beliefs regarding medication use, their treatment adherence was higher, likely because their symptoms are more pronounced and directly affect daily life¹⁸.

The importance of nursing interventions for strengthening health beliefs in chronic illnesses should be emphasized. It is indicated that educational and counseling services led with the active participation of healthcare professionals can raise patients' awareness of medication use and thus positively influence treatment adherence¹⁹.

In conclusion, from the perspective of the Health Belief Model, personalized intervention strategies should be developed to improve patients' treatment adherence. More comprehensive, long-term studies evaluating the effectiveness of these strategies are recommended²⁰. However, this study has some limitations. Since the data were gathered from a single family health center, the generalizability of the findings may be restricted. Additionally, due to the cross-sectional design, causality between the variables cannot be definitively established. Since self-report scales were used in the research, there may be bias or subjective assessments in participants' responses. Future research with multi-center, large-sample, and longitudinal designs will allow for a more extensive evaluation of the findings.

Conclusion

In conclusion, it has been demonstrated that the health beliefs of individuals with chronic diseases regarding medication use are significantly related to their treatment adherence. An increase in the level of health beliefs positively influences patients' adherence to treatment, and this relationship was found to be particularly strong among COPD patients.

Based on these findings, it is emphasized that healthcare professionals should prioritize regular patient education and counseling services in the management of chronic diseases. Supportive interventions should be planned to help patients maintain regular medication use, implement lifestyle modifications, and develop a sense of responsibility for their own health. Additionally, strengthening social support systems and ensuring regular follow-up appointments can enhance treatment success.

Future studies should be conducted with larger and more diverse samples, using multi-center and longitudinal designs. Furthermore, focusing on intervention studies that evaluate the effectiveness of strategies aimed at positively developing health beliefs could be beneficial for improving treatment adherence in chronic diseases.

REFERENCES

1. World Health Organization. The top 10 causes of death. World Health Organization. <https://www.who.int/news-room/fact-sheets/detail/noncommunicable-diseases>. Published 2020. Accessed March 8, 2025.
2. Williams B, Mancia G, Spiering W, et al. ESC/ESH task force for the management of arterial hypertension. 2018 ESC/ESH guidelines for the management of arterial hypertension. *Eur Heart J*. 2018;39(33):3021-3104. doi: 10.1093/eurheartj/ehy339.

3. Virani SS, Alonso A, Aparicio HJ, et al. Heart disease and stroke statistics—2020 update. *Circulation*. 2020;141(9):e139-e596. doi: 10.1161/CIR.0000000000000757.
4. Yurekli AA, Bilir N, Husain MJ. Türkiye'de hipertansiyon yükünün tahmini ve yönetimi, 2015-2030. *PLoS One*. 2019;14(9):e0221556. doi: 10.1371/journal.pone.0221556.
5. International Diabetes Federation. IDF Diabetes Atlas. 10th ed. International Diabetes Federation; 2021. <https://diabetesatlas.org/atlas/tenth-edition/>. Accessed February 20, 2024.
6. Saeedi P, Petersohn I, Salpea P, et al. IDF Diabetes Atlas Committee. Global and regional diabetes prevalence estimates for 2019 and projections for 2030 and 2045. *Diabetes Res Clin Pract*. 2019;157:107843. doi: 10.1016/j.diabres.2019.107843.
7. Global Initiative for Chronic Obstructive Lung Disease (GOLD). Global strategy for the diagnosis, management, and prevention of chronic obstructive pulmonary disease—2021 report. GOLD. <https://goldcopd.org/2021-gold-report/>. Published 2021. Accessed March 8, 2025.
8. GBD 2017 Risk Factor Collaborators. Global, regional, and national comparative risk assessment of 84 behavioral, environmental and occupational, and metabolic risks or clusters of risks for 195 countries and territories, 1990-2017. *Lancet*. 2018;392(10159):1923-1994. doi: 10.1016/S0140-6736(18)32225-6.
9. Glanz K, Rimer BK, Viswanath K, eds. *Health Behavior: Theory, Research, and Practice*. 6th ed. New York: Jossey-Bass/Wiley; 2020.
10. Erci B, Çiçek Z. Reliability and validity of drugs use health belief scale in adult women. *Int Arch Nurs Health Care*. 2017;3:064. doi: 10.23937/2469-5823/1510064.
11. Doğan MD, Tosun E, Tek AD. Kronik hastalıklarda hastalık algısı, yaşam kalitesi, öz-bakım yönetimi. *Gümüşhane Üniversitesi Sağlık Bilimleri Dergisi*. 2018;7(3):33-40.
12. Kripalani S, Risser J, Gatti ME, Jacobson TA. Development and evaluation of the Adherence to Refills and Medications Scale (ARMS) among low-literacy patients with chronic disease. *Value Health*. 2009;12(1):118-123.
13. Gökdoğan F, Kes D. Validity and reliability of the Turkish Adherence to Refills and Medications Scale. *Int J Nurs Pract*. 2017;e12566. doi: 10.1111/ijn.12566.
14. Peng Y, Zhong GC, Wang L, et al. Chronic obstructive pulmonary disease, lung function and risk of type 2 diabetes: A systematic review and meta-analysis of cohort studies. *BMC Pulm Med*. 2020;20:137. doi: 10.1186/s12890-020-1178-y.
15. World Health Organization. Hypertension. World Health Organization. <https://www.who.int/news-room/fact-sheets/detail/hypertension>. Published 2021. Accessed February 20, 2024.

- 16.** Chimezie RO. Health awareness: A significant factor in chronic diseases prevention and access to care. *J Biosci Med.* 2023;11(2):64-79. doi: 10.4236/jbm.2023.112006.
- 17.** Mustapa A, Justine M, Manaf H. Effects of patient education on the quality of life of patients with type 2 diabetes mellitus: A scoping review. *Malays Fam Physician.* 2022;17(3):22.
- 18.** Poletti V, Pagnini F, Banfi P, Volpato E. Illness perceptions, cognitions, and beliefs on COPD patients' adherence to treatment—a systematic review. *Patient Prefer Adherence.* 2023;17:1845-1866. doi: 10.2147/PPA.S418437.
- 19.** Flaubert JL, Le Menestrel S, Williams DR, Wakefield MK, eds; National Academies of Sciences, Engineering, and Medicine. *The Future of Nursing 2020-2030: Charting a Path to Achieve Health Equity.* National Academies Press; 2021.
- 20.** Tian L, Weng Y, Xu A, Chen Y, Tang J. Effect of behavior modification combined with health belief model education on adherence to skin moisturizing care in patients with psoriasis vulgaris. *Sci Rep.* 2024;14(1):31997. doi: 10.1038/s41598-024-31997-4.

Examination of the Relationship between Adolescents' Psychological Resilience and Depression and Somatic Symptoms During the COVID-19 Pandemic*

Bidar Süreyya KARAASLAN**, Deniz YILDIZ***

Abstract

Aim: The COVID-19 pandemic has had profound impacts on physical, psychological, economic, and social aspects globally. This study was designed with the consideration of how the pandemic, which affects each age group differently, might impact individuals going through the challenging stages of adolescence. In line with this purpose, this study aims to examine whether the relationship between psychological resilience, depression, and somatic symptoms is significant during adolescence in the context of the COVID-19 pandemic.

Method: The sample comprised 417 students aged 14-17, living in Turkey. Instruments used included Demographic Information Form, DSM V Level-2 Somatic Symptoms Scale for 11-17 Years Old Child Form, Adolescent Psychological Resilience Scale and Kutcher Adolescent Depression Scale. Independent Sample T-Test, ANOVA and Correlation Analysis were used to analyze the data.

Results: As a result of the study, it was determined that there is a significant negative relationship between the psychological resilience levels of adolescents and their depression and somatic symptoms. It was also found that the mean scores of depression, somatic symptoms, and psychological resilience showed statistically significant differences in terms of the presence of a chronic illness, presence of a separate room for adolescents at home, time allocated for sports and physical activities, receiving support from family when experiencing problems, and receiving support from friends when experiencing problems.

Conclusion: Uncovering the relationship between adolescents' psychological resilience and their depression and somatic symptoms during the pandemic is expected to contribute to future psychological support efforts, particularly considering the negative impact of both somatization and depression on adolescents' functionality.

Keywords: COVID-19, resilience, depression, somatic symptoms.

COVID-19 Salgın Sürecinde Ergenlerin Psikolojik Sağlamlıkları ile Depresyon ve Somatik Belirtileri Arasındaki İlişkinin İncelenmesi

Öz

Amaç: COVID-19 pandemisi, dünya çapında fiziksel, psikolojik, ekonomik ve sosyal açılardan derin etkiler yaratmıştır. Bu çalışma, her yaş grubunu farklı şekilde etkileyen pandeminin, ergenliğin zorlu evrelerinden geçen bireyleri nasıl etkileyebileceği göz önünde bulundurularak tasarlanmıştır. Çalışmanın amacı COVID-

Özgün Araştırma Makalesi (Original Research Article)

Geliş / Received: 18.09.2024 & **Kabul / Accepted:** 07.07.2025

DOI: <https://doi.org/10.38079/igusabder.1552168>

* This study has been derived from the master's thesis titled "Examining the Relationship Between Adolescents' Psychological Resilience and Depression and Somatic Symptoms During the COVID-19 Pandemic (Covid-19 Salgın Sürecinde Ergenlerin Psikolojik Sağlamlıkları ile Depresyon ve Somatik Belirtileri Arasındaki İlişkinin İncelenmesi)" which was accepted in 2021 at Istanbul Gelisim University, Institute of Graduate Studies, Department of Clinical Psychology and prepared by Bidar Süreyya KARAASLAN under the consultancy of Asst. Prof. Deniz YILDIZ.

** Clinical Psychologist, Istanbul Metropolitan Municipality Esenler Psychological Counseling Center, Istanbul, Türkiye.

E-mail: bidarozkerim@hotmail.com.tr [ORCID https://orcid.org/0000-0002-4878-0291](https://orcid.org/0000-0002-4878-0291)

*** Asst. Prof., Istanbul Gelisim University, Faculty of Health Sciences, Department of Child Development, Istanbul, Türkiye. E-mail: deyildiz@gelisim.edu.tr [ORCID https://orcid.org/0000-0003-2152-1895](https://orcid.org/0000-0003-2152-1895)

ETHICAL STATEMENT: This study was approved by the Istanbul Gelisim University Ethics Committee Presidency with the decision dated 21/08/2020 and numbered 2020-22 to conduct the research.

19 salgın sürecinde ergenlerde psikolojik sađamlık ile depresyon ve somatik belirtiler arasındaki ilişkinin incelenmesidir.

Yöntem: Araştırmaya Türkiye’de yaşamakta olan 14-17 yaş arası 417 öğrenci katılmıştır. Araştırmanın verileri sosyodemografik veri formu, DSM V Düzey-2 Bedensel Belirtiler Ölçeđi 11-17 Yaş Arası Çocuk Formu, Ergen Psikolojik Dayanıklılık Ölçeđi ve Kutcher Ergen Depresyon Ölçeđi kullanılarak toplanmıştır. Verilerin analizinde Bağımsız Örneklem T-Testi, ANOVA ve Korelasyon Analizi kullanılmıştır.

Bulgular: Araştırma sonucunda ergenlerin psikolojik sađamlık düzeyleri ile depresyon ve bedensel belirtiler düzeyleri arasında negatif yönde anlamlı bir ilişki olduğu belirlenmiştir. Ayrıca, depresyon, somatik belirtiler, psikolojik sađamlık ortalama skorlarının kronik hastalığa sahip olma, evde ayrı odası olma, spor faaliyetlerine zaman ayırma, sorunla karşılaştığında aile ve arkadaşlardan destek alma değışkenlerine göre istatistiksel olarak anlamlı farklılıklar gösterdiği saptanmıştır.

Sonuç: Pandemi sürecinde ergenlerin psikolojik dayanıklılıkları ile depresyon ve somatik semptomları arasındaki ilişkinin ortaya konması, özellikle somatizasyon ve depresyonun ergenlerin işlevselliđi üzerindeki olumsuz etkisi göz önünde bulundurulduğunda, gelecekteki psikolojik destek çalışmalarına katkı sađlaması açısından önemlidir.

Anahtar Sözcükler: COVID-19, psikolojik sađamlık, depresyon, somatik belirtiler.

Introduction

The COVID-19 pandemic has significantly impacted people both physically and psychologically, not only due to the pandemic itself but also as a result of the restrictive measures implemented as precautions. In this regard, the COVID-19 pandemic is considered a societal trauma. It has been reported that pandemics cause widespread anxiety, fear, and stress among individuals¹. According to data from a study conducted in China at the beginning of the pandemic, involving approximately 194 cities, 54% of participants reported experiencing moderate or severe levels of anxiety, depression, and stress². Another study conducted in Turkey found that the fear and uncertainty surrounding COVID-19 increased anxiety and depressive symptoms among individuals³. During pandemics, people often exhibit reactions similar to those observed in post-traumatic stress situations. Emotional breakdowns, difficulty in adapting, and anxiety are among these reactions, serving as defense mechanisms against the experienced circumstances⁴. In this sense, the COVID-19 pandemic has undermined people's confidence in life, leading to uncertainty and manifesting in crises throughout the process⁵. Prolonged exposure to stressors, social isolation, feeling of uncertainty during pandemic can contribute to a decline in psychological resilience^{3,4}. Moreover, disruption of daily routines, lack of social support, persistent fear of infection may exacerbate vulnerability, making it difficult for individuals to cope effectively with challenges.

Adolescence is a period marked by significant psychological, sociological, and biological changes. During this period, adolescents often experience a heightened sense of identity confusion, crisis, and adjustment difficulties. It is believed that certain personal factors such as self-confidence, high resilience, and internal locus of control can help adolescents navigate this turbulent period more healthily and contribute to the formation of a stable identity⁶. Due to these characteristics of adolescence, much research has focused on the effects of COVID-19 and its restrictions on adolescents. Meherali et al. reviewed 18 studies involving 20,150 children and adolescents from five countries (Australia, Canada, China, Italy, and the USA) and found that COVID-19 restrictions significantly impacted their mental health, leading to increased anxiety, depression, sleep and appetite

disturbances, and impaired social interactions^{7,8}. Furthermore, a review by Panda et al. identified anxiety, depression, irritability, boredom, inattention, and fear of the COVID-19 pandemic as prevalent psychological issues among children and adolescents⁹. Research has shown that as age and support decrease, coping with the pandemic becomes more challenging¹⁰, while psychological resilience is strengthened when external factors such as individual, familial, school, and peer relationships are strong and healthy¹¹.

Somatization is the body's response to stress and emotional stimuli¹². It has been known that psychological disorders, such as depression, can manifest as physical symptoms¹³. While the specific etiology of somatization disorders has not yet been conclusively determined, several possible risk factors have been identified, such as psychological strain and stressful life events¹⁴. In a study conducted with adolescents aged 13-17 in Turkey, it was reported that frequently experienced but unexpressed negative emotions and thoughts could manifest as physical complaints in adolescents¹⁵. Researchers have indicated that adolescents reported more somatization symptoms during the pandemic than before¹⁶. For the individual, somatization can lead to serious functional impairments, a reduction in quality of life, and diminished work participation¹⁷.

Psychological resilience refers to the ability, outcome, or dynamic process of successfully adapting to adversity, trauma, or other major stressors¹⁸. Many studies have shown that individuals with higher levels of psychological resilience cope better with adverse situations compared to others. Research has demonstrated that individuals with higher levels of psychological resilience tend to navigate challenging times more optimistically and maintain better mental health. Regarding these results, it is possible to mention that psychological resilience may mitigate the adverse effects of stress^{19,20}. Thus, resilience serves as a buffer against stress or traumatic events and can protect against psychological distress. Assessing an individual's psychological resilience could, therefore, help predict their mental health status.

Considering the aforementioned studies, it is believed that the sudden onset of the COVID-19 pandemic has significantly affected adolescents, who are already undergoing numerous developmental changes. For these reasons, this study was designed based on the hypothesis that there would be a significant negative correlation between the psychological resilience of adolescents during the COVID-19 pandemic and their depressive and somatic symptoms. The aim of the study is to examine the relationship between the psychological resilience, depression levels, and somatic symptoms of adolescents aged 14-17 during the pandemic. Uncovering the relationship between adolescents' psychological resilience and their depression and somatic symptoms during the pandemic is expected to contribute to future psychological support efforts, particularly considering the negative impact of both somatization and depression on adolescents' functionality. This study is also expected to serve as an example for preventive and protective mental health efforts in Turkey in response to any global risk situation. Moreover, it aims to highlight the importance of conducting more sensitive psychological strengthening programs for adolescents.

Material and Methods

Participants

The sample of this study consists of adolescents aged 14-17 living in various cities across Turkey. According to the sample size standards developed by Yazıcıoğlu and Erdoğan (2004), with probabilities of $p=0.8$ and $q=0.2$, a sampling error of 0.5, and a confidence level of $\alpha=0.05$, a minimum sample size of 384 individuals is required from a population exceeding 10 000 000²¹. Given the difficulty of reaching an equal number of participants from each city, a random sampling method was employed. In order to collect data, adolescents were reached through WhatsApp and social media platforms such as Facebook and Instagram, and surveys prepared using Google Forms were distributed. To ensure the accuracy and reliability of the collected data, all responses were reviewed to identify incomplete or inconsistent answers. Responses that were clearly invalid, such as contradictions or out-of-range values, were removed. The final dataset was carefully examined for any other anomalies or errors, and only the valid, complete responses were included in the analysis. A total of 427 students from the cities of Istanbul, Kocaeli, Diyarbakır, İzmir, Ankara, and Gaziantep participated in the study. Due to outlier responses, 10 surveys were excluded. Therefore, the final sample of the study consists of 417 adolescents aged 14-17 residing in Istanbul, Kocaeli, Diyarbakır, İzmir, Ankara, and Gaziantep.

Data Collection: In this study, the data collection method used was a survey. During the data collection phase, the predetermined scales were distributed to individuals via online survey forms.

Data Collection Instruments: The first section of the survey used in the study includes a Demographic Data Form, which collects personal information about the participants. The second section of the survey consists of the Adolescent Psychological Resilience Scale, the Kutcher Adolescent Depression Scale, and the DSM-5 Level-2 Somatic Symptoms Scale for Children Aged 11-17.

Demographic Data Form: The Demographic Data Form, prepared by the researcher, is a structured form designed to collect demographic information such as age, gender, and the presence of chronic illness from the sample.

Adolescent Psychological Resilience Scale (APRS): This scale was developed by Bulut et al. in 2012 to measure the psychological resilience levels of adolescents. It consists of sub-dimensions including family support, peer support, school support, adaptation, perseverance, and empathy²².

Kutcher Adolescent Depression Scale (KADS-11): Developed by Kutcher et al. in 2004²³, the validity and reliability of this scale were tested in 2019 by Balcı and Uysal²⁴. According to the exploratory and confirmatory factor analyses, the KADS-11 has a unidimensional structure. The confirmatory factor analysis revealed an excellent model-data fit for the one-factor model. The scale's Cronbach's alpha internal consistency coefficient was found to be 0.82.

DSM-5 Level-2 Somatic Symptoms Scale for Children Aged 11-17: This scale, translated and adapted into Turkish by Sapmaz et al. (2016)²⁵, is an adaptation of the 15-item Patient Health Questionnaire Physical Symptoms (PHQ-15), developed by Kroenke

et al. in 2002, to assess somatic symptoms in children and adolescents. Items 4 and 11, which are specific to adults, were omitted from the children's version. Reliability analyses included internal consistency coefficients, item-total score correlation, test-retest reliability, and inter-rater reliability. Validity analyses involved exploratory factor analysis and correlation analysis with the 'Children's Somatization Scale' for concurrent validity²⁶.

Ethical Statement

This study was approved by the Istanbul Gelisim University Ethics Committee Presidency with the decision dated 21/08/2020 and numbered 2020-22 to conduct the research. The participants in this study were informed before the survey and a consent form was signed.

Data Analysis

The skewness and kurtosis values of the variables analyzed in the study were found to fall between the critical values of -1 and +1, indicating a normal distribution²⁷. The data were analyzed using IBM SPSS 21, where statistical tests and analyses were applied. The Independent Samples T-Test and ANOVA were used to determine group differences, while Pearson Correlation Analysis was used to examine the relationships between variables.

Results

According to sociodemographic variables, adolescents' levels of depression, somatic symptoms, and psychological resilience did not significantly differ by gender (Table 1).

It was found that the mean scores of somatic symptoms showed statistically significant differences in terms of the presence of a chronic illness, the presence of a separate room for adolescents at home, the time allocated for sports and physical activities, receiving support from family when experiencing problems, and receiving support from friends when experiencing problems. Adolescents who reported the presence of a chronic illness were found to have higher somatic symptoms compared to those without any chronic illness ($p = 0.007$). Based on the LSD test, determined after the homogeneity test, it was found that adolescents who did not have a separate room at home had higher somatic symptoms compared to those who shared a room or had their own room ($p = 0.007$). Adolescents who stated they did not allocate sufficient time for sports and physical activities had higher somatic symptoms compared to those who did ($p = 0.014$). Furthermore, adolescents who reported not receiving or partially receiving support from their family or friends when facing problems were found to have higher somatic symptoms compared to those who received support ($p = 0.000$; $p = 0.042$).

Table 1. Depression, Somatic Symptom Scale and Psychological Resilience Scale scores according to participants sociodemographic characteristics.

Variables		n(%)	Depression (mean±SD)	Analysis results	Somatic Symptoms (mean±SD)	Analysis results	Psychological Resilience (mean±SD)	Analysis results
Sex	Female	297(71.2)	14.71±7.48	t=-0.536	8.23±4.66	t=0.057	88.64±10.89	t=0.223
	Male	120(28.8)	12.12±6.84	p=0.593	5.75±4.26	p=0.954	87.96±11.90	p=0.824
Presence of chronical diseases	Yes	47(11.3)	14.53±6.82	t=0.559	9.26±4.57	t=2.726	90.83±10.36	t=1.555
	No	370(88.7)	13.89±7.46	p=0.577	7.29±4.65	p=0.007	88.14±11.26	p=0.121
Presence of a separte room at home	Only room	181(43.4)	13.55±7.15	f=0.509 p=0.602	7.11±4.35	f=4.999 p=0.007 3 > 1, 2	89.22±10.66	f=3.453 p=0.033 1, 2 > 3
	Shared room with siblings	206(49.4)	14.29±7.75		7.51±4.83		88.49±11.25	
	No separte room	30(7.2)	14.23±6.27		10.00±4.95		83.47±12.75	
Sports or outdoor activites	Yes	95(22.8)	12.89±7.93	f=7.674	6.68±4.43	f=4.346	92.20±11.13	f=13.386
	Sometimes	179(42.9)	12.99±6.62	p=0.001	7.26±4.74	p=0.014	89.22±10.01	p=0.000
	No	143(34.3)	15.90±7.60	3 > 1, 2	8.39±4.66	3 > 1, 2	84.99±11.67	1, 2 > 3
Support from family in time of crisis	Yes	258(61.9)	12.14±7.10	f=23.155	6.86±4.61	t=8.767	92.17±9.94	f=54.960
	Partially	126(30.2)	16.69±6.58	p=0.000	8.23±4.33	p=0.000	83.97±10.07	p=0.000
	No	33(7.9)	17.82±8.06	3, 2 > 1	9.94±5.41	3, 2 > 1	76.39±9.71	1 > 2 > 3
Support from friends in time of crisis	Yes	199(47.7)	12.74±7.63	f=7.662	7.21±4.81	f=3.197	92.08±10.35	f=36.902
	Partially	174(41.7)	14.55±7.11	p=0.001	7.45±4.38	p=0.042	86.94±10.56	p=0.000
	No	44(10.6)	17.18±6.18	3 > 1, 2	9.16±5.00	3 > 1, 2	77.95±9.15	1 > 2 > 3

The mean scores of depression showed statistically significant differences in terms of time allocated for sports and physical activities, receiving support from family when experiencing problems, and receiving support from friends when experiencing problems. According to the results of the LSD test, determined after the homogeneity test, adolescents who stated they did not allocate enough time for sports and physical activities had higher levels of depression compared to others ($p = 0.001$). Adolescents who reported receiving support from their family during times of difficulty had lower levels of depression compared to others ($p = 0.000$), while adolescents who reported not receiving support from their friends during times of difficulty had higher levels of depression compared to other adolescents ($p = 0.001$).

The mean scores of psychological resilience were found to show statistically significant differences in terms of the presence of a separate room for adolescents at home, time allocated for sports and physical activities, receiving support from family when experiencing problems, and receiving support from friends when experiencing problems. According to LSD test results conducted following the homogeneity test, adolescents who had a shared or their own room at home had higher resilience scores compared to those who did not have a separate room ($p = 0.033$). Additionally, adolescents who reported allocating sufficient time for sports and physical activities had higher resilience scores compared to those who did not ($p = 0.000$). Adolescents who reported receiving support from their family or friends during times of difficulty had higher resilience scores

compared to those who did not receive support from family or friends ($p = 0.000$; $p = 0.000$).

Table 2. Relationship between depression, somatic symptoms, and psychological resilience.

	1	2	3	4	5	6	7	8	9
1. Depression	-								
2. Somatic Symptoms	0.62**	-							
3. Psychological Resilience	-0.52**	-0.32**	-						
4. Family Support	-0.32**	-0.27**	0.69**	-					
5. Peer Support	-0.12*	-0.10*	0.58**	0.31**	-				
6. School Support	-0.38**	-0.19**	0.62**	0.21**	0.12*	-			
7. Adjustment	-0.39**	-0.21**	0.62**	0.26**	0.23**	0.23**	-		
8. Perseverance	-0.54**	-0.29**	0.51**	0.12*	-0.03	0.48**	0.31**	-	
9. Empathy	-0.07	-0.02	0.44**	0.21**	0.32**	0.04	0.37**	-0.04	-

According to the results of the Pearson Correlation Analysis presented in Table 2, a significant negative correlation was observed between adolescents' psychological resilience levels and both depression ($r(415) = -0.52$, $p < 0.001$) and somatic symptom levels ($r(415) = -0.32$, $p < 0.001$). Additionally, a significant positive correlation was observed between depression and somatic symptom levels ($r = 0.62$, $p < 0.001$).

Discussion

As a result of this study, a significant and negative correlation was found between adolescents' psychological resilience levels and depression symptoms. As adolescents' psychological resilience increases, their depression scores decrease. This finding is consistent with many studies in the literature. A study examining the effects of childhood trauma also found that increased psychological resilience alleviated the levels of depressive symptoms²⁸. Research has shown that strong psychological resilience has a protective effect against the psychological symptoms of the COVID-19 pandemic and reduces the prevalence of depression^{10,29,30}.

This study demonstrated that as psychological resilience increases, the scores of somatic symptoms decrease. In a study examining psychological resilience, coping styles, and psychological symptoms during the coronavirus pandemic, it was found that somatization symptoms were negatively affected by low levels of psychological resilience, fear of infection, and dysfunctional coping mechanisms¹⁰. A study from China in 2020 also identified a negative relationship between individuals' psychological resilience levels and somatization symptoms³⁰. In light of literature, it can be concluded that psychological resilience plays a protective role against mental health problems.

As another finding of the study, a significant and positive correlation was found between depressive symptoms and somatic symptoms. It has long been known that mental disorders, such as depression, can manifest with physical symptoms and that somatization can accompany the clinical picture¹³. When individuals are exposed to stressful life events and struggle to cope, they tend to exhibit physical responses. According to research findings that examined the relationship between life satisfaction

and somatic symptoms in adolescents, a significant relationship was found between adolescents' life satisfaction, depressive symptoms, and somatization³¹. In a study conducted by Kapıkıran (2001), it was found that the adaptation levels of adolescents were significantly negatively correlated with somatic symptoms³². Upon reviewing the existing research in the field, it was observed that this study supports previous studies.

The study also revealed that during the COVID-19 pandemic, adolescents' levels of depression, somatic symptoms, and psychological resilience did not significantly differ by gender. Across many cultural contexts, female adolescents have a predisposition to develop depression primarily due to biological vulnerabilities. While many studies in the literature suggest that female adolescents tend to have higher levels of depression and somatization compared to males³³⁻³⁶, there are also studies in line with this study's findings in terms of depression scores^{37,38}. The differing results in this research may be attributed to the unequal gender distribution in the sample, the self-report nature of measures, and methodological differences such as the variation in scales used.

Regarding the studies examining the differences in adolescents' psychological resilience levels by gender, while some studies found no significant differences³⁹, other studies indicated that girls had higher psychological resilience levels compared to boys^{40,41}. The effect of gender on psychological resilience has been tested in many studies, but no consensus has been reached. The differing results across studies may be due to methodological differences, such as unequal gender distributions, the scales used, the environments from which the samples were drawn, and the differences in sample sizes.

As a result of the study, it was found that the average depression scores of adolescent individuals did not show a statistically significant difference based on the presence of chronic illness. Both groups were found to exhibit mild levels of depressive symptoms. However, upon reviewing the literature, it was identified that many studies have reached different conclusions from this research. In his study, Toros (2002) reported that depressive symptoms in children and adolescents could increase due to chronic illness⁴². According to research, depressive findings in individuals with chronic illness range between 20% and 80%⁴³. The differing results in our study may be due to the smaller number of adolescents with a chronic illness (47) compared to those without, the reliance on self-report symptom scales, and the fact that the study was conducted during the pandemic, which may have caused the entire sample group to already exhibit mild depressive levels, thus leading to no significant difference being detected. These factors may have influenced the results.

The study found that the average somatic symptom scores of adolescents showed a statistically significant difference based on the presence of chronic illness, with those presence of chronic illness exhibiting higher symptom levels than those without. This finding is in line with other studies in the literature^{44,45}. This study also found that the average psychological resilience scores of adolescent individuals did not show a statistically significant difference based on the presence of chronic illness. When the literature is examined, it is noted that patients with chronic diseases often experience repetitive psychological stress, meaning they can be vulnerable to maladaptation⁴⁶, so a lower level of psychological resilience would be expected. The inconsistency of our results

with the literature may be due to the small number of adolescents with chronic illness⁴⁷ compared to those without.

As a result of the study, it was determined that adolescents without a separate room at home exhibited higher somatic symptoms compared to those with shared or private rooms, and their psychological resilience levels were lower. In the literature review, no studies directly examining this relationship were found. However, it is thought that presence of a separate room, which provides personal space and privacy, could influence factors such as psychological resilience and somatization in adolescents. Adolescents without a private room may experience more physical symptoms of stress (e.g., headaches, stomach issues) due to constant social pressures and the lack of personal space. This may increase somatization symptoms. Individuals need private space to cope with difficulties and to rest. Presence of a personal room can enhance an adolescent's academic and personal interests, making them feel respected within the family and reinforcing their sense of individuality. These positive feelings may enable adolescents to recover more easily after facing challenges, as they feel more comfortable in their environment.

The study also found that adolescents who reported not allocating enough time to sports and physical activities had higher levels of depression and somatic symptoms, and lower levels of psychological resilience compared to those who did. Numerous studies have found that exercise reduces stress and prevents many illnesses, as well as decreasing depression and somatic symptoms⁴⁷⁻⁴⁹. Moreover, having a healthy body and mind is shown to be a protective factor in coping with challenges⁵⁰. In this context, our findings align with the existing literature.

In this study, it was found that adolescents who are able to receive support from their family or friends when facing problems have lower depression and somatic symptom scores and higher psychological resilience scores. Similarly, a study by Eskin and colleagues (2008) conducted among 805 high school students in Aydın province found a significant relationship between weak family and friend support and the level of depression in students⁵¹. Studies in the literature have shown that as the social support for adolescents increases, their level of adjustment improves and their level of depression decreases⁵²⁻⁵⁴.

Conclusion

This study highlights the significant relationships between psychological resilience, depression, and somatic symptoms among adolescents. The findings demonstrate that higher levels of psychological resilience are associated with lower levels of depression and somatic symptoms, reinforcing the protective role of resilience in adolescent mental health. The study also reveals no significant gender differences in depression, somatic symptoms, or resilience, contradicting previous literature. Additionally, while no differences were found in depression or resilience based on the presence of chronic illness, adolescents with chronic illnesses exhibited higher somatic symptoms. Other key findings include the impact of personal space, with adolescents lacking private rooms showing higher somatic symptoms and lower resilience, and the role of physical activity and social support in improving mental health outcomes. The relationship between adolescents' psychological resilience, depression, and somatic symptoms during the

pandemic is expected to provide valuable insights for future psychological support efforts, especially given the negative impact of both somatization and depression on adolescents' overall well-being and functioning. This study is also expected to serve as an example for preventive and protective mental health efforts in Turkey in response to any global risk situation.

However, the study's limitations must be considered. These include an unequal gender distribution and reliance on self-reported measures. Furthermore, the study was conducted during the COVID-19 pandemic, which may have affected the overall levels of depressive symptoms across the sample.

For future research, larger and more diverse samples should be considered to examine the interactions. Longitudinal studies could help establish causal relationships and explore the long-term effects of resilience-building interventions. Additionally, examining the influence of personal space on adolescent mental health warrants further investigation, as this study offers preliminary insights into a potentially significant but underexplored area.

Ethical Considerations: This study was approved by the Istanbul Gelisim University Ethics Committee Presidency with the decision dated 21/08/2020 and numbered 2020-22 to conduct the research. The participants to be included in the study were informed before the survey, and a consent form was signed.

Acknowledgments

This article has been derived from the first author's master's thesis.

Conflict of Interests

The authors declare no conflict of interests.

REFERENCES

1. World Health Organization. Stresli Anlarda Ne Yapmalı?: Resimli Rehber. <https://apps.who.int/iris/bitstream/handle/10665/333917/WHO-EURO-2020-361-40096-54908-tur.pdf> (2020).
2. Wang C, Pan R, Wan X, et al. Immediate psychological responses and associated factors during the initial stage of the 2019 coronavirus disease (COVID-19) epidemic among the general population in China. *International Journal of Environmental Research and Public Health*. 2020;17(5):1729. doi: 10.3390/ijerph17051729.
3. Satıcı B, Gocet-Tekin E, Deniz ME, Satıcı SA. Adaptation of the Fear of COVID-19 Scale: Its association with psychological distress and life satisfaction in Turkey. *International Journal of Mental Health and Addiction*. 2020;19(6):1980-1988.
4. Kasapoğlu F. COVID-19 Salgını sürecinde kaygı ile maneviyat, psikolojik sağlamlık ve belirsizliğe tahammülsüzlük arasındaki ilişkilerin incelenmesi. *Electronic Turkish Studies*. 2020;15(4):599-614. doi: 10.7827/TurkishStudies.44284.

5. Doğan MM, Düzel B. Covid-19 özelinde korku-kaygı düzeyleri. *Electronic Turkish Studies*. 2020;15(4):739-752. doi: 10.7827/TurkishStudies.44678.
6. Ünüvar A. Gerçeklik kuramına dayalı psiko-eğitim programının lise öğrencilerinin denetim odağı ve yılmazlık düzeyi üzerindeki etkisinin incelenmesi. [Doktora Tezi]. Dokuz Eylül Üniversitesi Eğitim Bilimleri Enstitüsü, İzmir. 2012.
7. Meherali S, Punjani N, Louie-Poon S, et al. Mental health of children and adolescents amidst COVID-19 and past pandemics: A rapid systematic review. *International Journal of Environmental Research and Public Health*. 2021;18:3432.
8. Pirinççi CŞ, Cihan E, Yıldırım NÜ. Üniversite öğrencilerinde fiziksel aktivite düzeyinin yaşam kalitesi, kronik hastalık varlığı, sigara kullanımı ve akademik başarıyla olan ilişkisi. *KTO Karatay Üniversitesi Sağlık Bilimleri Dergisi*. 2020;1(1):15-23.
9. Panda PK, Gupta J, Chowdhury SR, et al. Psychological and behavioral impact of lockdown and quarantine measures for COVID-19 pandemic on children, adolescents and caregivers: a systematic review and meta-analysis. *Journal Of Tropical Pediatrics*. 2021;67:fmaa122.
10. Bilge Y, Bilge Y. Koronavirüs salgını ve sosyal izolasyonun psikolojik semptomlar üzerindeki etkilerinin psikolojik sağlamlık ve stresle baş etme tarzları açısından incelenmesi. *Klinik Psikiyatri Dergisi*. 2020;23:38-51. doi: 10.5505/kpd.2020.66934.
11. Masten AS. Resilience in children threatened by extreme adversity: Frameworks for research, practice, and translational synergy. *Development and Psychopathology*. 2011;23(2):493-506. doi: 10.1017/S0954579411000198.
12. Stoudemire A. Somatothymia: parts I and II. *Psychosomatics*. 1991;32(4):365-381.
13. Lipowski EE, Bauwens SF, Collins TM. An examination of histamine-2 receptor antagonist use by medicaid recipients in Wisconsin long-term care facilities. *Journal of the American Geriatrics Society*. 1988;36(6):531-536.
14. Nater M, Fischer S, Ehlert U. Stress as a pathophysiological factor in functional somatic syndromes. *Current Psychiatry Research and Reviews*. 2011;7(2):152-169.
15. Yavuz M, Erdur B, Isik M, et al. The associations between somatization, alexithymia, and mental problems in adolescents. *Anadolu Psikiyatri Dergisi*. 2019;20(3):321-327. Hawes MT, Szenczy AK, Klein DN, Hajcak G, Nelson BD. Increases in depression and anxiety symptoms in adolescents and young adults during the COVID-19 pandemic. *Psychological Medicine*. 2021:1-9. doi: 10.1017/S0033291720005358.
16. Rask MT, Rosendal M, Fenger-Grøn M, Bro F, Ørnbøl E, Fink P. Sick leave and work disability in primary care patients with recent-onset multiple medically

- unexplained symptoms and persistent somatoform disorders: A 10-year follow-up of the FIP study. *General Hospital Psychiatry*. 2015;37(1):53–59.
17. Norris F, Tracy M, Galea S. Looking for resilience: understanding the longitudinal trajectories of responses to stress. *Social Science & Medicine*. 2009;68:2190–2198.
 18. Poole JC, Dobson KS, Pusch D. Childhood adversity and adult depression: The protective role of psychological resilience. *Child Abuse Neglect*. 2017;64:89–100.
 19. Sheerin CM, Lind MJ, Brown EA, Gardner CO, Kendler KS, Amstadter AB. The impact of resilience and subsequent stressful life events on MDD and GAD. *Depression and Anxiety*. 2018;35:140–147. doi: 10.1002/da.22700.
 20. Yazıcıoğlu Y, Erdoğan S. SPSS Uygulamalı Bilimsel Araştırma Yöntemleri, Ankara: Detay Yayıncılık, 2004.
 21. Bulut S, Doğan U, Altundağ Y. Ergen psikolojik dayanıklılık ölçeği (EPDÖ): Geçerlik ve güvenirlik çalışması. In *International Counseling and Education Conference (ICEC 2012, May)*.
 22. Brooks SJ, Krulewicz SP, Kutcher S. The kutcher adolescent depression scale: Assessment of its evaluative properties over the course of an 8-week pediatric pharmacotherapy trial. *Journal of Child and Adolescent Psychopharmacology*. 2003;13(3):337-349.
 23. Balcı S, Uysal E. Kutcher Ergen Depresyonu Ölçeği (Kedö-11) Türkçe uyarlaması: Geçerlik ve güvenirlik çalışması. *Social Sciences Studies Journal*. 2019(30):607-616.
 24. Sapmaz SY, Demirgören BS, Ülker GY, Aydemir Ö. DSM-5 Düzey 2 Bedensel Belirtiler Ölçeği Türkçe Formunun geçerliliği ve güvenirliği (11-17 Yas Çocuk ve 6-17 Yas Anne-Baba Formları). *Anadolu Psikiyatri Dergisi*. 2017;18:114-121. doi: 10.5455/apd.229979.
 25. Kroenke K, Spitzer RL, Williams J B. The PHQ-15: validity of a new measure for evaluating the severity of somatic symptoms. *Psychosomatic Medicine*. 2002;64(2):258-66.
 26. Tabachnick B, Fidell LS. Using Multivariate Statistics (6th ed.). New York: Pearson Longman, 2015.
 27. Wingo AP, Wrenn G, Pelletier T, Gutman AR, Bradley B, Ressler KJ. Moderating effects of resilience on depression in individuals with a history of childhood abuse or trauma exposure. *Journal of Affective Disorders*. 2010;126(3):411-414.
 28. Bozdağ F. Pandemi sürecinde psikolojik sağlamlık. *Electronic Turkish Studies*. 2020;15(6):247-257. doi: 10.7827/TurkishStudies.44890.
 29. Ran L, Wang W, Ai M, Kong Y, Chen J, Kuang L. Psychological resilience, depression, anxiety, and somatization symptoms in response to COVID-19: A study of the general population in China at the peak of its epidemic. *Social Science & Medicine*. 2020;262:113261. doi: 10.1016/j.socscimed.2020.113261.

30. Telef BB. Ergenlerin yaşam doyumlarının ve psikolojik semptomlarının incelenmesi. *Yeni Symposium*. 2013;51(1):3-12.
31. Kapikiran NA. Lise öğrencilerindeki psikopatolojik belirtilerin cinsiyet ve sınıf değişkenleri açısından incelenmesi. *Pamukkale Üniversitesi Eğitim Fakültesi Dergisi*. 2001;10(10):34-39.
32. Mullen S. Major depressive disorder in children and adolescents. *The mental Health Clinician*. 2018;8:275-283. doi: 10.9740/mhc.2018.11.27.
33. Magklara K, Bellos S, Niakas D, et al. Depression in late adolescence: A cross-sectional study in senior high schools in Greece. *BMC Psychiatry*. 2015;15(1):199.
34. Beck JE. A developmental perspective on functional somatic symptoms. *Journal of Pediatric Psychology*. 2008;33:547-562. doi: 10.1093/jpepsy/jsm113.
35. Romero-Acosta K, Canals J, Hernández-Martínez C, Penelo E, Zolog TC, Domènech-Llaberia E. Age and gender differences of somatic symptoms in children and adolescents. *Journal of Mental Health*. 2013; 22(1):33-41.
36. Sabuncuoğlu O, Çevikasılan A, Berkem M. Marmara depreminden etkilenen iki ayrı bölgede ergenlerde depresyon, kaygı ve davranış. *Klinik Psikiyatri*. 2003;6:189-197.
37. Sabuncuoğlu O, Ekinci Ö, Bahadır T, Akyuva Y, Altınöz E, Berkem M. Ergen öğrenciler arasında akran örselemesi ve depresyon belirtileriyle ilişkisi. *Klinik Psikiyatri*. 2006;9:27-35.
38. Turgut Ö, Çapan BE. Ergen psikolojik sağlamlık düzeyinin yordayıcıları: Algılanan sosyal destek ve okul bağlılığı. *Mehmet Akif Ersoy Üniversitesi Eğitim Fakültesi Dergisi*. 2017;(44):162-183. doi: 10.21764/maeuefd.309934.
39. Yıldırım P, Yıldırım E, Otrar M, Şirin A. Ergenlerde psikolojik dayanıklılık ile benlik kurgusu arasındaki ilişkinin incelenmesi. *Eğitim Bilimleri Dergisi*. 2015;42:277.
40. Önder A, Gülay H. İlköğretim 8. sınıf öğrencilerinin psikolojik sağlamlığının çeşitli değişkenler açısından incelenmesi. *Dokuz Eylül Üniversitesi Buca Eğitim Fakültesi Dergisi*. 2008;(23):192-7.
41. Toros F. Çocukluk çağı ve ergenlik dönemi depresyonlarında risk etmenleri. *Türkiye Klinikleri Psikiyatri Dergisi*. 2002;3(2):75-79.
42. Edmondson JC. Chronic Pain and the Placebo Effect. *Comprehensive Textbook of Psychiatry*, Sadock B, Sadock (Ed), 2001. 7. baskı.
43. Kokkonen J, Kokkonen ER. Psychological and somatic symptoms in young adults with chronic physical diseases. *Psychotherapy and Psychosomatics*. 1995;64(2):94-101.
44. Fishbain DA, Lewis JE, Gao J, Cole B, Steele Rosomoff R. Is chronic pain associated with somatization/hypochondriasis? An evidence-based structured review. *Pain Practice: The Official Journal of World Institute of Pain*. 2009;9(6):449-467.

45. Gong MS. Hope and resilience of patients on dialysis (Unpublished master's thesis). Seoul, South Korea: Ehwa Women's University. (2009).
46. Steptoe A, Wardle J, Fuller R, et al. Leisure-time physical exercise: Prevalence, attitudinal correlates, and behavioral correlates among young Europeans from 21 countries. *Preventive Medicine*. 1997;26(6):845-854. doi: 10.1006/pmed.1997.0224.
47. Canan F, Ataoğlu A. Anksiyete, depresyon ve problem çözme becerisi algısı üzerine düzenli sporun etkisi. *Anatolian Journal of Psychiatry*. 2010;11(38):38-43.
48. Makar E. Spor eğitimi gören öğrencilerin, sosyal beceri, fiziksel benlik algısı ve fiziksel aktivite düzeyleri arasındaki ilişkinin incelenmesi [yüksek lisans tezi]. Bartın Üniversitesi, Eğitim Bilimleri Enstitüsü, 2016.
49. Belcher BR, Zink J, Azad A, Campbell CE, Chakravartti SP, Herting MM. The roles of physical activity, exercise, and fitness in promoting resilience during adolescence: Effects on mental well-being and brain development. *Biological Psychiatry: Cognitive Neuroscience and Neuroimaging*. 2021;6(2). doi: 10.1016/j.bpsc.2020.08.005.
50. Eskin M, Ertekin K, Harlak H, Dereboy Ç. Lise öğrencisi ergenlerde depresyonun yaygınlığı ve ilişkili olduğu etmenler. *Türk Psikiyatri Dergisi*. 2008;19(4).
51. Elmacı F. Parçalanmış ve bütünlüğünü koruyan aileye sahip ergenlerin depresyon ve uyum düzeylerinde sosyal desteğin rolü. *Kuram ve Uygulamada Eğitim Bilimleri*. 2006;6(2):403-431.
52. Pinkerton J, Dolan P. Family support, social capital, resilience and adolescent coping. *Child & Family Social Work*. 2007;12:219-228.
53. Tusaie K, Puskar K, Sereika SM. A predictive and moderating model of psychosocial resilience in adolescents. *Journal of Nursing Scholarship*. 2007;39:54-60.

Are Hairdressers a Threat to Children's Health?

Hasret Yağmur SEVİNÇ AKIN*, Elif DEMİR**, Zeliha DEMİR GİDEN***, Ramazan GİDEN****

Abstract

Aim: In this study, the impact of hair salon employees' health literacy on their approach to factors affecting children's health has been examined.

Method: This cross-sectional descriptive study was conducted with 200 hair salon employees who agreed to participate in the research. The research data were collected using a Personal Information Form and the Health Literacy Scale, both prepared by the researchers based on the literature.

Results: Seventy-four percent of hair salon employees reported that they performed procedures on “pregnant women”. 39.5% stated that they only used protective equipment for the “mother” during the procedure. In addition, 91.5% reported that they performed procedures on “breastfeeding mothers”. 77.5% stated that they did not use “protective equipment”. 72.5% of the employees believed that cosmetic products did not negatively affect newborns. The average total score of the Health Literacy Scale for the hair salon employees participating in the study was found to be 41.90 ± 5.41 .

Conclusion: Our research found that hair salon employees have a low level of health literacy. To increase the health literacy level of hair salon employees, training sessions should be conducted, and educational videos, posters, brochures, and public service announcements should be prepared.

Keywords: Hairdresser, child, child health.

Kuaförler Çocuk Sağlığı İçin Bir Tehdit Midir?

Öz

Amaç: Bu çalışmada, kuaför salonu çalışanlarının sağlık okuryazarlığının çocukların sağlığını etkileyen faktörlere yaklaşımları üzerindeki etkisi incelenmiştir.

Yöntem: Bu kesitsel tanımlayıcı çalışma, araştırmaya katılmayı kabul eden 200 kuaför salonu çalışanı ile yürütülmüştür. Araştırma verileri, araştırmacılar tarafından literatür doğrultusunda hazırlanan “Kişisel Bilgi Formu” ve “Sağlık Okuryazarlığı Ölçeği” kullanılarak toplanmıştır.

Bulgular: Kuaför salonu çalışanlarının %74’ü “hamile kadınlar” üzerinde işlem yaptıklarını bildirmiştir. %39,5’i ise işlem sırasında sadece “anne” için koruyucu ekipman kullandıklarını belirtmiştir. Ayrıca, %91,5’i “emziren anneler” üzerinde işlem yaptıklarını bildirmiştir. %77,5’i ise “koruyucu ekipman” kullanmadıklarını ifade etmiştir. Çalışanların %72,5’i kozmetik ürünlerin yenidoğanları olumsuz etkilemediğini düşünmektedir. Araştırmaya katılan kuaför salonu çalışanlarının “Sağlık Okuryazarlığı Ölçeği” toplam puan ortalaması $41,90 \pm 5,41$ olarak bulunmuştur.

Özgün Araştırma Makalesi (Original Research Article)

Geliş / Received: 17.01.2025 & **Kabul / Accepted:** 07.07.2025

DOI: <https://doi.org/10.38079/igusabder.1621828>

* (Corresponding Author) Asst. Prof., Harran University, Viransehir School of Health, Şanlıurfa, Türkiye.

E-mail: hasreto227@hotmail.com ORCID <https://orcid.org/0000-0002-3962-7113>

** Assoc. Prof., Harran University, Viransehir School of Health, Şanlıurfa, Türkiye. E-mail: e.deniz63@hotmail.com

ORCID <https://orcid.org/0000-0003-4545-5175>

*** Asst. Prof., Faculty of Medicine, Harran University, Şanlıurfa, Türkiye. E-mail: z.dmr@hotmail.com

ORCID <https://orcid.org/0000-0002-1476-0073>

**** Assoc. Prof., Faculty of Medicine, Harran University, Şanlıurfa, Türkiye. E-mail: dr.ramazangiden@gmail.com

ORCID <https://orcid.org/0000-0003-2127-1056>

ETHICAL STATEMENT: This study has been approved by the Ethics Committee of the Faculty of Medicine (Ethics Committee No: 12.02.2024-01.30) Türkiye within which the study was undertaken.

Sonuç: Araştırma, kuaför salonu çalışanlarının sağlık okuryazarlığı düzeyinin düşük olduğunu ortaya koymuştur. Kuaför salonu çalışanlarının sağlık okuryazarlığı düzeyini artırmak için eğitimler düzenlenmeli, eğitici videolar, posterler, broşürler ve kamu spotları hazırlanmalıdır.

Anahtar Sözcükler: Kuaför, çocuk, çocuk sağlığı.

Introduction

The enclosed nature of hair salons and inadequate ventilation lead to the accumulation of chemicals from the products used, adversely affecting the health of both employees and customers in the salons¹⁻³.

Although most cosmetic products are applied to the skin, the substances they contain can penetrate the skin barrier and enter systemic circulation. Systemic exposure can also occur through contact with mucous membranes, oral intake, or inhalation^{4,5}.

Exposure of women using hair salons to harmful chemicals through transdermal absorption or inhalation during sensitive stages of growth and development, such as pregnancy and breastfeeding, negatively affects the health of children during these periods⁵.

Exposure to harmful chemicals in hair salons during sensitive periods of development can lead to birth defects in the fetus and developmental disorders in multiple systems, particularly the endocrine system, as well as an increased risk of disease in later stages of life⁶.

Research has identified a correlation between exposure to harmful chemicals and various adverse outcomes, including miscarriage, birth defects, stillbirth, small-for-gestational-age (SGA) births, impaired fetal development, low birth weight (LBW), preterm birth (PTB), as well as an increased risk of leukemia, neuroblastoma, Wilms tumor, and allergic rhinitis associated with asthma⁷⁻⁹. Due to these circumstances, it is essential for hairdressers to have a high level of awareness regarding the negative effects of the products they use on the health of pregnant women and their babies.

Health literacy is defined as the knowledge, motivation, and skills individuals possess to make informed decisions about protecting and improving their health, accessing information, understanding and evaluating it, and applying it in their daily lives¹⁰. Limited health literacy can affect various health conditions, increasing the risk of negative health outcomes and costs. Low health literate people are less knowledgeable about their own health status. They also have limited knowledge about the general importance of preventive measures in health protection and management¹¹.

Based on this information, this study examined the impact of hair salon employees' health literacy on their approach to factors affecting children's health.

Material and Methods

Research design

A cross-sectional descriptive study design was employed.

Collection of data

Data collection was conducted over a period of five months (February to June 2024). The data was gathered through individual interviews with each hairdresser, with each interview lasting approximately 20 to 30 minutes.

Population/ Sample of the Study

The research was conducted in a province in southeastern Turkey with hair salon employees who agreed to participate in the research.

The sample size was determined using the A-priori Sample Size Calculator for Multiple Regression (alpha level = .05, effect size = 0.15, number of variables = 17, and desired statistical power = 0.95). The calculation indicated that a minimum of 100 individuals should be included in the study. The research was completed with 200 hair salon employees who met the inclusion criteria.

Inclusion Criteria for the Study:

- The hair salon employee must be 18 years of age or older.
- The employee must be literate.
- The employee must be willing to participate in the research.
- The employee must be open to communication and cooperation.

Being under 18 years of age or illiterate are exclusion criteria for the research.

Data collection

The research data was collected using a Personal Information Form and the Health Literacy Scale (HLS-14), both prepared by the researchers based on the literature.

Personal Information Form: The descriptive information form, created based on the literature, consists of 17 questions. It includes questions about hair salon employees' "age, educational background, professional experience, the procedures they perform, and the effects of these procedures on the health of babies, pregnant women, and children".

Health Literacy Scale (HLS-14): The Health Literacy Scale was developed by Suka et al. (2013) in Japan to assess the health literacy levels of adults and was originally created in 2010. This scale, consisting of a total of 14 questions and using a five-point Likert type, has three sub-dimensions: functional health literacy, interactive health literacy, and critical health literacy. The scale yields a minimum score of 14 and a maximum score of 70. As the score obtained from the scale increases, the level of health literacy also increases. The reliability analysis revealed that the Cronbach's Alpha value of the developed scale was 0.85¹², and in this study, it was found to be 0.84.

Data analysis

A computer program was used to evaluate the research data. Descriptive analyses were conducted using percentage, mean, and standard deviation. The Kolmogorov-Smirnov

test was used to examine the normal distribution of the scales used in the study. The Mann-Whitney U test was used to examine differences between two independent groups based on the normality of the variables, while the Kruskal-Wallis test was employed to assess differences among three or more independent groups. A statistical significance level of $p < 0.05$ was considered.

Ethical Statement

Before starting the research, ethical approval was obtained from the Clinical Research Ethics Committee (Ethics Committee No: 12.02.2024-01.30), and permission for the use of the scale employed in the study was obtained via email from the author of the scale.

The researchers provided participants with information about the study, assured them that their individual information would be kept confidential, and obtained their verbal and written consent in accordance with the principle of voluntariness.

Results

The average age of hair salon employees is 30.77 ± 6.98 years, with 80.0% being female and 18.0% currently pregnant while continuing to work. Among the women, 47.0% reported that they had continued working during previous pregnancies. Additionally, 75.5% are single, 58% are high school graduates, and 35% have 6-10 years of professional experience. Furthermore, 99% have received training or courses, 58% work as skilled workers/apprentices, 80.5% have a designated area for preparing chemical products in their salons, 87.5% perform keratin treatments in their salons, and all employees reported that their salons are well-ventilated (Table 1).

Table 1. Demographic characteristics of hair salon employees (n=200)

Characteristics		n	%
Gender	Female	160	80.0
	Male	40	20.0
Marital Status	Married	151	75.5
	Single	49	24.5
Graduated School	Primary/Secondary School	48	24.0
	High School	116	58.0
	Vocational High School	25	12.5
	University	11	5.5
Professional experience	1-5 year	58	29.0
	6-10 year	70	35.0
	11-15 year	36	18.0
	16 and over	36	18.0
Receiving Training/Courses	Yes	198	99.0
	No	2	1.0
Employment status	Salon owner	84	42.0
	Master/apprentice	116	58.0

The presence of a separate area for preparing chemical products in the salon	Yes	39	19.5
	No	161	80.5
The provision of keratin treatments in the salon	Yes	175	87.5
	No	25	12.5

74% of hair salon employees reported that they provide services to pregnant women in the salon, 39.5% stated that only the mother uses protective equipment during the process, 91.5% mentioned that they offer services to breastfeeding mothers, and 77.5% indicated that they do not use protective equipment. Hair salon employees believe that 80% of them believe that cosmetic products have a negative effect on pregnant women and 77% believe that cosmetic products have a negative effect on unborn babies. On the other hand, 72.5% of hair salon employees think that cosmetic products do not adversely affect newborns (Table 2).

Table 2. Characteristics of hair salon employees regarding child health (n=200)

Characteristics		n	%
The provision of services to pregnant women in the salon	Yes	148	74.0
	No	46	23.0
	I do not question it	6	3.0
The use of protective equipment during procedures for pregnant women	For the mother only	79	39.5
	For both the mother and myself	17	8.5
		58	29.0
	I do not use		
The provision of services to breastfeeding mothers in the salon	Yes	183	91.5
	No	7	3.5
	I do not question it	10	5.0
The use of protective equipment during procedures for breastfeeding mothers	For myself only	2	1.0
	For the mother only	8	4.0
	For both the mother and myself	28	14.0
		155	77.5
	I do not use		
The impact of cosmetic products on pregnant women	Yes	160	80.0
	No	14	7.0
	I don't know	26	13.0
The impact of cosmetic products on unborn babies	Yes	154	77.0
	No	20	10.0
	I don't know	26	13.0
The impact of cosmetic products on newborns	Yes	44	22.0
	No	145	72.5
	I don't know	11	5.5

The average total score of health literacy for hair salon employees participating in the study was determined to be 41.90 ± 5.41 (Table 3).

Table 3. The distribution of average scale and sub-dimension scores of hair salon employees

Scale and sub-dimensions	Number of Items	Min-Max	Median	X $\pm$ SD
Functional health literacy	5	5-25	7	9.61 $\pm$ 5.24
Interactive health literacy	5	13-25	17	16.68 $\pm$ 2.66
Critical health literacy	4	12-20	16	15.60 $\pm$ 1.31
Health literacy scale total	14	32-56	41	41.90 $\pm$ 5.41

X : Mean, SD: Standard Deviation

There is a statistically significant difference between the health literacy scale and male hair salon employees who are not working while pregnant, single employees, salon owners, and those who do not provide services to pregnant women ($p < 0.05$) (Table 4).

Table 4. The distribution of health literacy scale average scores according to the demographic characteristics and child health-related features of hair salon employees

Characteristics	Health Literacy Scale X $\pm$ SD
Gender	Female Male Test Statistics/p
The status of continuing work while pregnant	Yes No Test Statistics/p
Marital Status	Married Single Test Statistics/p
Employment status	Salon owner Master/apprentice Test Statistics/p
The provision of services to pregnant women in the salon	Yes No I do not question it Test Statistics/p
The provision of services to breastfeeding mothers in the salon	Yes No I do not question it Test Statistics/p

^aMann Whitney U Test, ^b Kruskal Wallis Test

Discussion

This study examined how hairdressers' health literacy influences their approaches to factors affecting child health. In the literature, there has been no study that investigates

the approaches of hair salon employees towards factors affecting child health and their health literacy.

People mostly prefer hair salons to feel better and to take care of their personal grooming¹³. Hair salons are places where people receive services such as hair and skin care, manicure-pedicures, waxing, makeup, and similar treatments. In addition to providing all these services in an enclosed environment, the materials used during the procedures and the chemical odors pose a serious health threat to both hair salon employees and customers^{14,15}. Most of the employees in these salons are of reproductive age and can continue working while pregnant^{2,6}. In this study, similar to the literature, it was found that women working in hair salons continue to work while pregnant. These adverse working conditions can also lead to fetal exposure⁶. In the study conducted by Babić et al.¹⁶ an increased risk of ventricular septal defect, poor neonatal, or maternal health indicators was found in the newborns of hair salon employees.

Frequent exposure of pregnant women receiving treatments in hair salons to hair dye, through transdermal absorption or inhalation, can negatively impact fetal development^{17,18}. Ooka et al.⁵ found an association between maternal occupational exposure to hair dye for more than one week during pregnancy and an increased risk of stillbirth.

In our study, the health literacy levels of hairdressing salon employees were also examined. Health literacy requires reading written health information and acting accordingly. In the workplace, individuals with a good level of health literacy can assess how their health relates to their occupation and take appropriate actions to help reduce occupational accidents, diseases, and adverse exposures¹⁹.

This study determined that the health literacy levels of hair salon employees were low. In addition, in our study, it was found that the majority of hair salon employees performed procedures on pregnant and breastfeeding women, and although those who thought that these procedures would harm pregnant women and the unborn baby were in the majority, the use of protective equipment during the procedure was very low, and the rate of those who thought that cosmetic products did not adversely affect the newborn was high. These findings were interpreted as the result of low health literacy among hair salon employees.

Cosmetic products used during pregnancy are known to cause stillbirth, miscarriage, and developmental damage in endocrine and other systems²⁰. The fetus can be exposed to many substances through the placenta. Heavy metals ingested through diet and cosmetic products affect the fetus, and exposure to these substances may continue after birth through breastfeeding. Many studies reveal the presence of heavy metals in breast milk^{4,21}. In order to eliminate the negative effects of chemicals used in hairdressing salons on children's health, both mothers and hair salon employees should have a high level of health literacy²².

Most of the studies evaluating the health literacy of different groups in Turkey and in the world report that health literacy is at inadequate levels and that initiatives should be taken to improve it²³⁻²⁷.

Conclusion

74% of hair salon employees reported that they provide services to pregnant women in the salon, 39.5% stated that only the mother uses protective equipment during the process, 91.5% mentioned that they offer services to breastfeeding mothers, and 77.5% indicated that they do not use protective equipment. Also, 72.5% of hair salon employees think that cosmetic products do not adversely affect newborns.

According to the results of this study, it was determined that hair salon employees have a low level of health literacy.

Recommendations

The high level of health of a society is an indicator of the development of that country. Protecting and improving child health is essential for a healthy society. The high level of health literacy of hair salon employees, where women receive services during pregnancy and breastfeeding, will lead to the protection of the health of the pregnant woman and the mother, and therefore the child. In order to increase the level of health literacy of hairdressing salon employees, trainings should be provided, and educational videos, posters, brochures, public spots, and television programs should be prepared.

Limitations of the Study: The research is limited to the findings obtained from hair salon employees in only one province. The data obtained are limited to the approaches of the hair salon employees participating in the research; generalisation should not be made.

Acknowledgments: The authors would like to thank all of the hair salon employees for their voluntary participation.

Funding: The authors declare that no funds, grants, or other support were received during the preparation of this manuscript.

Declaration of competing interest: The authors have no relevant financial or non-financial interests to disclose.

REFERENCES

1. Senthong P, Wittayasilp S. Working conditions and health risk assessment in hair salons. *Environmental Health Insights*. 2021;15:1-10. doi: 10.1177/11786302211026772.
2. Kezic S, Nunez R, Babic Z, Hallmann S, et al. Occupational exposure of hairdressers to airborne hazardous chemicals: A scoping review. *International Journal of Environmental Research and Public Health*. 2022;19(7):4176. doi: 10.3390/ijerph19074176.
3. Makuvara Z, Marumure J, Simbanegavi TT, Machingura J, Chaukura N, Gwenzi W. Unveiling the dark side of beauty? Beauty parlours as potential pollution and human exposure hotspots. *Process Safety and Environmental Protection*. 2024;182:1153-1170.

4. He L, Michailidou F, Gahlon HL, Zeng W. Hair dye ingredients and potential health risks from exposure to hair dyeing. *Chemical Research in Toxicology*. 2022;35(6):901-915.
5. Ooka T, Horiuchi S, Shinohara R, Kojima R, Akiyama Y, Miyake K, Japan Environment and Children's Study Group. Association between maternal exposure to chemicals during pregnancy and the risk of foetal death: The Japan Environment and Children's Study. *International journal of Environmental Research and Public Health*. 2021;18(22):11748.
6. Ish J, Symanski E, Gimeno Ruiz de PD, et al. Maternal occupational exposure to chemicals and child cognitive function. *Pediatr Res*. 2022;92:1153–1160. doi: 10.1038/s41390-022-02089-6.
7. Shirangi A, Wright J, Blair EM, McEachan RR, Nieuwenhuijsen MJ. Occupational chemical exposures in pregnancy and fetal growth: Evidence from the born in bradford study. *Scand J Work Environ Health*. 2020;46(4):417-428. doi: 10.5271/sjweh.3878.
8. Tokinobu A, Tanaka K, Arakawa M, Miyake Y. Pre- and postnatal maternal hair dye use and risk of wheeze and asthma in 5-year-old Japanese children: The kyushu okinawa maternal and child health study. *International Journal of Environmental Health Research*. 2022;33(12):1697–1705. doi: 10.1080/09603123.2022.2120189.
9. Kojima R, Shinohara R, Horiuchi S, et al. Association between gestational hair dye use and allergies at 3 years old: The Japan environment and children's study. *Environmental Research*. 2021;201:111530.
10. Buhr E, Ewers M, Tannen A. Potentials of school nursing for strengthening the health literacy of children, parents and teachers. *International Journal of Environmental Research and Public Health*. 2020;17(7):2577.
11. Nantsupawat A, Wichaikhum OA, Abhicharttibutra K, Kunaviktikul W, Nurumal MSB, Poghosyan L. Nurses' knowledge of health literacy, communication techniques, and barriers to the implementation of health literacy programs: A cross-sectional study. *Nursing & Health Sciences*. 2020;22(3):577-585.
12. Türkoğlu N, Kılıç D. Adaptation of health literacy scale to Turkish: Validity and reliability study. *Journal of Anatolia Nursing and Health Sciences*. 2021;24(1):25-33.
13. Erzen Yıldız H, Demir C, Yürektürk Ş, Karahan T. Determination of infectious diseases knowledge levels of service users from hairdressers. *Journal of Medicine and Applied Sciences*. 2023;3(2):24-32.
14. Demir C, Erzen Yıldız H, Yürektürk Ş, Gür T. Determining the knowledge levels infectious diseases of the hairdresser's employees. *Van Health Sciences Journal*. 2022;15:181-191.
15. Ofloğlu G, Doğanel Aksoy G. A research on the quality of business life of hairdressers. *Third Sector Social Economic Review*. 2023;58(2):1511-1524.

16. Babic Z, Macan M, Franic Z, et al. Association of hairdressing with cancer and reproductive diseases: A systematic review. *J Occup Health*. 2022;64(1):e12351.
17. Yaşar Ö, Akdeniz Ş. The negative effects of cosmetics and personal care products on health and nurse's roles: Literature review. *Kırşehir Ahi Evran University Journal of Health Sciences*. 2020;1(3):118-125.
18. Özdemir R, Şahin S, Arıöz A. Use of cosmetics during pregnancy and health risks. *Journal of Nursing Science*. 2022;5(1):30-37. doi: 10.54189/hbd.908848.
19. Koch P, Kersten JF, Nienhaus A. Monitoring a cohort of trainees: Changes over time and associations between health literacy, health behaviour and health. *J Occup Med Toxicol*. 2023;18:18. doi: 10.1186/s12995-023-00387-1.
20. Doyranlı M, Günaydın S, Dinç Kaya, H. Current cosmetic procedures in pregnancy. *Sakarya University Journal of Holistic Health*. 2022;5(2):206-217. doi: 10.54803/sauhsd.1092712.
21. Sade G, Özkan H. Effects of some chemicals in cosmetic products on pregnant, fetus and newborn health. *The Journal of Gynecology - Obstetrics and Neonatology*. 2020;17(3):473-477
22. Gökoğlu AG. The effect of women's health literacy level on health behaviors and child health. *Başkent University Journal of Health Sciences Faculty*. 2021;6(2):132-148.
23. Bazm R, Sardari F. Growth of health literacy research activity in three Middle Eastern countries. *BMJ Health Care Inform*. 2019;26:e000027.
24. Hussein SH, Almajran A, Albatineh AN. Prevalence of health literacy and its correlates among patients with type II diabetes in Kuwait: A population based study. *Diabetes Res Clin Pract*. 2018;141:118-125.
25. Akyol Güner T, Kuzu A, Bayraktaroğlu T. The relationship between health literacy and rational drug use in individuals with diabetes. *Turkish Journal of Diabetes and Obesity*. 2020;3:214-223.
26. Tuğut N, Yılmaz A, Çelik BY. The relationship between nursing students' health literacy levels and healthy lifestyle behaviors. *Institute of Health Sciences Journal*. 2021;6(2):120-8.
27. Chu-Ko F, Chong ML, Chung CJ, Chang CC, Liu HY, Huang LC. Exploring the factors related to adolescent health literacy, health-promoting lifestyle profile, and health status. *BMC Public Health*. 2021;21:1-12.

Bibliometric Evaluation of the Relationship between Selenium and Breast Cancer: A Synopsis

Selim ÖĞÜT*

Abstract

Aim: To discover the relationship between breast cancer and selenium via bibliometric analysis, identify their current status in literature, and investigate the international research activity based on breast cancer and selenium publications.

Method: The Web of Science Core Collection (WoS) database was used to retrieve the data. The keywords ("breast cancer") and ("selenium") were utilized in "topic" selection mode for the search. Bibliometric analysis was employed to evaluate the papers, and correlation analysis was performed to identify the associations between the number of publications and citation counts.

Results: A total of 731 outputs were produced between 1980 and 2025. The USA was reported as the most productive and most cited country. The most productive journal, publisher, and institution were reported as "Biological Trace Element Research", "Elsevier", and "Harvard University", respectively. The most cited journal was "Cancer Research and Treatment", the most active funding institution was "National Institutes of Health NIH," and "breast cancer" was the most common keyword.

Conclusion: The analysis highlights a growing interest in the potential role of selenium in breast cancer prevention, diagnosis, and treatment. The findings also reveal emerging themes and knowledge gaps that warrant further investigation, particularly regarding selenium's biological mechanisms and clinical applications. Overall, this analysis serves as a guide for future research directions and promote evidence-based advancements in breast cancer management related to selenium.

Keywords: Bibliometric analysis, breast cancer, cancer research, oncology, selenium.

Selenyum ile Meme Kanseri Arasındaki İlişkinin Bibliyometrik Değerlendirmesi

Öz

Amaç: Bu çalışmanın amacı, meme kanseri ile selenyum arasındaki ilişkiyi bibliyometrik analiz yoluyla ortaya koymak, literatürdeki mevcut durumu belirlemek ve meme kanseri ile selenyum konularında yapılan uluslararası araştırma faaliyetlerini incelemektir.

Yöntem: Veriler Web of Science Core Collection (WoS) veritabanından elde edildi. Arama için "konu" seçiminde "meme kanseri" ve "selenyum" anahtar kelimeleri kullanıldı. Yayınlar bibliyometrik analiz yöntemiyle değerlendirilmiş, yayın sayısı ile atıf sayısı arasındaki ilişkileri belirlemek amacıyla korelasyon analizi uygulanmıştır.

Bulgular: 1980 ile 2025 yılları arasında toplam 731 yayın üretilmiştir. En fazla yayın yapan ve en çok atıf alan ülke Amerika Birleşik Devletleri olmuştur. En üretken dergi "Biological Trace Element Research", en üretken yayınevi "Elsevier" ve en üretken kurum ise "Harvard Üniversitesi" olarak belirlenmiştir. En çok atıf alan dergi "Cancer Research and Treatment" olurken, en aktif fon sağlayan kurum "National Institutes of Health (NIH)" olmuştur. En sık kullanılan anahtar kelime ise "meme kanseri" (breast cancer) olarak tespit edilmiştir.

Sonuç: Bu analiz, selenyumun meme kanserinin önlenmesi, tanısı ve tedavisindeki potansiyel rolüne yönelik artan ilgiyi ortaya koymaktadır. Bulgular, selenyumun biyolojik mekanizmaları ve klinik

Özgün Araştırma Makalesi (Original Research Article)

Geliş / Received: 23.07.2025 & **Kabul / Accepted:** 21.08.2025

DOI: <https://doi.org/10.38079/igusabder.1749163>

* Asst. Prof. Dr., Bandırma Onyedi Eylül University, Faculty of Medicine, Department of Biophysics, Bandırma, Türkiye.

E-mail: sogut@bandirma.edu.tr [ORCID https://orcid.org/0000-0001-9126-6477](https://orcid.org/0000-0001-9126-6477)

uygulamaları konusunda daha fazla araştırmaya ihtiyaç duyulduğunu ve bu alandaki bilgi boşluklarını göstermektedir. Genel olarak bu çalışma, gelecekteki araştırmalar için yol gösterici bir kaynak olmayı ve meme kanseri yönetiminde selenyumla ilişkili kanıta dayalı gelişmeleri teşvik etmeyi amaçlamaktadır.

Anahtar Sözcükler: Bibliyometrik analiz, meme kanseri, kanser araştırmaları, onkoloji, selenyum.

Introduction

In 2022, approximately 2.3 million women worldwide were diagnosed with breast cancer, leading to nearly 670,000 deaths due to the disease¹. Although countless factors have been identified that influence the etiology of breast cancer, family history, sex, and age are considered among the most notable. Treatment options vary depending on the type and spread of the cancer. In general, chemotherapy, surgical intervention, targeted drug therapy, anti-hormone therapy, and radiation therapy are preferred²⁻⁴.

Approximately 5–10% of breast cancers are inherited through genetic mutations passed down from a parent. The most well-known mutations involve the BRCA1 and BRCA2 genes. Genetic predisposition, particularly involving mutations in these two genes, is considered a significant risk factor for malignancies such as breast cancer⁵⁻⁹.

Trace elements are known for their beneficial effects on several biological pathways. These minerals play a critical role in cell stabilization, regulation of oxidative stress, complex DNA damage distribution (DDR), and repair mechanisms. Experimental studies have shown that the trace element selenium has significant anticancer properties. Selenium enhances immune response by activating lymphocytes and stimulating the production of immunoglobulins and antibodies¹⁰. It contributes to the strengthening of the immune system, including cytotoxic lymphocyte activity and natural killer cell function¹¹. However, selenium toxicity may adversely affect individuals through excessive supplementation or high dietary levels¹².

In this context, selenium, a critically important trace element, is regarded as having potential benefits in cancer prevention¹³. Selenium is vital for many cellular processes because it constitutes various selenoproteins that are believed to play protective roles in certain types of cancer¹⁴⁻¹⁵. The potential role of selenium in reducing cancer risk has been investigated and continues to be explored¹⁶. Studies have indicated higher serum concentrations of copper and ceruloplasmin protein in various malignancies, including leukemia, breast, cervical, and endometrial cancers. The activation of DNA and RNA polymerase enzymes also depends on copper, which serves as a cofactor for antioxidant enzymes¹⁷.

Selenium plays a vital role in synthesizing a limited number of selenoproteins involved in antioxidant defense, thyroid hormone metabolism, tumor growth, and cell proliferation¹⁸⁻¹⁹. While selenium is recognized to play a significant role in apoptotic processes, its effects are not fully understood due to the complexity of these pathways and limited knowledge of selenoproteins. Current evidence suggests that selenium exerts its effects through mechanisms such as caspase activation, protein kinase signaling, reactive oxygen species (ROS) neutralization, and p53 phosphorylation. Increased selenium levels have been shown to induce apoptosis in various neoplastic cells, including liver, colon, and prostate cancer, as well as lymphoma and leukemia.

Additionally, several selenium-containing compounds are widely considered to exhibit chemopreventive and anticancer effects.

A crucial statistical tool for mapping the present level of knowledge in a particular scientific field, spotting possible avenues for future research, and confirming scientific findings is bibliometric analysis²⁰. It reflects the practical applicability of handling large volumes of scientific data and its significant contributions to research impact. The development of bibliometric tools such as R and VOSviewer, along with scientific databases like Google Scholar, Scopus, and Web of Science—including their accessibility and usability—have all contributed to this popularity. The interdisciplinary influence of bibliometric methodology, spanning from data science to operational research, also plays a critical role in its widespread adoption²¹.

By employing a bibliometric approach to studies on the relationship between breast cancer and selenium, it is possible to identify general research trends, keywords, and frequently explored themes. Such a study offers researchers the opportunity to evaluate the existing literature more effectively and to guide future investigations.

Recent years have seen a significant increase in interest in bibliometric analysis, resulting in numerous bibliometric performances in a wide range of areas, including medical²², health²³, life²⁴, and natural sciences²⁵. However, the association between breast cancer and selenium is lacking in literature. The present study aims to reveal the prevailing research trends, key contributing publications, and popular research topics in the context of a bibliometric analysis on the relationship between breast cancer and selenium. Furthermore, it is expected that this research will help identify gaps and directions in the current literature regarding the potential role of selenium in breast cancer treatment, thereby paving the way for future studies.

Material and Methods

The Web of Science Core Collection (WoS) catalogue (www.webofknowledge.com) was used to retrieve the data. To prevent misunderstandings brought on by daily variations in the quantity of publications, the search was initiated and ended on May 26, 2025. The keywords (“breast cancer”) and (“selenium”) were utilized in “topic” selection mode for the search. “Article” was chosen as the only research type, and “English” was the only language. Science Citation Expanded (SCI-E) and Social Science Citation Expanded (SSCI) were selected as WoS indexes; others were excluded. Further, the .txt documents with bibliometric indicators, including Citation Count (WoS Core), Number of Publications (NP), Publication Year, etc., were downloaded from the website.

Statistical Analysis

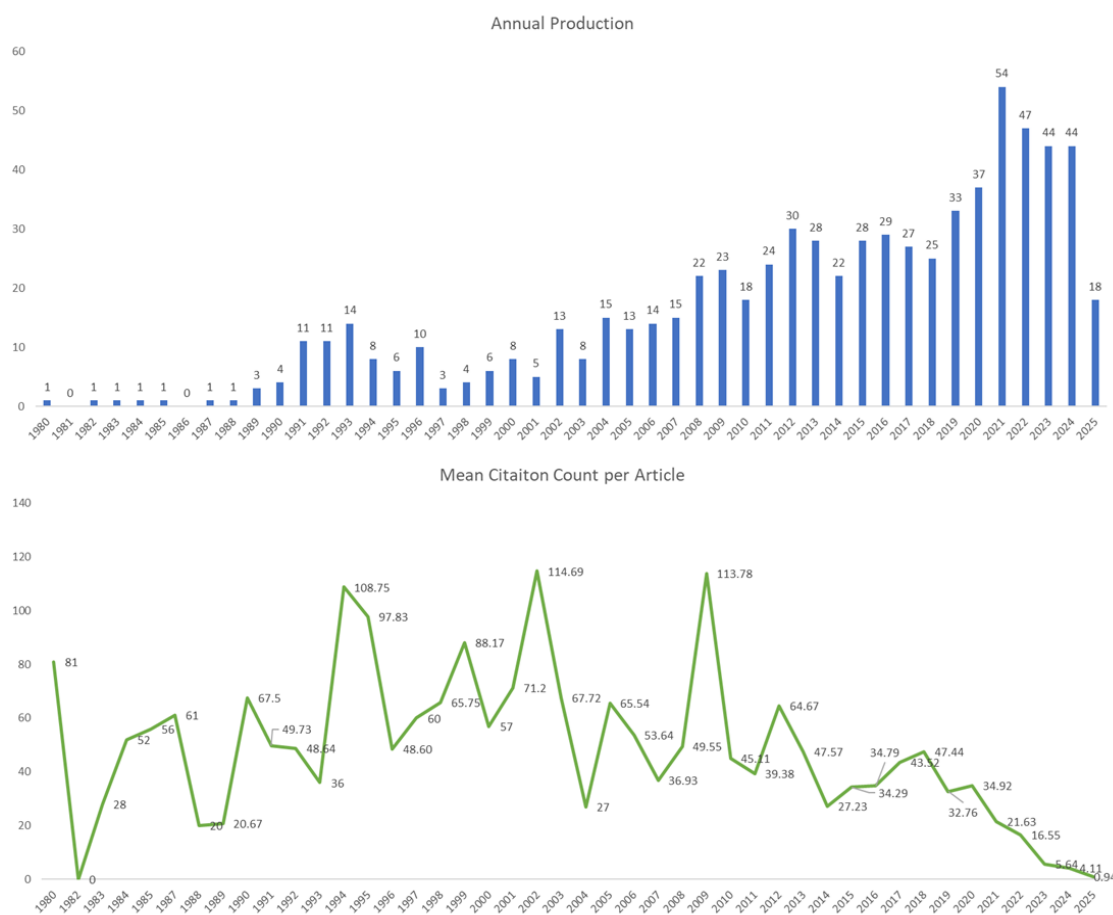
Median, minimum, and maximum values were reported for numerical variables, while frequency (n) and percentage (%) were provided for categorical ones. Income classifications were retrieved from <https://databank.worldbank.org/> website. The Kruskal-Wallis (K-W) test was utilized for group comparisons. Spearman Correlation Coefficients were calculated to determine the associations between bibliometric indicators, namely NP and CC values. Biblioshiny web application of the bibliometrix package (www.bibliometrix.org) were utilized for bibliometric analyses. VOSviewer software (v.1.6.16) was used to obtain graphs for co-authorship analysis and citation

analysis. The R statistical programming language was used for the remaining analyses. Two-sided $p\text{-value} \leq 0.05$ was taken as statistically significant in all analyses.

Results

A total of 731 publications that were published between 1980 and 2025 were analyzed in this bibliometric research. The bibliometric papers on breast cancer and selenium showed an increasing mode, with an annual growth rate of 6.63%. The distributions of publications and citations over the years were shown in Figure 1. The peak in NP was noticed in 2021 with 54 outputs. The total number of authors who contributed to these products was 3,746. Bibliometric analyses in BRCA & selenium were published in 731 different sources. From a collaboration perspective, a total of 17 single-authored documents were recorded; additionally, international co-authorships were calculated as 24.9%.

Figure 1. Annual production and mean citation count per article distributions on breast cancer and selenium publications



All of the research has been documented in Science Citation Index (SCI)-indexed journals ($n=731$, 100%), whereas 6 of them was also indexed in SSCI journals. Oncology ($n=187$, 25.581%), Biochemistry & Molecular Biology ($n=133$, 18.194%), and Nutrition & Dietetics ($n=75$, 10.260%) were listed as top-three WoS categories where the majority of the BRCA & selenium publications were produced.

The research has been published in fundamental scientific fields such as Oncology, Biophysics, Biochemistry, and Molecular Biology, as well as in applied disciplines including Nutrition, Public Health, Internal Medicine, and Pharmacology-Toxicology. This diversity indicates that studies on the relationship between selenium and breast cancer have been addressed from clinical, molecular, epidemiological, and environmental perspectives, thereby reflecting the multidisciplinary approach within the literature.

Basic descriptive statistics for Single Country Publications (SCP), Multi-Country Publications (MCP), total NP and CC were found to be 0.4 [0 - 21], 3 [0 - 128], 3 [1 - 153], and 1 [0 - 25], respectively. NP ($p=0.178$), SCP ($p=0.086$), MCP ($p=0.439$), and CC ($p=0.101$) values were found to be similar across income classifications. Median, minimum, and maximum values were also provided for these bibliometric indicators for each income class (Table 1).

Table 1. Group comparison results regarding bibliometric indicators across income classifications

Variable	Lower-Middle Income	Upper-Middle Income	High Income	p-value
NP	21 [9 - 40]	28.5 [18 - 135]	13 [9 - 153]	0.178
SCP	8 [4 - 31]	21.5 [15 - 115]	10 [3 - 128]	0.086
MCP	9 [5 - 13]	7 [3 - 20]	5 [0 - 25]	0.439
CC	413 [159 - 1496]	879.5 [698 - 5019]	524 [101 - 9479]	0.101

Further, strong and significant association was found via correlation analysis between NP and CC values for all countries ($r=0.616$; $p=0.002$), while they were calculated as $r=0.8$; $p=0.2$ for upper-middle, $r=0.355$ $p=0.193$ for high economic-level countries.

The USA (153 publications), China (135 publications), and India (40 publications) were observed to be in the top-three list regarding the number of scholarly outputs. Similarly, the USA (9479 citations), China (5019 citations), and India (1496 citations) were also placed in the top three in terms of citation counts received. “Biological Trace Element Research” was recorded as the most active journal (42 publications), and “Cancer Research and Treatment” was reported as the most cited source (1086 citations) (Table 2).

Table 2. Most active countries, journals, and most cited countries and journals

Country	NP	SCP	MCP	Country	CC	Source	CC	Best Quartile	Journal	NP	Best Quartile
USA	153	128	25	USA	9479	Cancer Res	1086	Q ₁	Biological Trace Element Research	42	Q ₂
China	135	115	20	China	5019	Biol Trace Elem Res	649	Q ₂	Cancer Epidemiology Biomarkers & Prevention	17	Q ₁
India	40	31	9	India	1496	J Biol Chem	499	Q ₂	Nutrients	17	Q ₁
Iran	37	26	11	Netherlands	964	Carcinogenesis	459	Q ₂	Anticancer Research	13	Q ₄
Poland	29	16	13	Iran	944	Am J Clin Nutr	434	Q ₁	Journal Of Trace Elements In Medicine And Biology	13	Q ₂
Germany	22	15	7	Brazil	815	Am J Epidemiol	404	Q ₁	Cancer Research	12	Q ₁
Egypt	21	8	13	UK	746	Cancer Epidem Biomar	392	Q ₁	Breast Cancer Research And Treatment	11	Q ₂
Turkey	20	17	3	Portugal	732	Int J Cancer	342	Q ₁	Nutrition And Cancer-An International Journal	11	Q ₃
Canada	19	14	5	Türkiye	698	Jnci-J Natl Cancer I	341	Q ₁	International Journal Of Cancer	10	Q ₁
Korea	19	17	2	Finland	624	J Nutr	314	Q ₂	Plos One	10	Q ₁

Current breast cancer and selenium literature has been published by different affiliations over the years. Harvard University (n=37), and National Institutes of Health (NIH) (n=34) were reported as top contributors. National Institutes of Health (NIH) (n=91), United States Department of Health Human Services (n=91), National Natural Science Foundation of China (NSFC) (n=73) formed the top-three list in terms of funding agents, and “Elsevier” (163 publications) was the most active publisher (Table 3).

Table 3. Most active affiliations, funding agencies and publishers

Affiliation	NP	Funding Agencies	NP	Publisher	NP
Harvard University	37	National Institutes Of Health NIH USA	91	Elsevier	163
National Institutes Of Health (NIH) - USA	34	United States Department Of Health Human Services	91	Springer Nature	113
Pennsylvania Commonwealth System Of Higher Education (PCSHE)	34	National Natural Science Foundation Of China NSFC	73	Wiley	50
Lund University	31	NIH National Cancer Institute NCI	64	MDPI	44
Tehran University Of Medical Sciences	31	National Natural Science Foundation Of Guangdong Province	15	Amer Assoc Cancer Research	37
Sun Yat Sen University	30	NIH National Institute Of Environmental Health Sciences NIEHS	14	Humana Press Inc	30

Roswell Park Comprehensive Cancer Center	28	Coordenacao De Aperfeicoamento De Pessoal De Nivel Superior Capes	12	Taylor & Francis	30
University Of Texas System	27	Conselho Nacional De Desenvolvimento Cientifico E Tecnologico CNPQ	11	Oxford Univ Press	21
Pennsylvania State University	26	China Postdoctoral Science Foundation	10	Amer Chemical Soc	17
University Of Illinois System	23	European Union EU	10	Royal Soc Chemistry	17

“breast cancer” (n=226), “selenium” (n=176), and “risk” (n=68) were listed as the most commonly utilized keywords (Figure 2a). Further, trend topics from 1991 to 2023 were revealed to be wide-range, as it covers “plasma retinol”, “green synthesis”, “surface decoration.”, “serologic presurcos” etc. (Figure 2b).

Figure 2a. Most relevant keywords on BRCA & Selenium research

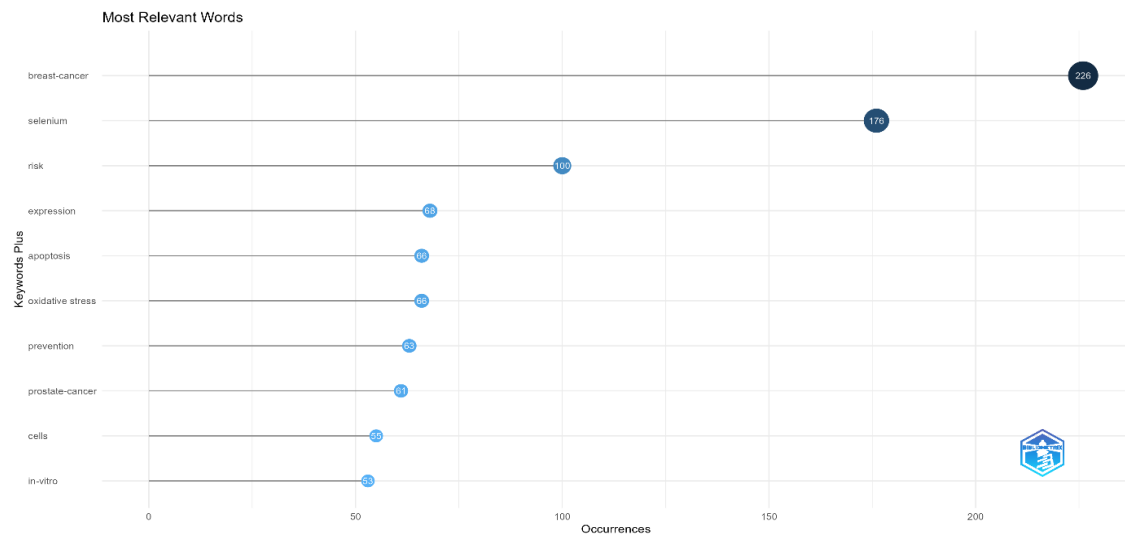
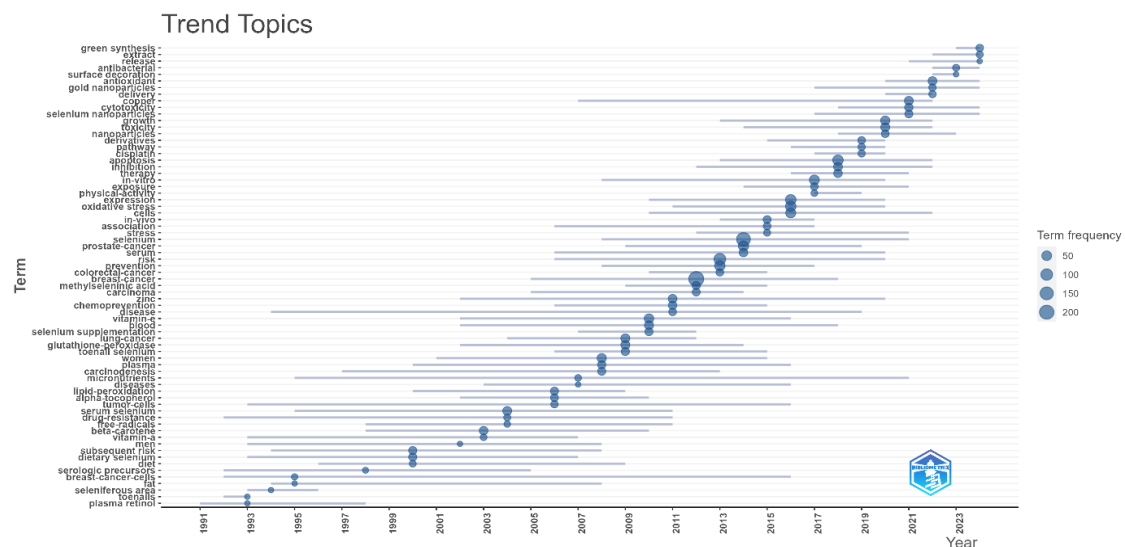


Figure 2b. Trend topics on BRCA & Selenium research



Co-authorship analysis based on countries, and citation analysis based on sources are plotted in Figure 3. The indicator in the figure of citation analysis showed the current number of average citations from dark blue to yellow (Figure 3a). Moreover, a total of 6 clusters were offered by co-authorship analysis based on worldwide partnership (Figure 3b).

Figure 3a. Citation analysis based on sources.

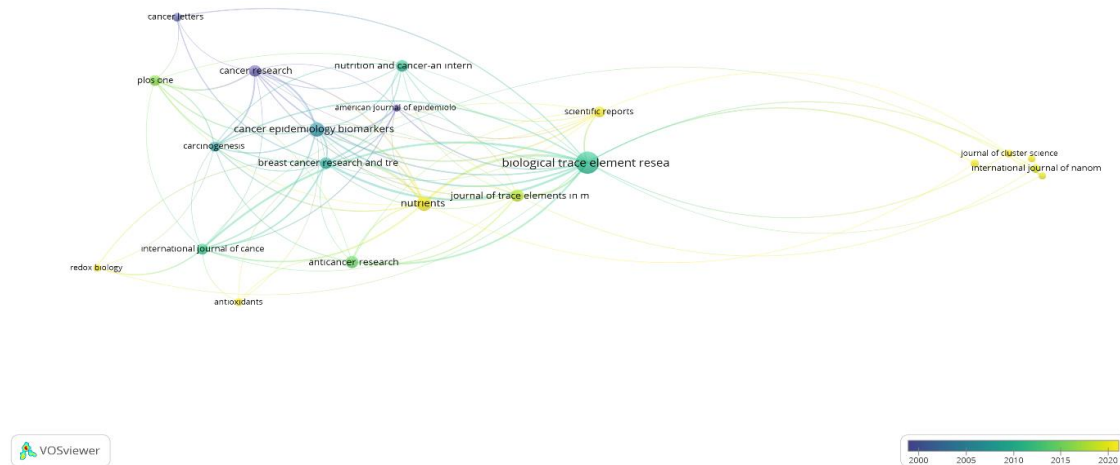
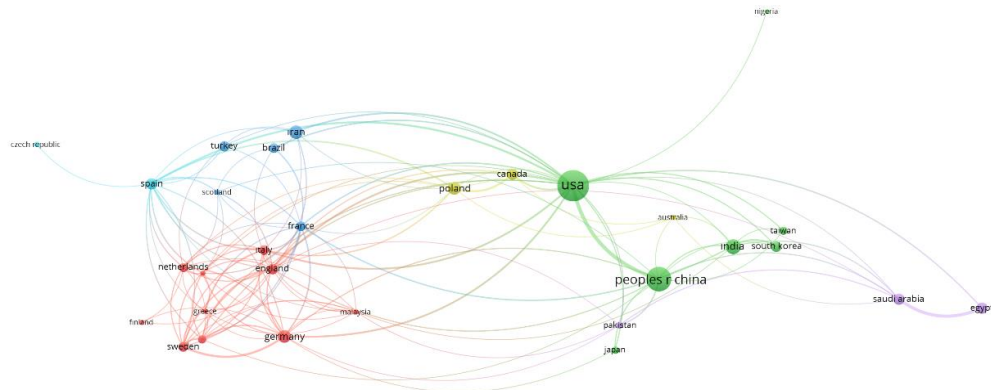


Figure 3b. Co-authorship analysis based on countries. **Cluster 1 (Red):** Denmark, England, Finland, Germany, Greece, Italy, Malaysia, Netherlands, Norway, Sweden. **Cluster 2 (Green):** India, Japan, Nigeria, China, South Korea, Taiwan, USA. **Cluster 3 (Blue):** Brazil, France, Iran, Scotland, Türkiye. **Cluster 4 (Yellow):** Australia, Canada, Poland. **Cluster 5 (Purple):** Egypt, Pakistan, Saudi Arabia. **Cluster 6 (Light Blue):** Czech Republic, Spain.



Discussion

The majority of the breast cancer and selenium bibliometric documents were produced in the “Oncology” WoS category. The USA was reported as the most fruitful and most cited country. Further, the most active journal, publisher, and institution were reported as “Biological Trace Element Research”, “Elsevier”, and “Harvard University”, respectively. The most cited journal was “Cancer Research and Treatment”, the most active funding institution was “National Institutes of Health NIH,” and “breast cancer” was listed as the most common keyword.

Up until now, various bibliometric analyses regarding breast cancer have been produced. These studies have evaluated either the association between inflammation and breast cancer²⁶, or have summarized crucial information about metastatic breast cancer via scientific reports²⁷, or have inspected the targeted therapy for this cancer type²⁸. Similarly, several bibliometric research studies on selenium regarding its relationship to thyroid diseases²⁹, and its effects on drinking water³⁰ have been conducted previously. Even though its relationship to several diseases and its effects on the environment and cancer prevention were identified, to date, no research on investigating the association between selenium and breast cancer has been carried out. Therefore, to the best, this current study is thought to be the first one to explore this association.

The USA was reported as the most productive and most cited country on breast cancer and selenium research in this study. This leadership may be credited to investments in cancer research and development, as well as funding opportunities for research personnel, diagnostic supplies, etc., in this country. Moreover, most prolific countries were observed to be prevail across the world, that is, each continent has its productive country regarding breast cancer and selenium studies. This could be the reflection of both the prevalence of breast cancer, and the crucial role on global collaboration of scholarly outputs.

Several limitations could be pointed out for the current bibliometric research. First, since revealing the general framework was the primary goal of the search, self-citations were disregarded. Second, the WoS database was chosen as the primary source; no coverage was given to other databases like SCOPUS, DOAJ, EBSCO, PubMed, etc. Third, the terms "breast cancer" and "selenium" were broad search terms; more focused terms could be employed for further investigation. Some specific keywords were ignored, though, to form a broad structure.

Conclusion

In conclusion, this bibliometric analysis offers a structured overview of the most current scholarly literature on the association between breast cancer and selenium. The analysis highlights a growing interest in the potential role of selenium in breast cancer prevention, diagnosis, and treatment, as demonstrated by an increasing number of publications over time. Key contributing institutions, sources, funding agencies, and countries were identified, emphasizing the global and multidisciplinary nature of this research area. The findings also reveal emerging themes and knowledge gaps that warrant further investigation, particularly regarding selenium's biological mechanisms and clinical applications. Overall, this analysis serves as a guide for future research directions and promote evidence-based advancements in breast cancer management related to selenium.

REFERENCES

1. World Health Organization. *Breast cancer*. World Health Organization. <https://www.who.int/news-room/fact-sheets/detail/breast-cancer>. Published August 2025. Accessed February 21, 2025.

2. Harris RJ, Lippman ME, Veronesi U, Willett, W. Breast cancer. *New England Journal of Medicine*. 1992;327:473–480. doi: 10.1056/NEJM199208133270706
3. Mahata J, Basu A, Ghoshal S, et al. Chromosomal aberrations and sister chromatid exchanges in individuals exposed to arsenic through drinking water in West Bengal, India. *Mutation Research*. 2003;534(1–2):133–143. doi: 10.1016/s1383-5718(02)00255-3.
4. Waks AG, Winer EP. Breast cancer treatment: A review. *JAMA*. 2019;321(3):288–300.
5. Veronesi U, Boyle P, Goldhirsch A, Orecchia R, Viale G. Breast cancer. *The Lancet*. 2005;365(9472):1727–1741. doi: 10.1016/S0140-6736(05)66546-4.
6. Collaborative Group on Hormonal Factors in Breast Cancer. Familial breast cancer: Collaborative reanalysis of individual data from 52 epidemiological studies including 58 209 women with breast cancer and 101 986 women without the disease. *The Lancet*. 2001;358(9291):1389–1399. doi: 10.1016/S0140-6736(01)06524-2.
7. Allison KH. Molecular pathology of breast cancer: What a pathologist needs to know. *American Journal of Clinical Pathology*. 2012;138(6):770–780.
8. Hulka BS. Epidemiology of susceptibility to breast cancer. *Progress in Clinical and Biological Research*. 1996;395:159–174.
9. Feng Y, Spezia M, Huang S, et al. Breast cancer development and progression: Risk factors, cancer stem cells, signaling pathways, genomics, and molecular pathogenesis. *Genes & Diseases*. 2018;5(2):77–106. doi: 10.1016/j.gendis.2018.05.001.
10. Zou XN, Taylor PR, Mark SD, et al. Seasonal variation of food consumption and selected nutrient intake in Linxian, a high risk area for esophageal cancer in China. *International Journal for Vitamin and Nutrition Research*. 2002;72(6):375–382.
11. Evans SO, Khairuddin PF, Jameson MB. Optimising selenium for modulation of cancer treatments. *Anticancer Research*. 2017;37:6497–6509.
12. Fairweather-Tait SJ, Bao Y, Broadley MR, et al. Selenium in human health and disease: An overview. *Antioxidants & Redox Signaling*. 2011;14:3–26.
13. Rayman MP. Selenium and human health. *The Lancet*. 2012;379:1256–1268.
14. Lu J, Holmgren A. Selenoproteins. *Journal of Biological Chemistry*. 2009;284(2):723–727.
15. Papp LV, Lu J, Holmgren A, Khanna KK. From selenium to selenoproteins: Synthesis, identity, and their role in human health. *Antioxidants & Redox Signaling*. 2007;9(7):775–806. doi: 10.1089/ars.2007.1528.
16. Callejón-Leblic B, Rodríguez-Moro G, Arias-Borrego A, et al. Absolute quantification of selenoproteins and selenometabolites in lung cancer human serum by column switching coupled to triple quadrupole inductively coupled plasma mass spectrometry. *Journal of Chromatography A*. 2020;1619:460919.

17. Jayachandran A, Shrestha R, Bridle KR, et al. Association between hereditary hemochromatosis and hepatocellular carcinoma: A comprehensive review. *Hepatoma Research*. 2020;6:8. doi: 10.20517/2394-5079.2019.35.
18. Schomburg L. Selenium, selenoproteins and the thyroid gland: Interactions in health and disease. *Nature Reviews Endocrinology*. 2011;8(3):160–171.
19. Combs GF. Selenium in cancer prevention: A review of the evidence and mechanism of action. *Proceedings of the Nutrition Society*. 2005;64(4):527–542.
20. Donthu N, Kumar S, Mukherjee D, Pandey N, Lim WM. How to conduct a bibliometric analysis: An overview and guidelines. *Journal of Business Research*. 2021;133:285–296.
21. Douhani AA. A bibliometric analysis and science mapping of scientific publications of Alzahra University during 1986–2019. *Library Hi Tech*. 2020;39:915–935.
22. Hu W, Tu Y, Tan J, et al. Global research trends on endoplasmic reticulum stress in retinal diseases from 2000 to 2024. *International Ophthalmology*. 2025;45(1):1–21.
23. Konar NM, Suner A. Altmetric, bibliometric, and visualized study of top 100 most cited papers in digital health. *Bandırma Onyedil Eylül Üniversitesi Sağlık Bilimleri ve Araştırmaları Dergisi*. 2024;6(2):262–275. doi: 10.46413/boneyusbad.1420103.
24. Aylaz G, Konar NM. Current publication activity on nanoplastics & microplastics: A bibliometric analysis. *Sustainable Water Resources Management*. 2024;10(2):95.
25. Ju L, Liu Y, Liu S, et al. Bibliometric analysis of global trends and characteristics of remote sensing for mineral exploration in the early 21st century. *All Earth*. 2024;36(1):1–17.
26. Meng G, Xu H, Yang S, et al. Bibliometric analysis of worldwide research trends on breast cancer about inflammation. *Frontiers in Oncology*. 2023;13:1166690.
27. Jiang S, Meng Q, Ji F, et al. A bibliometric analysis of metastatic breast cancer: Two-decade report (2002–2022). *Frontiers in Oncology*. 2023;13:1229222.
28. Wu D, Pan C, Hu Y, et al. A bibliometric and visualization analysis of research trends and hotspots on targeted therapy for breast cancer from 2003 to 2022. *Frontiers in Oncology*. 2024;14:1366900.
29. Wu Y, Cai T, Tao Y, et al. Emerging insights and global trends in the relationship between selenium and thyroid diseases: A bibliometric analysis. *Endocrine, Metabolic & Immune Disorders - Drug Targets*. 2024;24(7):808–819.
30. Abejón R. A bibliometric analysis of research on selenium in drinking water during the 1990–2021 period: Treatment options for selenium removal. *International Journal of Environmental Research and Public Health*. 2022;19(10):5834.

Comparison of Liver Venous Deprivation and Portal Vein Embolization for Future Liver Remnant Hypertrophy: A Single-Center Retrospective Study

Çağrı ERDİM*, Tevfik GÜZELBEY**, Mehmet CİNGÖZ***, Mustafa Fatih ARSLAN****, Ali DABLAN****, Oğuzhan TÜRK SAYAR*****, Mehmet Hamza TÜRK CANOĞLU*****, Hüseyin KILAVUZ*****, İlhan Nahit MUTLU*****, Özgür KILIÇKESMEZ*****

Abstract

Aim: This study aimed to compare the safety, feasibility, and efficacy of liver venous deprivation (LVD) and portal vein embolization (PVE) in inducing future liver remnant (FLR) hypertrophy prior to major hepatectomy.

Method: In this retrospective single-center study, 38 patients who underwent PVE (n=29) or LVD (n=9) between June 2020 and January 2025 were analyzed. Patients were selected based on small FLR volume requiring preoperative hypertrophy induction. Pre- and post-procedural liver volumetric measurements were performed using contrast-enhanced CT, and standardized FLR (sFLR) percentages were calculated. Clinical outcomes, including postoperative complications and mortality, were also evaluated.

Results: Among 38 patients, 21 (15 PVE and 6 LVD) proceeded to surgery. Although pre-procedural sFLR percentages were similar between groups ($19.5 \pm 2.0\%$ for PVE vs. $19.9 \pm 2.6\%$ for LVD; $p=0.806$), post-procedural sFLR percentages were significantly higher in the LVD group ($33.4 \pm 5.1\%$ vs. $24.5 \pm 5.1\%$, $p=0.012$). The mean degree of standardized FLR hypertrophy, expressed as an absolute percentage point increase was significantly greater in the LVD group (13.5% vs. 5% , $p=0.009$), and the percentage FLR increase was higher ($68.6 \pm 20.7\%$ vs. $24.7 \pm 15.6\%$, $p=0.006$). No significant differences were observed in postoperative complication rates (16.6% vs. 20% , $p=0.601$) or mortality (16.7% vs. 13.3% , $p=0.847$).

Conclusion: LVD demonstrated superior FLR hypertrophy compared to PVE while maintaining a comparable safety profile. LVD may offer an effective alternative for patients with small baseline FLR

Özgün Araştırma Makalesi (Original Research Article)

Geliş / Received: 16.04.2025 & **Kabul / Accepted:** 21.08.2025

DOI: <https://doi.org/10.38079/igusabder.1677862>

* MD, Başakşehir Çam and Sakura City Hospital, Department of Radiology, Istanbul, Türkiye.

E-mail: cagrierdem@hotmail.com [ORCID https://orcid.org/0000-0002-2869-6842](https://orcid.org/0000-0002-2869-6842)

** MD, Başakşehir Çam and Sakura City Hospital, Department of Radiology, Istanbul, Türkiye.

E-mail: drmuzelbey@gmail.com [ORCID https://orcid.org/0000-0001-5330-169X](https://orcid.org/0000-0001-5330-169X)

*** MD, Başakşehir Çam and Sakura City Hospital, Department of Radiology, Istanbul, Türkiye.

E-mail: cingozmehmett@hotmail.com [ORCID https://orcid.org/0000-0002-6937-2692](https://orcid.org/0000-0002-6937-2692)

**** MD, Başakşehir Çam and Sakura City Hospital, Department of Radiology, Istanbul, Türkiye.

E-mail: mfarslano6@gmail.com [ORCID https://orcid.org/0000-0003-4361-5817](https://orcid.org/0000-0003-4361-5817)

***** MD, Başakşehir Çam and Sakura City Hospital, Department of Radiology, Istanbul, Türkiye.

E-mail: alidablan@hotmail.com [ORCID https://orcid.org/0000-0003-4198-4416](https://orcid.org/0000-0003-4198-4416)

***** MD, Başakşehir Çam and Sakura City Hospital, Department of Radiology, Istanbul, Türkiye.

E-mail: oguzhanturksayar@gmail.com [ORCID https://orcid.org/0009-0003-7617-6125](https://orcid.org/0009-0003-7617-6125)

***** MD, Gülhane Training and Research Hospital, Department of Radiology, Ankara, Türkiye.

E-mail: mdturkanoglu@yahoo.com [ORCID https://orcid.org/0000-0002-2931-4789](https://orcid.org/0000-0002-2931-4789)

***** MD, Başakşehir Çam and Sakura City Hospital, Department of General Surgery, Istanbul, Türkiye.

E-mail: drhuseyinkilavuz@gmail.com [ORCID https://orcid.org/0000-0001-8860-0630](https://orcid.org/0000-0001-8860-0630)

***** Asst. Prof., Başakşehir Çam and Sakura City Hospital, Department of Radiology, Istanbul, Türkiye.

E-mail: ilhanahit@gmail.com [ORCID https://orcid.org/0000-0002-9326-5432](https://orcid.org/0000-0002-9326-5432)

***** Prof., Medicana Atakoy Hospital, Department of Radiology, Istanbul, Türkiye. E-mail: okilickesmez@yahoo.com [ORCID https://orcid.org/0000-0003-4658-2192](https://orcid.org/0000-0003-4658-2192)

ETHICAL STATEMENT: Before the start of the research, a written decision No: 2025-90 was taken from the Ethics Committee of University of Health Sciences, Başakşehir Çam and Sakura City Hospital. Ethics committee was taken on 08.04.2025.

volumes at high risk of insufficient liver regeneration. Further prospective studies are warranted to confirm these findings and define the optimal clinical indications for LVD.

Keywords: Portal vein embolization, liver venous deprivation, future liver remnant, hepatic hypertrophy, major hepatectomy, interventional radiology.

Gelecekteki Karaciğer Rezidüsü Hipertrofisi için Karaciğer Venöz Deprivasyonu ile Portal Ven Embolizasyonunun Karşılaştırılması: Tek Merkezli Retrospektif Bir Çalışma

Öz

Amaç: Bu çalışma, major hepatektomi öncesinde gelecekteki karaciğer rezidüsü (FLR) hipertrofisini indüklemek amacıyla uygulanan karaciğer venöz deprivasyonu (LVD) ile portal ven embolizasyonunun (PVE) güvenlik, uygulanabilirlik ve etkinlik açısından karşılaştırılmasını amaçlamaktadır.

Yöntem: Bu retrospektif, tek merkezli çalışmada, Haziran 2020 ile Ocak 2025 tarihleri arasında PVE (n=29) veya LVD (n=9) uygulanan toplam 38 hasta analiz edilmiştir. Hastalar, preoperatif hipertrofi indüksiyonu gerektiren düşük FLR hacmi temel alınarak seçilmiştir. İşlem öncesi ve sonrası karaciğer volumetrik ölçümleri kontrastlı BT ile yapılmış ve standartlaştırılmış FLR (sFLR) yüzdeleri hesaplanmıştır. Postoperatif komplikasyonlar ve mortalite dahil olmak üzere klinik sonuçlar da değerlendirilmiştir.

Bulgular: Toplam 38 hastanın 21'i (15 PVE ve 6 LVD) cerrahiye yönlendirilmiştir. İşlem öncesi sFLR yüzdeleri gruplar arasında benzer bulunmuştur (PVE için $19,5 \pm 2,0$; LVD için $19,9 \pm 2,6$; $p=0,806$). Ancak işlem sonrası sFLR yüzdesi LVD grubunda anlamlı derecede daha yüksek saptanmıştır ($33,4 \pm 5,1$ 'e karşı $24,5 \pm 5,1$; $p=0,012$). Ortalama FLR hipertrofi oranı LVD grubunda belirgin şekilde daha fazlaydı ($13,5$ 'e karşı 5 ; $p=0,009$) ve FLR yüzdesel artışı da daha yüksekti ($68,6 \pm 20,7$ 'e karşı $24,7 \pm 15,6$; $p=0,006$). Postoperatif komplikasyon oranları ($16,6$ 'ya karşı 20 ; $p=0,601$) ve mortalite ($16,7$ 'ye karşı $13,3$; $p=0,847$) açısından anlamlı fark saptanmadı.

Sonuç: LVD, PVE'ye kıyasla daha üstün FLR hipertrofisi sağlarken benzer bir güvenlik profili sunmuştur. LVD, düşük başlangıç FLR hacmine sahip ve yetersiz karaciğer rejenerasyonu riski yüksek olan hastalar için etkili bir alternatif olabilir. Bu bulguların doğrulanması ve LVD'nin optimal klinik endikasyonlarının belirlenmesi için ileriye dönük çalışmalara ihtiyaç vardır.

Anahtar Sözcükler: Portal ven embolizasyonu, karaciğer venöz deprivasyonu, gelecekteki karaciğer rezidüsü, hepatik hipertrofi, major hepatektomi, girişimsel radyoloji.

Introduction

Major hepatectomy remains a critical intervention for patients with advanced hepatobiliary malignancies, yet its success hinges on ensuring adequate future liver remnant (FLR) volume and function to prevent postoperative liver failure^{1,2}. Portal vein embolization (PVE) has long been the standard preoperative strategy to induce FLR hypertrophy by redirecting portal flow to the non-embolized liver^{3,4}. However, PVE alone does not always achieve sufficient hypertrophy, particularly in patients with compromised liver function or small baseline FLR^{5,6}. To address this limitation, novel approaches such as hepatic vein embolization (HVE) have emerged to augment FLR regeneration by modulating both inflow and outflow dynamics^{7,8}.

The concept of combining PVE and HVE was first explored by Hwang et al.⁷, who demonstrated that sequential right HVE after PVE induced incremental FLR hypertrophy by exacerbating ischemic injury in the embolized lobe. While effective, this two-stage approach prolonged the preoperative period and carried risks of interval tumor progression. Building on this foundation, Guiu et al.^{9,10} introduced the liver venous deprivation (LVD) technique, which simultaneously embolizes the portal and hepatic veins during a single procedure. Their pioneering work revealed that LVD not only accelerated FLR volume increase but also induced significant histological changes,

including sinusoidal dilatation and hepatocyte atrophy in the embolized lobe, correlating with enhanced regenerative capacity⁹.

In this study, we aimed to compare the feasibility, safety, and regenerative potential of PVE alone versus the simultaneous combined approach of portal and hepatic vein embolization known as LVD, evaluating their effects on volumetric growth and clinical outcomes.

Material and Methods

Patient Selection

This retrospective, single-center study included patients who underwent PVE and/or HVE between June 2020 and January 2025 as a preparatory step for major hepatic resection. The study was approved by the institutional ethics committee (Ethical approval number: 2025-90), and written informed consent was obtained from all patients prior to the procedures.

Inclusion Criteria:

- Patients undergoing major liver resection (right/left hepatectomy or extended hepatectomy).
- Patients with a small FLR (<25% of total liver volume) in non-cirrhotic patients or <40% in cirrhotic patients.
- Patients who underwent pre- and post-procedure CT-based liver volumetric measurements.
- Patients with primary or metastatic liver malignancies scheduled for major liver resection (right/left hepatectomy or extended hepatectomy).
- No evidence of significant extrahepatic disease precluding curative resection.

Exclusion Criteria:

- Patients without pre-procedural volumetric liver data.
- Those who had previous liver surgery affecting volumetric analysis.
- Patients with portal vein thrombosis or hepatic venous outflow obstruction before embolization.
- Patients with unresectable tumors or contraindications to major hepatectomy.

PVE Procedure

In our study, all PVE procedures were performed under mild to moderate sedation following appropriate sterile field preparation and local anesthesia (10 mL of 1% prilocaine). Embolization procedures were carried out using a percutaneous transhepatic approach under ultrasound and fluoroscopic guidance. The choice between an ipsilateral or contralateral portal vein approach was determined based on the patient's vascular anatomy and tumor localization.

During the procedure, acoustic set-assisted access was used to puncture the target portal vein segment, and a 5F introducer sheath was placed. After the sheath placement, an

initial portography was performed using a 5F Simmons 1 catheter (Cordis, Cardinal Health, United States) to evaluate vascular anatomy, confirm adequate contrast opacification of the target branches, and assess potential collateral circulation. Once the branches to be embolized were identified, a 2.7F microcatheter (Progreat, Terumo, Tokyo, Japan) was advanced into the target portal vein branches to perform controlled embolization. N-butyl cyanoacrylate (NBCA) mixed with lipiodol was the primary embolic agent used for PVE. To ensure controlled embolization and optimal penetration into distal segmental branches, NBCA was diluted with lipiodol at a 12.5% concentration. The embolization process was continued until complete occlusion of the target portal vein branches was achieved. Following embolization, a control portography and Cone Beam CT (CBCT) imaging were obtained to confirm procedural success and to rule out non-target embolization. The access site was sealed using NBCA-lipiodol or coils to minimize the risk of bleeding and portal vein thrombosis (Figure 1-2).

All procedures were performed by experienced interventional radiologists, and any potential complications, including portal vein thrombosis, non-target embolization, and segmental infarction, were meticulously documented.

Figure 1(a, b). Axial contrast-enhanced CT images obtained before **(a)** and after **(b)** portal vein embolization (PVE), **(c)** Segmentation of the future liver remnant (FLR) (highlighted in green) on the pre-procedural CT image shown in **(a)**, **(d)** Segmentation of the FLR (highlighted in green) on the post-procedural CT image shown in **(b)**.

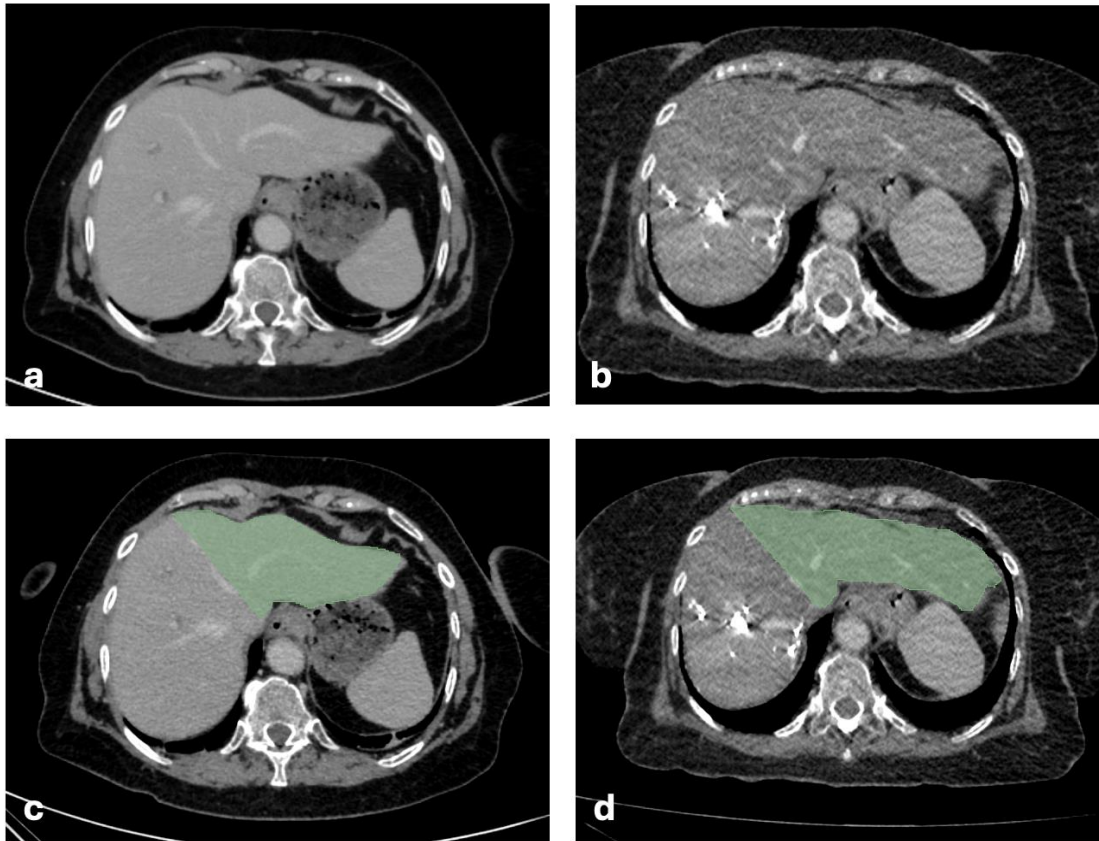


Figure 2(a). Angiographic image obtained from the right main portal vein following percutaneous transhepatic puncture, **(b)** Non-subtracted fluoroscopic image showing embolization of the right portal vein branches after portal vein embolization (PVE), **(c)** Coronal contrast-enhanced CT image obtained post-procedure, demonstrating NBCA-lipiodol opacities within the right portal vein branches.



HVE Procedure

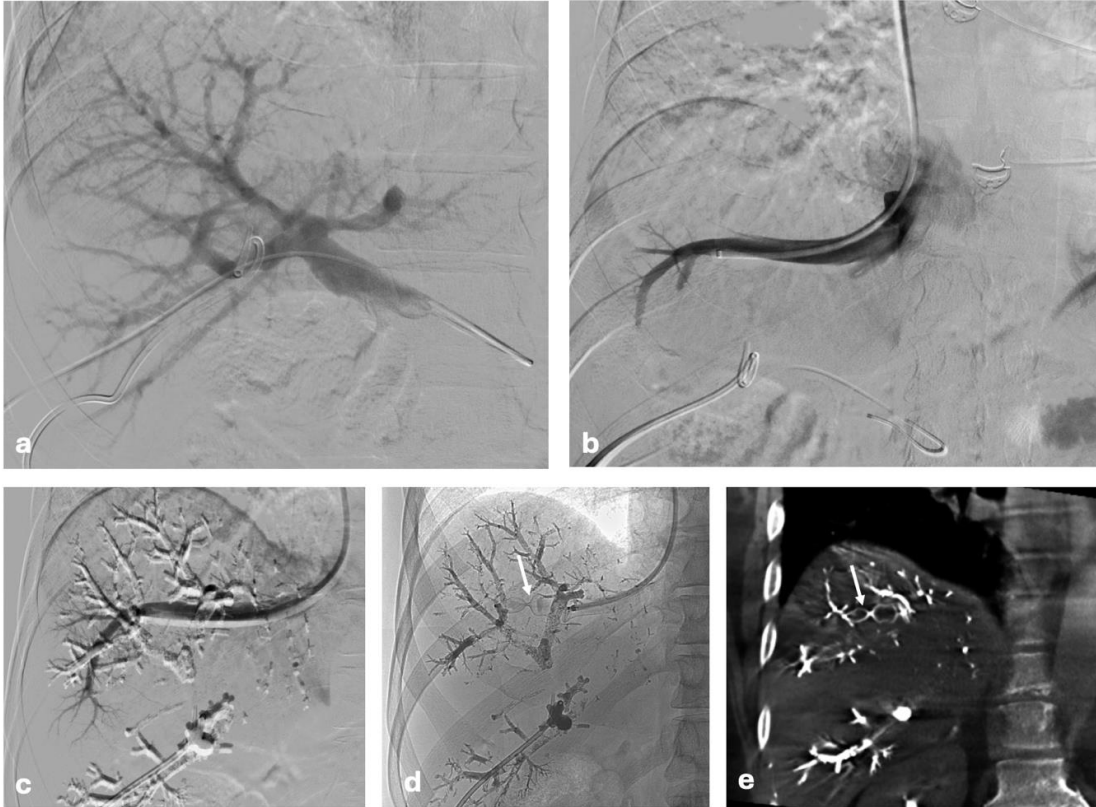
In all cases, LVD was performed as a single-stage procedure, with simultaneous embolization of the portal and hepatic veins during the same session. HVE was performed to enhance the hypertrophy of the FLR by preventing venous outflow from the embolized liver segments. In our study, the procedure was conducted using either a transjugular or percutaneous transhepatic approach, depending on the patient's vascular anatomy and procedural feasibility.

For the transjugular approach, a 9F long sheath was inserted into the inferior vena cava (IVC) via jugular vein puncture. Alternatively, in the percutaneous transhepatic approach, direct access to the right or middle hepatic vein was obtained, and a 9F introducer sheath was placed. The target hepatic vein(s) (right, middle, or accessory hepatic vein) were selectively catheterized under fluoroscopic guidance using a 5F catheter.

For embolization, an Amplatzer vascular plug was deployed within the hepatic vein at the predetermined location. In some cases, additional coil embolization was performed to enhance the effectiveness of venous occlusion. The embolization site was carefully selected to ensure that the deployed device remained 10 mm proximal to the IVC-HV junction, preventing unintended migration or incomplete occlusion.

Pre- and post-embolization venography was performed to confirm the correct positioning of the embolic material and to assess for any residual venous drainage or collateral formation. The procedure was considered successful upon complete occlusion of the hepatic vein, thereby inducing hepatic congestion in the embolized lobe and accelerating compensatory hypertrophy in the future liver remnant. Post-procedural follow-up included monitoring for potential complications, such as hepatic congestion, ischemic injury, or non-target embolization (Figure 3).

Figure 3(a). Angiographic image obtained from the main portal vein following percutaneous transhepatic puncture, **(b)** Following right jugular vein access, fluoroscopic image showing catheterization of the right hepatic vein before embolization, **(c)** Portal venogram demonstrating successful embolization of the right portal vein branches with NBCA-lipiodol mixture, **(d)** Fluoroscopic image showing occlusion of the right hepatic vein with an Amplatzer vascular plug (white arrow), **(e)** Coronal Cone Beam CT (CBCT) image obtained after liver venous deprivation (LVD), showing NBCA-lipiodol opacities in the right portal vein branches and Amplatzer vascular plug in the right hepatic vein (white arrow).



CT Volume Measurement

Liver volumetric measurements were performed using 3D Slicer software (version 5.8.1), a validated open-source tool for medical image segmentation and quantitative analysis. Volumetric assessment was based on contrast-enhanced abdominal CT scans acquired in the portal venous phase, with 5-mm slice thickness axial images used for segmentation.

The segmentation process involved manual and semi-automated selection of the liver parenchyma, ensuring precise delineation of the FLR and excluded non-hepatic structures. The following volumetric parameters were calculated with Figure 4^{4,11-13}.

Figure 4. Calculations

$$BSA = \sqrt{\frac{\text{Height (cm)} \times \text{Weight (kg)}}{3600}}$$

$$TELV = -794.41 + (1267.28 \times BSA)$$

$$sFLR = \frac{FLR \text{ Volume}}{TELV}$$

$$\%FLR \text{ Increase} = \frac{FLR \text{ Post-PVE/HVE} - FLR \text{ Pre-PVE}}{FLR \text{ Pre-PVE}} \times 100$$

All volumetric measurements were reviewed and approved by an experienced interventional radiologist. The liver segmentation process was carried out using threshold-based selection, region-growing algorithms, and manual refinements, ensuring accurate volumetric assessment.

Statistical Analysis

Statistical analyses were performed using IBM SPSS Statistics software (version 23.0; IBM Corp., Armonk, NY). Continuous variables (e.g., age, BMI, FLR volumes, %FLR increase) were expressed as mean $\pm$ standard deviation (SD) and compared using independent samples t-tests, as normality assumptions were confirmed via the Shapiro-Wilk test ($p > 0.05$). Categorical variables (e.g., gender, tumor type, complications, mortality) were analyzed using Fisher's exact test or Pearson's chi-squared test, depending on expected cell frequencies.

Results**Patient Demographics And Clinical Characteristics**

In total, 38 patients were included in the study: 29 underwent PVE, and 9 underwent LVD. Among patients who underwent LVD, surgical resection could not be performed in two cases due to tumor progression and in one case due to insufficient FLR hypertrophy. In the PVE group, 9 patients were excluded from surgical resection due to tumor progression, 3 due to insufficient FLR hypertrophy, 1 due to the development of acute renal failure, and 1 due to the patient's refusal to undergo surgery after embolization.

Ultimately, 21 patients who successfully underwent surgery 15 following PVE and 6 following LVD were included in the final analysis.

Demographic and clinical characteristics are summarized in Table 1. No significant differences were observed between the groups in terms of age (52.6 ± 11.4 vs. 59.2 ± 17.5 years, $p = 0.464$), gender distribution (male: 60% vs. 66.7%, $p = 0.715$), or BMI (25.2 ± 1.3 kg/m², vs. 24.8 ± 1.1 kg/m², $p = 0.545$). Cholangiocarcinoma was the predominant tumor type in both groups (66.7% in PVE vs. 83.3% in LVD, $p = 0.328$). The interval between embolization and surgery was comparable (56.3 ± 34.5 vs. 45.2 ± 10.5 days, $p = 0.272$). Postoperative complications occurred in 20% of patients who underwent PVE and 16.6% of those who underwent LVD ($p = 0.601$), with no significant differences in hospital stay (19.9 ± 7.6 vs. 20.8 ± 3.6 days, $p = 0.732$) or mortality rates (13.3% vs. 16.7%, $p = 0.847$).

However, follow-up duration was significantly shorter in the LVD group (9.2 ± 9.4 vs. 23.9 ± 17.3 months, $p=0.031$).

Table 1. Patient demographic and clinical characteristics

Variable	PVE (n = 15)	LVD (n = 6)	p
Age (years, mean $\pm$ SD)	52.6 $\pm$ 11.4	59.2 $\pm$ 17.5	0.464
Gender, n (%)			0.715
- Male	9 (60%)	4 (66.7%)	
- Female	6 (40%)	2 (33.3%)	
BMI (kg/m ² , mean $\pm$ SD)	25.2 $\pm$ 1.3	24.8 $\pm$ 1.1	0.545
Tumor Type, n (%)			0.328
- Cholangiocarcinoma	10 (66.7%)	5 (83.3%)	
- Hepatocellular Carcinoma	3 (20%)	0 (0%)	
- Hemangioendothelioma	1 (6.7%)	0 (0%)	
- Colon Cancer Metastasis	1 (6.7%)	1 (16.7%)	
VE-Surgery Interval (days, mean $\pm$ SD)	56.3 $\pm$ 34.5	45.2 $\pm$ 10.5	0.272
Postoperative Complications, n (%)	3 (20%)	1 (16.6%)	0.601
Hospital Stay (days, mean $\pm$ SD)	19.9 $\pm$ 7.6	20.8 $\pm$ 3.6	0.732
Follow-up Duration (months, mean $\pm$ SD)	23.9 $\pm$ 17.3	9.2 $\pm$ 9.4	0.031
Mortality, n (%)	2 (13.3%)	1 (16.7%)	0.847

Abbreviations; PVE: portal venous embolization, LVD: liver venous deprivation, BMI: body mass index, VE: venous embolization, SD: Standard Deviation

Volumetric Outcomes

Volumetric parameters are detailed in Table 2. The total estimated liver volume (TELV) was significantly lower in the LVD group (1536.6 ± 300.1 mL vs. 2144.5 ± 422.5 mL, $p=0.006$). Similarly, baseline FLR volume was significantly smaller in the LVD group (300.4 ± 35.5 mL vs. 412.4 ± 57.0 mL, $p=0.001$). Post-embolization FLR volumes were comparable between groups (501.2 ± 20.2 mL vs. 510.3 ± 63.2 mL, $p=0.622$). Baseline sFLR percentages were similar between groups ($19.9 \pm 2.6\%$ vs. $19.5 \pm 2.0\%$, $p=0.806$), whereas post-procedural sFLR was significantly higher in the LVD group ($33.4 \pm 5.1\%$ vs. $24.5 \pm 5.1\%$, $p=0.012$). Notably, the mean degree of hypertrophy was significantly greater in the LVD group (13.5% vs. 5% , $p=0.009$), as was the percentage FLR increase ($68.6 \pm 20.7\%$ vs. $24.7 \pm 15.6\%$, $p=0.006$).

Table 2. Volumetric Outcomes of PVE vs. LVD

Parameter	PVE (n = 15)	LVD (n = 6)	p
TELTV (ml, mean $\pm$ SD)	2144.5 $\pm$ 422.5	1536.6 $\pm$ 300.1	0.006
FLR Pre VE (ml, mean $\pm$ SD)	412.4 $\pm$ 57.0	300.4 $\pm$ 35.5	0.001
FLR Post VE (ml, mean $\pm$ SD)	510.3 $\pm$ 63.2	501.2 $\pm$ 20.2	0.622
sFLR Pre VE (%)	19.5 $\pm$ 2.0	19.9 $\pm$ 2.6	0.806
sFLR Post VE (%)	24.5 $\pm$ 5.1	33.4 $\pm$ 5.1	0.012
Mean degree of hypertrophy(%)	5	13.5	0.009
%FLR Increase (mean $\pm$ SD)	24.7 $\pm$ 15.6	68.6 $\pm$ 20.7	0.006

Abbreviations; PVE: portal venous embolization, LVD: liver venous deprivation, TELTV: total estimated liver volume, FLR: future liver remnant, sFLR: standardized future liver remnant, VE: venous embolization, SD: Standard Deviation

Safety And Follow-Up

Both groups demonstrated comparable safety profiles, with no significant differences in procedural complications or mortality. Hepatic congestion or ischemic injury specific to LVD was not observed in patients who underwent LVD.

These findings suggest that LVD induces more robust FLR hypertrophy compared to PVE alone, particularly in patients with smaller baseline FLR volumes, while maintaining a comparable safety profile.

Discussion

Our study highlights the significant advantages of LVD compared to PVE alone, particularly regarding FLR hypertrophy, resectability, and safety profiles. Consistent with prior reports, our results showed that LVD induced more robust FLR hypertrophy compared to conventional PVE. Specifically, we observed a mean percentage FLR increase of $68.6 \pm 20.7\%$ in the LVD group versus $24.7 \pm 15.6\%$ in the PVE group ($p=0.006$). This dramatic hypertrophy with LVD is consistent with findings in the emerging literature. The pioneer study by Guiu et al. first described “LVD” showing that adding hepatic vein occlusion to PVE produced rapid and substantial FLR growth (from 28.2% to 40.9% of total liver volume within 3 weeks)[9]. Subsequent comparative studies have confirmed that LVD yields a higher degree of hypertrophy than PVE. In the multicenter DRAGON collaborative analysis, the median FLR increase after LVD was 59% vs 48% with PVE ($p=0.020$)¹⁴. Similarly, a recent systematic review and meta-analysis found LVD associated with significantly larger post-embolization FLR volumes and faster kinetic growth rates¹⁵.

This superior hypertrophy directly translates into improved resectability: in DRAGON, 90% of patients were able to undergo curative resection after LVD, compared to 68% after PVE ($p=0.007$)¹⁴. Shindoh et al. demonstrated that even among patients with extremely low baseline FLR, PVE enabled eventual resection in approximately 72% of cases, while 28% of patients failed to proceed to surgery due to insufficient liver regeneration². In this study, surgical resection could not be performed in 33% of patients who underwent LVD and 48% of patients who underwent PVE due to tumor progression,

acute renal failure, insufficient FLR hypertrophy, or the patient's refusal to undergo surgery.

One critical advantage of LVD identified in this cohort and corroborated by literature is the accelerated hypertrophy kinetics, which potentially reduces the interval between embolization and surgery. This rapid hypertrophic response minimizes the risk of tumor progression that often prevents surgical intervention after PVE alone². Schnitzbauer et al. emphasized the clinical importance of rapid hypertrophy, particularly in aggressive hepatobiliary malignancies, where delays may preclude curative intent resection¹⁶.

Regarding procedural safety, our findings underscore the comparable risk profiles of LVD and PVE, with no significant differences in complications or mortality rates observed between groups. This aligns with existing literature documenting the favorable safety profile of PVE and suggesting LVD does not significantly increase procedural morbidity^{1,17}. Notably, hepatic congestion or ischemic injury specific to hepatic vein embolization was absent in our series, mirroring findings reported in recent large-scale studies^{9,14,18}.

Although pre-procedural FLR volumes were similar between patients who underwent LVD and those who underwent PVE, post-procedural sFLR percentages were significantly higher in the LVD group ($33.4 \pm 5.1\%$ vs. $24.5 \pm 5.1\%$, $p=0.012$). This finding suggests that LVD can achieve greater hypertrophy compared to PVE alone, potentially reducing the risk of insufficient liver regeneration and surgical dropout. Similar results have been reported in recent systematic reviews, supporting the superiority of LVD in inducing more robust FLR hypertrophy¹⁸.

The primary limitation of this study is the small sample size, particularly in the LVD group, which significantly reduced statistical power and hindered the detection of potentially meaningful differences. Second, heterogeneity in tumor types may have confounded outcomes. The predominance of cholangiocarcinoma in the PVE+HVE group and the absence of HCC cases limit the generalizability of results, as liver regeneration dynamics may differ across tumor subtypes. The retrospective design introduced additional constraints, including incomplete or non-standardized data collection. Key variables such as ASA classification and preoperative chemotherapy details were not consistently recorded, potentially biasing the interpretation of outcomes. Additionally, the absence of hepatocellular carcinoma (HCC) cases in the LVD group and their presence in 20% of the PVE group may have influenced hypertrophy outcomes, as liver regeneration capacity differs across tumor types. This imbalance should be considered when interpreting volumetric comparisons.

In conclusion, study demonstrates that LVD is a feasible and safe alternative to PVE, offering superior FLR hypertrophy, especially in patients with smaller baseline FLR volumes. The significantly greater percentage increase in FLR volume and higher standardized FLR achieved with LVD suggest that this technique may enhance resectability and improve surgical candidacy in patients at risk for insufficient liver regeneration following PVE alone. Importantly, LVD was not associated with increased procedural complications or mortality, supporting its safety profile. Although limited by a small sample size and retrospective design, studies findings contribute to the growing body of evidence supporting LVD as a more effective strategy for preoperative liver

hypertrophy. Further large-scale prospective studies are warranted to validate these results and establish standardized indications for LVD in hepatic surgery candidates.

REFERENCES

1. Abulkhir A, Limongelli P, Healey AJ, et al. Preoperative portal vein embolization for major liver resection. *Ann Surg.* 2008;247(1):49-57. doi: 10.1097/SLA.0b013e31815f6e5b.
2. Shindoh J, Vauthey JN, Zimmitti G, et al. Analysis of the efficacy of portal vein embolization for patients with extensive liver malignancy and very low future liver remnant volume, including a comparison with the associating liver partition with portal vein ligation for staged hepatectomy approach. *J Am Coll Surg.* 2013;217(1):126-133. doi: 10.1016/j.jamcollsurg.2013.03.004.
3. Kinoshita H, Sakai K, Hirohashi K, Igawa S, Yamasaki O, Kubo S. Preoperative portal vein embolization for hepatocellular carcinoma. *World J Surg.* 1986;10(5):803-808. doi: 10.1007/BF01655244.
4. van Lienden KP, van den Esschert JW, de Graaf W, et al. portal vein embolization before liver resection: A systematic review. *Cardiovasc Intervent Radiol.* 2013;36(1):25-34. doi: 10.1007/s00270-012-0440-y
5. Yokoyama Y, Nagino M, Nimura Y. mechanisms of hepatic regeneration following portal vein embolization and partial hepatectomy: A review. *World J Surg.* 2007;31(2):367-374. doi: 10.1007/s00268-006-0526-2
6. Imamura H, Shimada R, Kubota M, et al. Preoperative portal vein embolization: An audit of 84 patients. *Hepatology.* 1999;29(4):1099-1105. doi: 10.1002/hep.510290415
7. Hwang S, Lee SG, Ko GY, et al. Sequential preoperative ipsilateral hepatic vein embolization after portal vein embolization to induce further liver regeneration in patients with hepatobiliary malignancy. *Ann Surg.* 2009;249(4):608-616. doi: 10.1097/SLA.0b013e31819ecc5c
8. Ko G, Hwang S, Sung K, Gwon D, Lee S. Interventional oncology: new options for interstitial treatments and intravascular approaches. *J Hepatobiliary Pancreat Sci.* 2010;17(4):410-412. doi: 10.1007/s00534-009-0235-y
9. Guiu B, Chevallerier P, Denys A, et al. Simultaneous trans-hepatic portal and hepatic vein embolization before major hepatectomy: the liver venous deprivation technique. *Eur Radiol.* 2016;26(12):4259-4267. doi: 10.1007/s00330-016-4291-9
10. Guiu B, Quenet F, Escal L, et al. Extended liver venous deprivation before major hepatectomy induces marked and very rapid increase in future liver remnant function. *Eur Radiol.* 2017;27(8):3343-3352. doi: 10.1007/s00330-017-4744-9
11. Mosteller R. Simplified calculation of body-surface area. *New England Journal of Medicine.* 1987;317(17):1098-1098. doi: 10.1056/NEJM198710223171717

12. Vauthey JN, Chaoui A, Do KA, et al. Standardized measurement of the future liver remnant prior to extended liver resection: Methodology and clinical associations. *Surgery*. 2000;127(5):512-519. doi: 10.1067/msy.2000.105294
13. Vauthey JN, Abdalla EK, Doherty DA, et al. Body surface area and body weight predict total liver volume in Western adults. *Liver Transplantation*. 2002;8(3):233-240. doi: 10.1053/jlts.2002.31654
14. Heil J, Korenblik R, Heid F, et al. Preoperative portal vein or portal and hepatic vein embolization: DRAGON collaborative group analysis. *British Journal of Surgery*. 2021;108(7):834-842. doi: 10.1093/bjs/znaa149
15. Bell RJ, Hakeem AR, Pandanaboyana S, Davidson BR, Prasad RK, Dasari BVM. Portal vein embolization *versus* dual vein embolization for management of the future liver remnant in patients undergoing major hepatectomy: meta-analysis. *BJS Open*. 2022;6(6). doi: 10.1093/bjsopen/zrac131
16. Schnitzbauer AA, Lang SA, Goessmann H, et al. Right portal vein ligation combined with in situ splitting induces rapid left lateral liver lobe hypertrophy enabling 2-staged extended right hepatic resection in small-for-size settings. *Ann Surg*. 2012;255(3):405-414. doi: 10.1097/SLA.obo13e31824856f5
17. May B, Madoff D. Portal vein embolization: rationale, technique, and current application. *Semin Intervent Radiol*. 2012;29(02):081-089. doi: 10.1055/s-0032-1312568
18. Chaouch MA, Mazzotta A, da Costa AC, et al. A systematic review and meta-analysis of liver venous deprivation versus portal vein embolization before hepatectomy: future liver volume, postoperative outcomes, and oncological safety. *Front Med (Lausanne)*. 2024;10. doi: 10.3389/fmed.2023.1334661

Investigation of Art Therapy Applications in Geriatric Rehabilitation from the Perspective of Occupational Therapy*

Derya ALİOĞLU**, Sümeyye SARIŞAHİN***, Gülşah ZENGİN YAZICI****, Ümit UĞURLU*****

Abstract

Aim: This review aims to systematically examine art therapy practices applied within the scope of occupational therapy for geriatric individuals.

Method: A literature search was conducted using the keywords “art therapy” OR “music therapy” OR “dance therapy”, “older adults” OR “geriatric individuals”, and “occupational therapy” OR “ergotherapy”. The Boolean search method was employed in the PubMed and OTseeker databases.

Results: Seven articles published between 2017 and 2024 that met the inclusion criteria were identified. Among them, four were research articles (57%), two were randomized controlled trials (29%), and one was a descriptive study (14%). The characteristics and findings of these studies were organized under three thematic categories: dance therapy practices in geriatric rehabilitation, art and craft practices in geriatric rehabilitation, and other practices in geriatric rehabilitation.

Conclusion: The reviewed interventions were found to be effective in enhancing cognitive functioning, reducing symptoms of depression, and improving overall quality of life in geriatric populations. Furthermore, the importance of engaging older individuals in personalized, meaningful, and purposeful occupations was emphasized as a means to alleviate behavioral symptoms, reduce caregiver burden, and minimize caregiving time.

Keywords: Occupational therapy, art therapy, geriatric individuals.

Geriatrik Bireylerde Sanat Terapi Uygulamalarının Ergoterapi Perspektifiyle İncelenmesi Öz

Amaç: Bu derlemenin amacı geriatrik bireylerde ergoterapi alanında yapılmış olan sanat terapisi uygulamaların sistematik olarak incelenmesidir.

Yöntem: "Art therapy veya music therapy veya dance therapy", "older people veya geriatric individuals", "occupational therapy veya ergotherapy" anahtar kelimeleri kullanılarak literatür taraması yapılmıştır. Bu kapsamda PubMed ve OTSeeker veri tabanlarında Boolean arama yöntemiyle tarama yapılmıştır.

Bulgular: 2017-2024 yılları arasında yayımlanmış ve araştırma kriterlerini sağlayan yedi yayın tespit edilmiştir. Bunlardan dört tanesi araştırma makalesi (%57), ikisi randomize kontrollü çalışma (%29) ve diğeri de tanımlayıcı (%14) araştırma tarzında makaleleridir. Çalışmaların betimleyici özellikleri ve sonuçları “geriatrik rehabilitasyonda dans terapi uygulamaları, geriatrik rehabilitasyonda sanat ve zanaat uygulamaları ve geriatrik rehabilitasyonda diğer uygulamalar” olmak üzere üç alt başlıkta ele alınmıştır.

Derleme Makale (Review Article)

Geliş / Received: 29.11.2024 & **Kabul / Accepted:** 07.07.2025

DOI: <https://doi.org/10.38079/igusabder.1593437>

* The study titled “Investigation of Art Therapy Applications In Geriatric Rehabilitation from the Perspective Of Occupational Therapy” was presented as a poster presentation at the nationally organized “Congress on Innovative Approaches in Occupational Therapy” and published as an abstract in the Book of Abstracts.

** Occupational Therapist, Bezmialem Vakıf University, Faculty of Health Sciences, Department of Occupational Therapy, Istanbul, Türkiye. E-mail: derya.alioglu@hotmail.com [ORCID https://orcid.org/0009-0006-7438-7959](https://orcid.org/0009-0006-7438-7959)

*** Lecturer, Bezmialem Vakıf University Faculty of Health Sciences, Department of Occupational Therapy, Istanbul, Türkiye. E-mail: sumeyye.sarisahin@bezmialem.edu.tr [ORCID https://orcid.org/0000-0002-9886-0556](https://orcid.org/0000-0002-9886-0556)

**** Asst. Prof., Bezmialem Vakıf University, Faculty of Health Sciences, Department of Occupational Therapy, Istanbul, Türkiye. E-mail: gulsah.zengin@bezmialem.edu.tr [ORCID https://orcid.org/0000-0003-3348-5422](https://orcid.org/0000-0003-3348-5422)

***** Prof., Bezmialem Vakıf University, Faculty of Health Sciences, Department of Occupational Therapy, Istanbul, Türkiye. E-mail: ugurlu@bezmialem.edu.tr [ORCID https://orcid.org/0000-0003-0360-1904](https://orcid.org/0000-0003-0360-1904)

Sonuç: Müdahalelerin bilişsel işlevleri iyileştirmede, ilgili popülasyonda depresyonu azaltmada ve danışanların yaşam kalitesini artırmada etkili olduğu bulunmuştur. Ayrıca bireylerin kişiye özel, anlamlı ve amaçlı okupasyonlara katılımının ilgili popülasyonda davranışsal semptomların yanı sıra bakım veren yükünü ve bakım için harcanan zamanı azaltabileceği vurgulanmıştır.

Anahtar Sözcükler: Ergoterapi, sanat terapisi, geriatrik bireyler.

Introduction

Geriatrics is a branch of science that focuses on health issues, diseases, social and functional life, quality of life, preventive healthcare practices, and healthy aging in individuals aged 65 and above^{1,2}. Aging is characterized by a progressive decline involving morphological, physiological, and pathological changes that negatively impact both physical and mental capacities, leading to various diseases and deficiencies. According to the World Health Organization, as of 1998, the population aged 65 and over was 390 million, and it is projected to reach 800 million by 2025, comprising 10% of the global population^{3,4}.

Art and the creative process, which have existed since the dawn of human history, are inherently empowering, cathartic, and healing. Thus, the use of art as a therapeutic method dates back to prehistoric times and spans many cultures. Although art therapy is multidisciplinary, it is fundamentally a type of psychotherapy that integrates visual arts into the therapeutic process. While the concept of art therapy began gaining traction in the late 1900s, a growing number of psychologists, psychiatrists, and other healthcare professionals now recognize its potential in psychiatric treatment^{5,6}. In illnesses where physical resilience is low, it has been acknowledged that not only the body but also mental and emotional well-being is affected—underlining the importance of psychological healing. In this context, the book *Art Versus Illness* by Adrian was published in 1945⁷. Moreover, art therapy has since been adopted within the framework of the National Health Service^{5,8}.

Creativity is a two-part process that entails producing something both original and functional. It includes not only the ability to act spontaneously but also the skill of divergent thinking—thinking flexibly, uniquely, and in detail⁹. As such, creative processes yield outcomes that are original, engaging, and functional. Creative individuals are often open to personal experiences, independent, capable of questioning established ideas, flexible in their thinking, and emotionally and socially sensitive¹⁰. One way to enhance individual creativity is through the use of creative arts. Creative arts span a broad spectrum, including auditory and literary forms (such as music, drama, and literature), as well as visual and physical forms (such as dance, movement, and painting). Among verbal arts, literature and drama are most prominent, while non-verbal forms include music, dance/movement, and visual arts such as drawing, painting, and sculpture. Verbal and nonverbal art forms often complement one another^{9,10}.

In the international literature, art therapy is categorized into six types: visual art therapy, music therapy, dance/movement therapy, intermodal therapy, psychoanalytic therapy, and creative writing/poetry therapy (bibliotherapy)¹¹. Visual art therapy utilizes elements of visual art, such as drawing, sculpting, marbling, ceramics, and tile painting¹². According to the World Federation of Music Therapy, music therapy is defined as “the

planned use of music and/or musical elements (sound, rhythm, melody, and harmony) by a trained music therapist to develop and enhance communication, relationships, learning, expression, mobilization, organization, and other relevant therapeutic outcomes that meet the physical, emotional, social, and cognitive needs of individuals or groups”¹³.

Like other creative arts therapies, dance/movement therapy (DMT) uses the artistic process to support healing and restoration. It also engages bodily sensations and experiences. DMT is grounded in the belief that the body and mind are interconnected and that bodily movements reflect emotional states¹⁴. Intermodal expressive arts therapy is a relatively new and evolving field that promotes integration between different artistic forms, in contrast to traditional categorizations¹⁵. "Intermodal" refers to the therapeutic use of two or more art forms in tandem to facilitate positive change. The intrinsic sensory connections between art forms form the basis for transitions across modalities. Creative expression in this context enhances the natural healing capacity of the community¹⁶.

Psychoanalytic therapy, a deterministic and clinical approach developed by Sigmund Freud in 1895, is based on personality theory, instinctual drives, developmental psychology, and biological/genetic factors¹⁷. Psychodynamic therapy, a related model, attributes behavioral disorders to unconscious processes and emphasizes how developmental issues during early childhood may negatively affect an individual's mental functioning¹⁸. Bibliotherapy is a process through which individuals are supported in solving personal problems or gaining deeper self-understanding through the use of literature. The discovery of the therapeutic and developmental impact of the dynamic interaction between a reader and a book has led to the adoption of bibliotherapy in psychological counseling and guidance¹⁹. Occupational therapy is both an art and a science, aiming to assist individuals in engaging with meaningful occupations so they can perform essential daily activities that promote health and well-being^{20,21}. This definition illustrates the integration of artistic practice with evidence-based scientific methodology. The conceptualization of art within occupational therapy stems from its historical roots and development^{22,23}.

The application of art therapy in geriatric populations plays a significant role in occupational therapy interventions. However, the number of studies specifically examining this intersection remains limited. This review aims to systematically examine occupational therapy research that explores art therapy interventions in geriatric individuals. The findings are expected to provide foundational insights into whether art therapy practices that support cognitive health and promote active aging can enhance geriatric rehabilitation practices in occupational therapy.

Material and Methods

In this study, a systematic review approach was adopted in order to provide a comprehensive and evidence-based synthesis of the current literature regarding art-based occupational therapy interventions aimed at improving cognitive functions in geriatric populations. This method was conducted in accordance with predetermined inclusion and exclusion criteria to ensure methodological rigor and transparency. Relevant studies were identified through a systematic search of electronic databases, followed by a multi-stage selection process including title, abstract, and full-text

screening. This approach enabled the identification, evaluation, and synthesis of high-quality evidence, allowing for a more structured and objective analysis of how occupational therapy practices incorporating art, music, and movement influence cognitive health in older adults^{24,25}.

The systematic review focused on occupational therapy studies published between January 2017 and February 2024. The literature search was conducted using the PubMed and OTseeker databases, as well as the Google Scholar search engine. The Boolean search method was employed, utilizing the following keywords: “Art Therapy”, “Music Therapy”, “Dance Therapy” for interventions involving music and movement; “Older People” and “Geriatric Individuals” for the target population; and “Occupational Therapy” and “Ergotherapy” for the field of occupational therapy. The keywords were applied both individually and in various combinations to ensure a comprehensive search strategy. The Boolean operators used for this purpose are presented in Table 1.

Table 1. Keywords

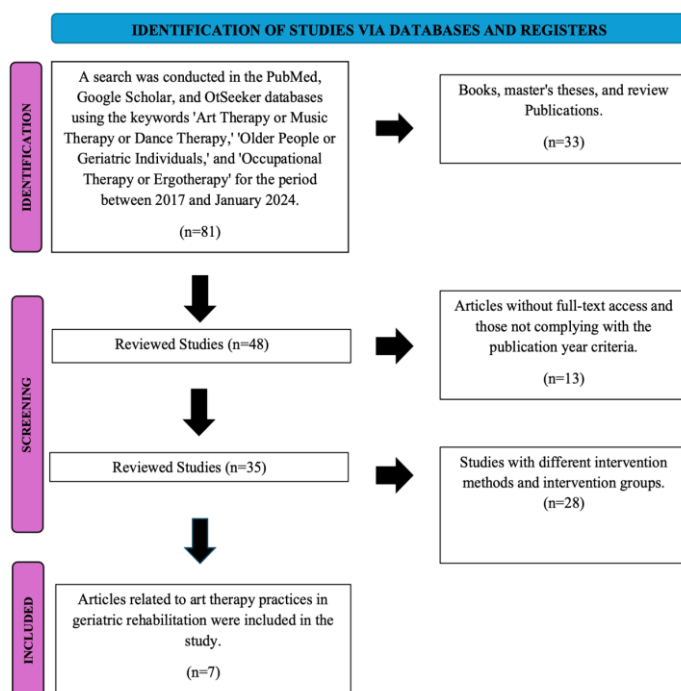
Art Therapy		Older People		Occupational Therapy
OR		OR		OR
Music Therapy	AND	Geriatric Individuals	AND	Ergotherapy
OR				
Dance Therapy				

Studies published between January 2017 and February 2024, written in English, involving sample groups composed of individuals aged 65 and older, and offering full-text access were included in this review. Conversely, review articles, meta-analyses, books, and book chapters were excluded from the analysis.

A total of 81 occupational therapy studies investigating the effects of art therapy interventions on cognitive functions in geriatric individuals were initially identified. Of these, 33 were excluded as they were reviews, meta-analyses, books, or book chapters. Following title and abstract screening, 13 additional studies that did not meet the inclusion criteria were removed. The full texts of the remaining 35 studies were then assessed. Among these, 10 did not involve occupational therapy interventions, 8 included participants under the age of 65, the full text of 5 could not be accessed, and 5 were excluded due to being published in a non-English language. As a result, 7 studies were included in this systematic review. The process of study selection and inclusion in this review is presented in Figure 1.

Results

Following the comprehensive search, seven studies were identified and included in the review (see Appendix 1). The selected studies comprised research articles (57%), randomized controlled trials (29%), and descriptive studies (14%). The descriptive characteristics and findings of these studies are presented under three thematic subheadings: Applications of Dance Therapy in Geriatric Rehabilitation, Applications of Art and Craft in Geriatric Rehabilitation, and Other Applications in Geriatric Rehabilitation.

Figure 1. Flow chart**Table 2.** Geriatric rehabilitation: insights on art therapy practices

Author/ Year	Study design	Participants	Evaluation	Intervention Methods	Conclusion
Rocha et al.²⁶ (2017)	Research Article	(n=18)	Semi-Structured Interview Form	Dance Therapy	It was concluded that the effects of dance therapy are multidimensional.
Bruyneel et al.²⁷ (2023)	Randomized Controlled Trial	Experimental Group (n=9), Control Group (n=10)	Lower Extremity Motor Coordination Test (LEMOCOT), Montreal Cognitive Assessment Scale (MoCA), Stroke-Specific Quality of Life Scale (SS-QOL)	Dance Therapy	No significant difference was observed between the two groups. However, the experimental group showed an increase in evaluation scores.
Kim D.²⁸ (2017)	Research Article	(n=28) (65+ geriatric individuals)	Functional Independence Measure (FIM), Beck Depression Inventory, Mini-Mental State Examination (MMSE-K)	A 16-session program combining physical activity, recreational activity, art, and crafts was conducted	A significant difference was found in restrictions in daily living activities, cognitive functions, and depression levels due to physical strength loss.
Regier et al.²⁹ (2017)	Research Article	(n=56) Individuals with Dementia Aged 75+	Mini-Mental State Examination (MMSE), Cornell Scale for Depression in Dementia	Activities including physical, cognitive, sensory exercises, social interactions, household tasks, music and recreational activities, and crafts were conducted	A significant difference was observed in cognitive functions and independent participation in daily living activities.

Kim D.³⁰ (2020)	Randomized Controlled Trial	Experimental Group (n=18), Control Group (n=17)	Functional Independence Measure (FIM), Mini-Mental State Examination (MMSE-K), Geriatric Depression Scale-K (SGDS-K), Geriatric Quality of Life Scale-Dementia (GQOL-D), Subjective Memory Complaints Questionnaire (SMCQ)	Reminiscence Therapy was applied through dance therapy, music therapy, physical activity, and daily living activities	A significant difference was found in cognitive functions, depression levels, and quality of life.
Spooner et al.³¹ (2019)	Research Article	(n=3) Individuals working in the military and veterans	Montreal Cognitive Assessment (MoCA), World Health Organization Quality of Life Scale (WHOQOL-BREF), Positive and Negative Affect Schedule (PANAS-X), Person Picking Apple from a Tree (PPAT)	Visual Art Therapy, Dance Therapy, and Music Therapy were applied via telerehabilitation	It was concluded that these methods are feasible and accessible through telerehabilitation.
Engelbrecht et al.³² (2023)	Research Article	(n=92)	Semi-Structured Interview Form to Evaluate Reminiscence Therapy and Music-Supported Reminiscence Therapy	Music-Supported Reminiscence Therapy was applied for 6 to 12 weeks	Music was reported to have a stimulating effect on reminiscence therapy. Additionally, it positively influenced non-verbal communication in geriatric individuals.

Applications of Dance Therapy in Geriatric Rehabilitation

As a result of the search process, two studies investigating the effects of dance therapy on geriatric individuals were identified in Table 2.

The first study is a research article incorporating qualitative analysis. In this study, conducted by Rocha et al., the effects of dance therapy on individuals with Parkinson's disease were examined. The findings indicated that dance therapy is a widely accepted complementary treatment for individuals with Parkinson's disease. It was found to be effective in improving motor symptoms and enhancing the overall quality of life. In addition to contributing to several rehabilitation goals, dance therapy was also reported to have a positive impact on artistic experiences and creative skills²⁶.

The second study reviewed under this subheading is a randomized controlled trial conducted by Bruyneel et al. This study investigated the effects of dance therapy interventions during the subacute phase of stroke rehabilitation in individuals who had experienced a stroke. Conducted in Switzerland, the study aimed to compare the effects of a dance therapy program integrated with conventional treatments on motor recovery and quality of life with those of traditional treatment approaches alone. The results revealed no statistically significant differences between the groups in terms of balance, motor coordination, cognitive functions, or quality of life. However, an improvement in scores was observed in the dance therapy group compared to their baseline assessment. Furthermore, most participants expressed a desire to continue dance therapy after

discharge from the rehabilitation center, reporting increased participation and improvements in their motor coordination skills²⁷.

Applications of Art and Craft in Geriatric Rehabilitation

This section presents two studies that examined the impact of integrated art therapy practices on geriatric individuals in Table 2. The first study is a research article conducted by Kim, which aimed to evaluate the effects of integrated art therapy on daily living activities, cognitive status, and depression levels. The study was carried out in South Korea and involved a sample of 28 individuals aged 65 and over, comprising 12 males and 16 females. Various standardized scales were employed to assess participants: the Functional Independence Measure (FIM) was used to objectively evaluate their daily living functions; the Mini-Mental State Examination Korean Version (MMSE-K) assessed cognitive status; and the Beck Depression Inventory measured depression levels²⁸.

The physical activity component involved exercises designed to support motor skills and strengthen muscles. The recreational activities included tasks such as dart throwing and singing, aimed at enhancing motivation and increasing participation. The art and craft component included activities like making pressed flowers and creating eco-friendly bags, which were intended to develop fine motor skills, foster self-confidence, and improve attention span.

The results indicated significant improvements in participants' daily living activities following the intervention. Notably, cognitive function improved in both male and female participants. A significant reduction in depression levels was observed, with female participants showing greater improvements compared to their male counterparts²⁶.

The second study reviewed under this subheading is an intervention study conducted by Regier et al., which focused on the characteristics of activities designed for patients at mild, moderate, and severe stages of dementia. This study was carried out in the United States in 2016 and published in The Journal of the American Geriatrics Society in 2017. The sample consisted of 56 individuals with dementia: 21 in the mild stage, 13 in the moderate stage, and 22 in the severe stage.

Standardized scales were used to assess participants, including the Mini-Mental State Examination (MMSE) and the Cornell Scale for Depression in Dementia (CSDD). The Timed Up and Go (TUG) test was used to evaluate physical function. For caregivers, assessments included the Dementia Agitation Behavior Scale and measures of functional and distress levels.

The intervention program involved eight home visits over a four-month period, with each visit lasting 90 minutes. The activities provided included arts and crafts, physical exercises, cognitive activities, music and recreational activities, sensory stimulation, activities of daily living (ADL), and instrumental activities of daily living (IADL), as well as social engagement activities. The results demonstrated significant improvements across all activity areas. Additionally, the activities were adapted according to the cognitive stage of the participants (mild, moderate, or severe), ensuring that the intervention was tailored to the individual's specific needs²⁹.

Other Applications in Geriatric Rehabilitation

Under the subheading Other Applications in Geriatric Rehabilitation, three studies were reviewed in Table 2. These studies were grouped due to their integration of art therapy with other therapeutic modalities, such as reminiscence therapy and tele-rehabilitation.

The first study is a randomized controlled trial conducted by Kim D. in 2019 in South Korea, and published in the Journal of Hindawi in 2020. The study included a sample of 35 individuals diagnosed with Alzheimer's disease, who were randomly assigned to two groups. The experimental group (n=17) participated in a combined intervention involving integrated art therapy and reminiscence therapy. The control group (n=18) engaged in a conventional program composed of physical activities, recreational exercises, and daily living tasks. Both groups received 24 sessions, each lasting 60 minutes, conducted five times per week. The results indicated statistically significant improvements in the experimental group compared to the control group in subjective memory, cognitive functioning, and levels of depression ($p < 0.05$)³⁰.

The second study, conducted by Spooner et al. in 2018 in the United States and published in The Journal of Arts in Psychotherapy in 2019, explored the use of creative art therapies delivered via tele-rehabilitation to military veterans. The study sample comprised three veterans, each receiving a distinct form of art therapy: music therapy, dance/movement therapy, and visual arts therapy. The interventions were administered through the RVTRI-CAT program, a platform for tele-rehabilitation. Findings suggested that creative art therapy had beneficial effects on participants and that tele-rehabilitation could serve as a viable alternative for individuals lacking access to in-person services. Nevertheless, the study also acknowledged limitations of remote therapy in comparison to traditional face-to-face methods³¹.

Both individual and group therapies were favored formats across the interventions. Among professional groups, only nurses reported a higher use of traditional reminiscence therapy compared to music-based approaches. The findings concluded that music generally enhanced the effectiveness of reminiscence therapy. However, certain types of music were found to have a potentially adverse effect on participants' psychosocial well-being³⁰. Both individual and group therapies were favored formats across the interventions. Among professional groups, only nurses reported a higher use of traditional reminiscence therapy compared to music-based approaches. The findings concluded that music generally enhanced the effectiveness of reminiscence therapy. However, certain types of music were found to have a potentially adverse effect on participants' psychosocial well-being³².

Discussion

This review aimed to examine the effects of art therapy practices on individuals undergoing geriatric rehabilitation. The studies analyzed under the subheadings of Dance Therapy Applications in Geriatric Rehabilitation (28%), Art and Craft Applications in Geriatric Rehabilitation (28%), and Other Applications in Geriatric Rehabilitation (44%) collectively indicate that art therapy interventions have positive effects on both the physical and psychosocial well-being of older adults.

The studies focusing on dance therapy applications highlight its potential to improve the physical, cognitive, and emotional health of elderly individuals. For instance, in a study conducted by Rocha et al.²⁶, involving individuals with Parkinson's disease, the positive impact of appropriate music selection in dance therapy on the motor cortex was emphasized. Similarly, Bruyneel et al.²⁷, in their randomized controlled trial with stroke patients, underscored the importance of creating a safe and motivating environment during dance therapy sessions to foster participation and engagement. Overall, dance therapy has been shown to improve motor coordination, flexibility, and endurance. These findings suggest that integrating dance therapy into physical activity in an enjoyable and social context can increase motivation and enhance social participation among elderly individuals. Nevertheless, there is a need for more large-scale and long-term randomized controlled trials to establish the comprehensive effects of dance therapy in geriatric rehabilitation.

Art and craft activities were found to provide significant benefits, particularly in supporting cognitive function and emotional well-being. The reviewed studies indicate that these activities are effective in reducing depression, enhancing self-expression, and stimulating cognitive processes. In a study conducted by Kim³⁰, art and craft practices were shown to significantly reduce depression levels among geriatric individuals, with women demonstrating greater improvement compared to men—a difference attributed to varying levels of self-esteem. Likewise, the study by Regier et al. (2017) emphasized the importance of tailoring interventions to the specific stages of dementia, showing that personalized art therapy practices were effective in alleviating symptoms and enhancing quality of life²⁹. These findings collectively suggest that individualized approaches in art therapy are more likely to yield meaningful therapeutic outcomes.

Other applications in geriatric rehabilitation involved integrating art therapy with physical activity, telerehabilitation, and reminiscence therapy. Notably, telerehabilitation emerged as a promising approach due to its accessibility and ease of implementation, potentially enhancing the independence and well-being of elderly individuals. In a 2020 study by Kim, integrating art therapy with reminiscence therapy was shown to improve memory skills and foster social interaction among individuals with Alzheimer's disease³⁰. Similarly, Spooner et al. (2019) highlighted the effectiveness of delivering creative art therapies, such as music and visual arts, via telerehabilitation, particularly for veterans with limited access to in-person services³¹. However, it was also acknowledged that the therapeutic effects of telerehabilitation may be less robust compared to traditional face-to-face interventions.

Finally, a 2024 study by Engelbrecht et al. evaluated the impact of music-supported reminiscence therapy on geriatric individuals, demonstrating that appropriately selected music can significantly enhance verbal communication and memory skills³². The study also revealed that both individual and group therapy sessions were effective, although the professional background of the practitioner influenced the choice of intervention techniques. Importantly, while music generally enhanced the benefits of reminiscence therapy, certain types of music were reported to negatively affect participants' psychosocial states.

Limitations

This study has several limitations. First, the inclusion period was restricted to studies published between January 2017 and February 2024, and only seven studies met the inclusion criteria. This limited number of studies reduces the generalizability of the findings. A larger number of studies with broader sample sizes could have led to more robust and reliable conclusions. Second, there was considerable heterogeneity among the included studies in terms of assessment tools, duration of interventions, and evaluation methods. This methodological diversity limited the ability to compare and synthesize findings across studies. Another important limitation is the use of a limited number of databases. Future studies are recommended to include more comprehensive databases such as Scopus and Web of Science. Additionally, the scope of the search terms used in this review was relatively narrow. It is suggested that future research employ broader and more detailed search terms, such as “elderly” and “cognitive rehabilitation,” to capture a wider range of relevant literature.

Conclusion

The findings of this review demonstrate that art therapy practices are effective in improving cognitive functions, reducing depression levels, and enhancing the overall quality of life among geriatric individuals. Among the various subtypes of art therapy, dance therapy, music therapy, drama therapy, craft therapy, and tele-rehabilitation-based creative art therapy emerged as the most frequently utilized approaches for evaluation and intervention in geriatric rehabilitation.

Moreover, the reviewed studies emphasize the importance of engaging elderly individuals in personalized, meaningful, and purposeful activities. Such participation has been shown to reduce behavioral symptoms, alleviate caregiver burden, and decrease the time required for caregiving tasks, thereby contributing positively to both patients and their support systems.

This review primarily focused on specific subtypes of art therapy and a geriatric population within particular socio-cultural settings. Future research would benefit from exploring the combined effects of multiple art therapy modalities and investigating their impacts on elderly populations from diverse socio-cultural backgrounds. Expanding the scope of research in this direction may contribute to a more comprehensive understanding of the therapeutic potential of art-based interventions in geriatric rehabilitation and promote the development of more inclusive and adaptable therapeutic programs.

Funding and Acknowledgment: No financial support was received for this study.

Acknowledgement: The authors disclosed no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Ethical Statement: It is declared that the study is among the studies that do not require ethics committee permission.

REFERENCES

1. Tırpan K. Birinci basamak ve geriatri ilişkisi. *Akademik Geriatri*. 2010.
2. World Health Organization. World Report on Ageing and Health. Erişim:10.07.2024. https://iris.who.int/bitstream/handle/10665/186463/9789240694811_eng.pdf?sequence=1.
3. World Health Organization. Ageing and Health. Newsroom / Fact sheets. Erişim: 01.10.2024. <https://www.who.int/news-room/fact-sheets/detail/ageing-and-health>.
4. Uz Tunçay S, Özdiñler AR, Erdiñler DS. Geriatrik hastalarda düşme risk faktörlerinin günlük yaşam aktiviteleri ve yaşam kalitesine etkisi. *Türk Geriatri Dergisi*. 2011;14(3):245-252.
5. Çakmak Ö, Biçer İ, Demir H. Sağlıkta sanat terapisi kullanımı: Literatür taraması. *Sağlık ve Sosyal Refah Araştırmaları Dergisi*. 2020;2(2):12-21.
6. Case C, Dalley T. The therapy in art therapy. *The Handbook of Art Therapy*. 2006.
7. Adrian H. *Art Versus Illness: A Story of Art Therapy*. 1945.
8. Hogan S. *Healing Arts: The History of Art Therapy*. Jessica Kingsley Publishers. 2001.
9. Gladding ST. *The Creative Arts in Counseling*. John Wiley & Sons. 2021.
10. Dollinger SJ, Kazmierczak E, Storkerson PK. Creativity and self-exploration in projective drawings of abused women: Evaluating the inside me outside me workshop. *Journal of Creativity in Mental Health*. 2011;6(3):202-219. doi: 10.1080/15401383.2011.607094.
11. Öz E. Sanat Terapisine Genel Bir Bakış. *Sosyal ve Beşerî Bilimlere Küresel Yaklaşımlar*. (Edt. Cem Can, Abdurrahman Kilimci). Ankara: Detay Yayıncılık. 2015.
12. Öz Çelikbaş E. Dışavurumcu sanat terapisi. *Safran Kültür ve Turizm Araştırmaları Dergisi*. 2019;2(1):20-37.
13. World Federation of Music Therapy. What is music therapy? Accessed June 13, 2019. <https://www.wfmt.info/wfmt-new-home/about-wfmt/>.
14. Levy FJ. *Dance Movement Therapy: A Healing Art*. American Alliance for Health, Physical Education, Recreation, and Dance. 1988.
15. Atkins S. *Expressive Arts Therapy-Creative Process in Art and Life*. 2003.
16. Davis KM, Snyder MA, Hartig N. Intermodal expressive arts in group supervision. *Journal of Creativity in Mental Health*. 2018;13(1):68-75. doi: 10.1080/15401383.2017.1328294.
17. Corey G. *Psikolojik Danışma ve Psikoterapi Kuram ve Uygulamaları* (Ergene, T, Çev.). Mentis Yayıncılık. 2008.

18. Yam FC. Postmodern danışma kuramlarından öyküsel terapinin bilişsel davranışçı terapi ve psikanalitik terapi ile karşılaştırılması. *Humanistic Perspective*. 2023;5(1):708-722.
19. Öncü H. Bibliyoterapi yönteminin okullarda psikolojik danışma ve rehberlik amacıyla kullanılması. *Türkiye Sosyal Araştırmalar Dergisi*. 2012;161(161):147.
20. Eklund M. Occupation and wellness. In C. Brown & V. C. Stoffel (Eds.), *Occupational Therapy in Mental Health*. 2011;649-658.
21. Crepeau EB, Schell BAB, Cohn ES. Contemporary occupational therapy practice in the United States. *Willard & Spackman's Occupational Therapy*. 2009;11:216-229.
22. Levine RE. The influence of the arts-and-crafts movement on the professional status of occupational therapy. *The American Journal of Occupational Therapy*. 1987;41(4):248-254. doi: 10.5014/ajot.41.4.248.
23. Bathje, M. Art in occupational therapy: An introduction to occupation and the artist. *The Open Journal of Occupational Therapy*. 2012;1(1):8. doi: 10.15453/2168-6408.1034.
24. Emblad SY, Mukaetova-Ladinska EB. Creative art therapy as a non-pharmacological intervention for dementia: A systematic review. *Journal of Alzheimer's disease reports*. 2021;5(1):353-364. doi: 10.3233/ADR-201002.
25. Souza LBRD, Gomes YC, Moraes MGGD. The impacts of visual art therapy for elderly with neurocognitive disorder: A systematic review. *Dementia & Neuropsychologia*. 2022;16(1):8-18. doi: 10.1590/1980-5764-DN-2021-0042.
26. Rocha PA, Slade SC, McClelland J, Morris ME. Dance is more than therapy: Qualitative analysis on therapeutic dancing classes for Parkinson's. *Complementary Therapies In Medicine*. 2017;34:1-9. doi: 10.1016/j.ctim.2017.07.006.
27. Bruyneel AV, Pourchet T, Reinmann A. Dance after stroke improves motor recovery in the subacute phase: A randomized controlled trial. *Heliyon*. 2023;9(11):e22275.
28. Kim D. The effects of a combined physical activity, recreation, and art and craft program on ADL, cognition, and depression in the elderly. *Journal of Physical Therapy Science*. 2017;29(4):744-747. doi: 10.1589/jpts.29.744.
29. Regier NG, Hodgson NA, Gitlin LN. Characteristics of activities for persons with dementia at the mild, moderate, and severe stages. *The Gerontologist*. 2017;57(5):987-997.
30. Kim D. The effects of a recollection-based occupational therapy program of Alzheimer's disease: a randomized controlled trial. *Occupational Therapy International*. 2020;2020(1).
31. Spooner H, Lee JB, Langston DG, Sonke J, Myers KJ, Levy CE. Using distance technology to deliver the creative arts therapies to veterans: Case studies in art,

dance/movement and music therapy. *The Arts in Psychotherapy*. 2019;62:12-18.
doi: 10.1016/j.aip.2018.11.012.

- 32.** Engelbrecht R, Bhar S, Shoemark H, Elphinstone B, Ciorciari J. Reminiscence therapy and music with older adults: A descriptive study investigating the current views and practices of Australian aged care providers and volunteers. *Journal of Applied Gerontology*. 2024;43(9).

Epigenetically Mediated Health Effects of Intermittent Fasting

Tülay IŞIK*

Abstract

Globally, the prevalence of chronic diseases such as obesity, cardiovascular disorders, diabetes, and cancer is rising. These conditions are influenced by both genetic and environmental factors, with nutrition being one of the most critical environmental determinants. Intermittent fasting (IF) is a dietary pattern that has gained attention for its potential health benefits and impact on metabolic regulation. Recent studies in the field of nutrition-epigenetics suggest that IF may exert these effects through epigenetic modifications, including DNA methylation, histone modifications, and regulation by non-coding RNAs. IF encompasses various approaches such as alternate-day fasting, time-restricted feeding, and whole-day fasting. Evidence indicates that IF can enhance lipid and glucose metabolism, support healthy aging, reduce inflammation, and improve mitochondrial and immune function by modulating gene expression epigenetically. It may also promote autophagy, stem cell renewal, and anti-cancer responses, suggesting its potential role in preventing or mitigating metabolic and neurodegenerative diseases. Despite these benefits, adverse effects of IF have also been reported. Particularly concerning are findings related to maternal IF, which may impair fetal development and metabolic health in offspring via epigenetic inheritance. Additionally, in other life stages, IF may lead to micronutrient deficiencies, hypoglycemia, hormonal imbalances, fatigue, and increased metabolic disease risk, especially in vulnerable populations or when fasting is prolonged or poorly planned. This review aims to summarize the current evidence on how IF influences health and disease through epigenetic mechanisms. Personalized recommendations considering age, health status, and nutritional needs are essential. More comprehensive human studies are needed to clarify IF's dual role and to optimize its application for health promotion.

Keywords: Fasting, circadian rhythm, diet therapy, epigenetic processes.

Aralıklı Açlık Diyetlerinin Epigenetik Aracılı Sağlık Etkileri

Öz

Dünya genelinde obezite, kardiyovasküler hastalıklar, diyabet ve kanser gibi kronik hastalıkların görülme sıklığı artmaktadır. Bu hastalıklar hem genetik hem de çevresel faktörlerden etkilenmektedir ve beslenme, en önemli çevresel belirleyicilerden biridir. Aralıklı açlık (AA), metabolik düzenleme üzerindeki potansiyel etkileri nedeniyle sağlık yararları açısından dikkat çeken bir beslenme modelidir. Beslenme-epigenetik alanındaki güncel çalışmalar, AA'nin bu etkilerini epigenetik değişiklikler yoluyla gösterebileceğini ortaya koymaktadır. Bu değişiklikler arasında DNA metilasyonu, histon modifikasyonları ve kodlamayan RNA'ların düzenlenmesi yer almaktadır. AA; gün aşırı oruç, zaman kısıtlı beslenme ve tam gün oruç gibi farklı uygulamaları içermektedir. Kanıtlar, AA'nin lipid ve glukoz metabolizmasını iyileştirebileceğini, sağlıklı yaşlanmayı destekleyebileceğini, inflamasyonu azaltabileceğini ve mitokondriyal ile bağışıklık fonksiyonlarını iyileştirebileceğini göstermektedir. Ayrıca, ototofajiyi, kök hücre yenilenmesini ve antikanser yanıtları teşvik ederek metabolik ve nörodejeneratif hastalıkların önlenmesinde potansiyel bir rol oynayabilir. Bu yararların yanı sıra, AA'nin olumsuz etkileri de bildirilmektedir. Özellikle gebelikte uygulanan AA'nin, epigenetik kalıtım yoluyla fetüsün gelişimi ve metabolik sağlığı üzerinde olumsuz etkileri olabileceği gösterilmiştir. Ayrıca, diğer yaşam dönemlerinde de mikrobesein eksiklikleri, hipoglisemi, hormonal dengesizlikler, yorgunluk ve artmış metabolik hastalık riski gibi olumsuzluklar görülebilmektedir, özellikle kırılgan bireylerde veya yetersiz planlanmış uzun süreli AA uygulamalarında. Bu derlemede, AA'nin epigenetik mekanizmalar yoluyla sağlık ve hastalık üzerindeki etkileri güncel literatür ışığında

Derleme Makale (Review Article)

Geliş / Received: 09.01.2025 & **Kabul / Accepted:** 07.07.2025

DOI: <https://doi.org/10.38079/igusabder.1529934>

* PhD Student, Istanbul Medipol University, Institute of Health Sciences, Department of Nutrition and Dietetics, Istanbul, Türkiye. E-mail: dyttulay.isik@gmail.com **ORCID** <https://orcid.org/0000-0003-0160-8336>

özetlenmektedir. AA uygulamalarında yaş, sağlık durumu ve bireysel beslenme ihtiyaçları göz önünde bulundurularak kişiye özel öneriler verilmesi önemlidir. Bu alandaki insan çalışmalarının artırılması, AA'nin çift yönlü etkilerinin netleştirilmesi açısından gereklidir.

Anahtar Sözcükler: Açlık, sirkadiyen ritm, diyet terapi, epigenetik süreçler.

Introduction

Intermittent Fasting

Following the Industrial Revolution, some changes have been observed in dietary habits due to the changing living conditions of human life. It is characterized by an increased frequency of meals during the day and irregular eating patterns with meals shifted to later hours of the day¹. Along with these irregular eating habits developed over the process, the Western diet, which consists of highly processed foods, constitutes the main environmental factor in the current epidemic of metabolic diseases. Therefore, a transition to a healthy and nutritional diet can protect against the progression of chronic disease. Beyond this context, factors like side effects, patient adherence, tolerability, and shortcomings in disease management create obstacles to the practical use of pharmacological treatments in managing metabolic disorders. Hence, it is stated that dietary interventions can be used as a low-risk alternative or complementary treatment. Dietary interventions with adjusted meal timing or content show sustainable success in decreasing risk factors, revealing multiple favorable effects, and correcting disease conditions². Among these dietary interventions, intermittent fasting (IF) has emerged in the last 10-15 years as a non-traditional approach to potentially reduce body weight and improve metabolic health, gaining popularity independently of calorie restriction. It encompasses various dietary interventions that include periodic intervals of fasting followed by eating^{1,3}. Unlike other popular diets, it is suggested that IF could be an appealing alternative dietary intervention as it does not require calorie tracking and allows for unrestricted eating during specific hours of the day. There are various IF diets in terms of meal timing and energy intake cycles³. These can be grouped as alternate-day fasting, time-restricted feeding, and religious fasts^{1,4,5}.

Alternate Day Fasting: It is the most commonly preferred intermittent fasting diet intervention, except for religious fasting⁴. This dietary intervention is applied by alternating free eating days with fasting days. ADF has two main variations. In zero-calorie ADF, no caloric foods or beverages are consumed on fasting days, while MADF permits a meal, usually at lunchtime, covering around 25% of an individual's daily energy needs⁶. Additionally, alternate-day fasting can implement modified fasting with different durations. In this case, modified fasting periods with a small meal can extend up to 30-40 hours^{4,5}. The 5:2 eating pattern represents an adjusted form of ADF, requiring two days per week with reduced calorie intake (500–1,000 kcal daily) while allowing unrestricted eating on the remaining five days. These lower-calorie days may be scheduled either consecutively or separately throughout the week³.

Whole Day Fasting: Whole-day fasting involves completely avoiding food or severely restricting calories for only 1-2 days per week. These protocols can be as simple as a 24-hour fast once a week, but some include fasting multiple times per week or fasting periods longer than 24 hours⁴.

Time Restricted Feeding: Time-restricted eating protocols involve adhering to a daily routine in which a specific number of hours are fasted within 24 hours, and the remaining hours are allocated for eating. This method permits individuals to eat freely within a specific timeframe, typically ranging from 3–4 hours up to 10–12 hours, resulting in a fasting period of 12–21 hours daily. The most common form of time-restricted eating involves eating for eight hours and fasting for the remaining 16 hours. An essential aspect of IF is that while the timing of meals is regulated, total calorie consumption is generally not restricted^{5,7}.

Religious Fasting (Ramadan Fasting): Many religions, such as Islam, Christianity, Judaism include religious fasting⁸. These fasts, which vary in duration and dietary patterns, generally reduce the consumption of animal proteins, refined foods, and other worldly pleasures while increasing the intake of fruits and vegetables, social interaction, and religious practices such as prayer⁹. Therefore, the Ramadan fast in Islam can be examined within the context of intermittent fasting dietary interventions due to their similarities to secular intermittent fasting approaches. Ramadan fasting (RF) is a 30-day period during which Muslims abstain from food and drink from dawn to sunset during Ramadan^{8,10}. Traditionally, it is common practice to wake up at the first light of dawn and have breakfast before dawn. Energy intake is limited to the evening, night, and very early morning hours^{11,12}.

Fasting Mimicking Diet: A nutritional regimen formulated to replicate the physiological effects of extended fasting while allowing limited nutrient consumption¹³. This dietary approach primarily consists of plant-based foods, including vegetables, nuts, seeds, and healthy fats such as olive oil^{13,14}. It replaces regular meals with nutrient-dense bars, soups, and snacks, ensuring adequate micronutrient intake while inducing short-term calorie restriction. The diet is rich in complex carbohydrates and polyunsaturated fatty acids while being low in protein and sugar¹⁴. On the first day of a standard FMD protocol, approximately 1090 kcal is consumed, comprising 34% carbohydrate, 56% fat, and 10% protein. For the remaining days (days 2 through 5), the daily caloric intake is reduced to 725 kcal, with a macronutrient distribution of 47% carbohydrate, 44% fat and 9% protein¹⁵.

Effects of Intermittent Fasting on Health

It is stated that various IF interventions in animal and human studies have great potential to delay adverse health conditions associated with aging, as well as reduce the potential for numerous health issues, with a focus on metabolic disorders, neurodegenerative diseases, and cancer^{16–23}. Studies on animals have shown that IF has strong and persistent effects on biomarkers, lowering blood pressure, enhancing insulin sensitivity and glucose regulation, reducing body fat, and improving lipid metabolism^{24,25}. In healthy individuals, IF has been found to improve systemic metabolic indicators and slow aging by enhancing the function of multiple organs^{26,27}. IF helps address disorders in glucose and lipid metabolism, fosters the renewal of stem cells or organ tissues, and slows disease progression, particularly in those with obesity or metabolic syndrome^{28–30}. Moreover, when applied in conjunction with chemotherapeutic agents, IF increases chemotherapeutic efficacy while reducing associated side effects³¹. IF stimulates the renewal and differentiation of various tissues and cells, while also

enhancing antitumor immunity³². In addition, IF interventions affect the cellular autophagy, gut microbiome, and mitochondrial health³³⁻³⁵. A recent study demonstrated that intermittent fasting may promote weight loss by reducing fat accumulation without disrupting energy balance, thereby offering a protective effect against obesity³⁶.

Intermittent fasting (IF) has shown potential in delaying age-related diseases and reducing the risk of metabolic disorders like obesity, diabetes, and cancer. Animal and human studies indicate it improves metabolic health and may enhance chemotherapy outcomes.

Health Effects of Intermittent Fasting and Ramadan Fasting with Epigenetic Modifications

Despite extensive experimental evidence supporting the health benefits of IF dietary interventions, information on the underlying molecular mechanisms is insufficient and still under investigation^{37,38}. However, with the increasing number of genetic-nutritional studies in recent years, dietary components or dietary interventions have been reported to be an environmental factor that can alter the expression of genes. Studies on the effects of these dietary interventions on humans are ongoing. The most widely accepted hypothesis in this area suggests that epigenetics is responsible for these processes. Epigenetics is defined as a field of science that examines the ability of environmental factors such as lifestyle, physical activity, exposure to toxins, and nutrition to modulate gene expression without changing our DNA sequence. Epigenetics utilizes epigenetic modifications, including DNA methylation, histone modifications, and non-coding RNAs, to modulate and regulate gene expression³⁹. At this point, IF interventions are seen as lifestyle interventions representing a potential environmental factor that can influence the epigenome through various epigenetic modifications³⁷. Additionally, epigenetic modifications influenced by environmental factors are reported to be common in many diseases like obesity, metabolic syndrome, type 2 diabetes, insulin resistance, and cancer. Accordingly, the interactions between the environment and genetic structure are thought to be the underlying cause of the complex pathophysiology of chronic diseases^{37,40}.

N6-methyladenosine (m6A) methylation, a widespread and abundant epigenetic modification found in eukaryotic mRNA, is linked to obesity, lipid metabolism, and apoptosis, and plays a crucial role in both the physiological and pathological mechanisms underlying cardiovascular diseases^{41,42}. In a study conducted by Zujie et al.⁴², the favorable effects of IF on lipid accumulation, apoptosis, and m6A methylation in the heart tissue of obese mice were evaluated. Fifteen male C57BL/6J mice were divided into two groups: one group (n=15) was fed a high-carbohydrate (70%) normal diet, and the other group (n=30) was fed a high-fat diet (60%) for 13 weeks. At the end of 13 weeks, the obese mice on a high-fat diet were equally divided to form a third group. The third group of obese mice was subjected to 24:24 whole-day fasting for eight weeks, while the other two groups continued their previous diets. At the end of 21 weeks, IF intervention significantly reduced the mRNA expression of genes involved in fatty acid intake and synthesis (FATP1, FABP1, CD36, SREBF1, FAS, ACC α) and elevated the expression of genes involved in fatty acid breakdown (ATGL, HSL, LAL, LPL) in the hearts of mice with obesity induced by a high-fat diet. Moreover, IF attenuated apoptosis, indicated by a

reduction in TUNEL-positive cells, a decline in the Bax/Bcl-2 ratio, and a decrease in Caspase 3 protein levels. Mechanistically, IF lowered m6A methylation levels by downregulating METTL3 and upregulating FTO. Therefore, it is suggested that IF may reduce lipid accumulation and apoptosis in the heart tissue through a mechanism associated with decreased m6A RNA methylation levels, thereby improving cardiac functional and structural impairment⁴². However, a 2015 study demonstrated that alternate-day fasting applied for six weeks protected mice from *in vivo* ischemia-reperfusion injury. Yet, in mice with impaired autophagy (heterozygous null for Lamp2, which encodes lysosomal-associated membrane protein 2), this protective effect was not observed; instead, a worsening effect was noted⁴³. Another study conducted on rats subjected to alternate-day fasting for six months demonstrated an increase in myocardial fibrosis, a reduction in cardiac reserve, and an enlargement of the left atrial diameter compared to rats fed *ad libitum*. Therefore, it has been suggested that prolonged fasting may have detrimental effects, highlighting the need for greater caution in both fasting research and its practical applications⁴⁴.

Some studies conducted with dementia patients have shown that gene-environment interactions may underlie dementia^{45,46}. It has been reported that IF is protective against age-related neurological diseases and physiologically regulates DNA methylation^{46,47}. In a study investigating the effect of 16:8 time-restricted feeding on DNA methylation imaging in mice with vascular dementia (VaD) and its therapeutic effects in chronic cerebral hypoperfusion (CCH) associated with cognitive impairment, it has been shown that IF modulates DNA methylation and attenuates neuropathology and cognitive impairment. As a result, it was determined that slowing down the progression of vascular dementia is associated with an increase in DNA methylation due to hypermethylation observed in the IF group, compared to the control group with free access to food. In addition, in contrast to the control group, in the IF group, cognitive impairment and white matter lesions associated with neuropathology decreased; myelin basic protein activity and neuron numbers increased. These results offer insight into how IF could safeguard the brain from harm induced by CCH and indicate potential advantages in reducing neuropathological damage and cognitive impairments in VaD⁴⁶. A study conducted on 5XFAD mice carrying genetic mutations associated with Alzheimer's disease (AD) reported contrasting findings. In this study, the mice were fed *ad libitum* (AL) until the age of two months. They were then randomly assigned to two different dietary groups: one receiving AL feeding daily and the other following an every-other-day (EOD) feeding regimen for a duration of four months. At the end of six months, tissue sample analyses revealed no significant differences in plaque accumulation between the two groups. However, the EOD-fed mice exhibited increased cortical inflammation and neuronal damage, along with a reduction in proteins associated with synaptic plasticity. These findings suggest that the EOD dietary pattern may exacerbate AD-like neurodegenerative and neuroinflammatory alterations. Therefore, based on the results of this study, it is emphasized that calorie restriction through fasting should be carefully considered in the early (prodromal) stages of neurodegenerative diseases^{48,49}.

Fasting can regulate histone methylation and consequent gene transcription. Jumonji-D3 (JMJD3/KDM6B), a histone demethylase from the KDM6 family, epigenetically

activates genes by removing methyl groups from the H3K27-me3 histone. While JMJD3 is noted to have functions in differentiation and development, immunity, and tumor formation, and also plays a role in extending lifespan under mild mitochondrial stress, its metabolic functions have not been reported^{50,51}. In a study conducted by Byun et al.⁵⁰, it was shown that the Fasting-Induced Fibroblast Growth Factor-21 (FGF21)/Protein Kinase A (PKA) signalling stimulates hepatic autophagy and lipid breakdown via the JMJD3 histone demethylase in mice. JMJD3 modulates gene activity epigenetically by demethylating the H3K27-me3 histone. Through the demethylation of the H3K27-me3 histone, it epigenetically activates genes that regulate the global autophagy network, including Atg7, Tfeb, Atgl, and Fgf21, leading to autophagy-mediated lipid degradation. Another study conducted by Seok et al.⁵¹ demonstrated that the JMJD3 histone demethylase epigenetically activates mitochondrial fatty acid β -oxidation. Furthermore, it was found that JMJD3 forms a transcriptional complex with SIRT1 and PPAR α , which epigenetically stimulates genes promoting β -oxidation, including Fgf21, Cpt1a, and Mcad. It was suggested that the JMJD3-SIRT1-PPAR α complex creates a forward-feedback positive autoregulatory loop by automatically increasing the expression of its genes when stimulated by fasting. Therefore, the regulation of β -oxidation by this complex ensures the maintenance of energy balance in the liver during fasting⁵¹. Additionally, another animal study demonstrated that SIRT1 activates the PPAR α signaling pathway under fasting conditions, thereby enhancing hepatic fatty acid β -oxidation. This mechanism was shown to contribute to metabolic health by preventing hepatic steatosis and inflammation, consistent with previous findings⁵². These studies demonstrate that fasting may positively influence the pathogenesis of non-alcoholic fatty liver disease (NAFLD) in mice by activating hepatic autophagy, lipid degradation, and fatty acid β -oxidation through the histone demethylation mechanism^{50,51}. Moreover, previous studies have shown that fasting-induced FGF21 displays positive metabolic effects in mice, while these effects are not similar in humans. In mice, FGF21 levels rapidly increase within hours, while in humans, this increase is only observed after 7-10 days. This suggests that the function of FGF21 may have evolved differently in humans⁵³. In addition to Jumonji-D3, a histone demethylase, SIRT1, a histone deacetylase, can also be cited as an example of histone modification. SIRT1 activates the expression of certain genes that regulate the body's biological clock and energy utilization through deacetylation. However, it has been noted that overexpression of SIRT1 in mice does not play a role in intensifying adaptations to intermittent fasting, suggesting that the contribution of SIRT1 to fasting-induced epigenetic modifications is controversial. Consequently, it has been demonstrated that SIRT1 may not be the sole mediator of dietary interventions related to fasting⁵⁴.

Non-coding RNAs (ncRNAs) have been shown to mediate the functions of IF. ncRNAs, such as microRNAs (miRNAs) and long non-coding RNAs (lncRNAs), are reported to be involved in a wide range of biological, physiological, and pathological processes^{55,56}. Additionally, metabolic disorders such as metabolic syndrome and obesity, which tend to rise with age, are associated with irregular levels of circulating miRNAs⁵⁷. The impact of time-restricted feeding, a form of IF dietary intervention, on the expression of circulating miRNAs, which act as intercellular signalling molecules and have the potential to regulate biological pathways for metabolic advantages, is under

investigation⁵⁸. In a study conducted by Saini et al.⁵⁸, a 4-week 16:8 time-restricted feeding intervention was applied to nine elderly participants aged 65 and over who were overweight, and the effects on overall circulating miRNA and the target genes of miRNAs that changed with the IF intervention were examined. A significant decrease in body weight was observed in all participants after IF (2.6 kg, $p < 0.01$). It was found that fourteen miRNAs were expressed differently before and after IF (eight were lower and six were higher). The low-level expressed miRNAs (miR-2467-3p, miR-4649-5p, miR-301a-3p, miR-543, miR-3132, miR-495-3p, miR-19a-5p, miR-4761-3p) were found to increase the expression of genes including PTEN, TSC1, and ULK1. This increase in gene expression was shown to inhibit protein synthesis/cell growth pathways related to these genes and activate cell survival and metabolic adaptation pathways, potentially promoting healthy aging⁵⁸.

Alongside miRNAs, lncRNAs could play a role in the impact of IF on glucose metabolism and metabolic stress. Some lncRNAs are thought to function as regulators of energy metabolism, which is linked to all major biological processes^{6,59}. In a study conducted by Ruan et al.⁵⁹, it was determined that a type of long non-coding RNA, lncLGR, is induced in the liver of mice during fasting. The increased activity of lncLGR reduces glycogen storage by inhibiting hepatic glucokinase activity. lncLGR specifically binds to heterogeneous nuclear ribonucleoprotein L (hnRNPL) and facilitates hnRNPL's binding to hepatic glucokinase, thereby co-repressing the transcription of hepatic glucokinase. As a result, it has been shown that the lncRNA type lncLGR plays a functional role in glucose metabolism by reducing hepatic glucokinase enzyme activity. Another investigation by Brocker et al.⁶⁰ revealed that Gm15441, classified as a lncLGR, significantly contributes to mitigating inflammasome activation under fasting conditions. It was discovered that PPAR α is activated by fatty acids released from adipose tissue during fasting, directly enhancing the expression of the long non-coding RNA gene Gm15441. The expression of Gm15441 represses the antisense transcript that codes for thioredoxin-interacting protein (TXNIP). This repression reduces the activation of the NLR family pyrin domain-containing 3 (NLRP3) inflammasome, caspase 1 (CASP1) cleavage, and pro-inflammatory interleukin 1 β (IL1B) maturation, which are stimulated by TXNIP. Based on these studies, a mechanism has been proposed in which long non-coding RNAs (lncRNAs) attenuate hepatic inflammasome activation in response to metabolic stress induced by fasting⁶⁰. In addition, a human study conducted on overweight/obese women evaluated the effects of intermittent fasting on inflammatory markers in adipose tissue and skeletal muscle. In an 8-week study, the IF group exhibited an increase in M1 macrophages (pro-inflammatory) in adipose tissue and M2 macrophages in skeletal muscle following a 24-hour fast. This rise in macrophage levels suggests that IF may trigger a transient inflammatory response associated with enhanced lipolysis⁶¹. As a result, these findings highlight the effects of fasting on genetic mechanisms that regulate both the inflammatory response and energy metabolism.

It is suggested that different IF approaches affect the expression of genes connected to human health and various diseases⁶². Although it is stated that there are insufficient studies examining the effect of Ramadan Fasting (RF) and related dietary and lifestyle changes on specific genes related to human health and diseases, it has been shown that

RF has effects on the obesity gene (FTO)⁶², antioxidant stress genes (TFAM, Nrf2, SOD2) and genes controlling metabolism (SIRT1, SIRT3)⁶³, circadian gene (CLOCK) and glucocorticoid-controlled genes (DUSP1, IL-1 α)⁶⁴. In a study conducted by Madkour et al.⁶², the effects of RF on the FTO gene, which is associated with obesity and body fat accumulation, were investigated in overweight or obese fasting individuals. It was observed that the expression of the FTO gene significantly decreased at the end of Ramadan compared to before Ramadan in overweight or obese individuals. As a result, the reduction in FTO gene expression was noted to have positive effects on body weight and body fat percentage reduction, as well as the reduction in waist and hip circumference and other related metabolic events⁶². A human study investigated the beneficial effects of RF on antioxidant stress genes (TFAM, SOD2, Nrf2) and sirtuins (SIRT1, SIRT3), which are associated with aging and metabolism. The results showed an increase in antioxidant gene expression, including TFAM (90.4%), SOD2 (53.8%), and Nrf2 (411.8%), in overweight or obese individuals compared to those with normal body weight. However, at the end of Ramadan, there was a significant decrease in the SIRT3 gene (61.8%) that controls metabolism, while a decreasing trend was observed in the SIRT1 gene. Although the observed downregulation of SIRT1 and SIRT3 during fasting appears to contradict findings related to increased fatty acid oxidation and reduced visceral fat, this inconsistency is primarily attributed to the influence of other genetic and hormonal regulatory mechanisms rather than sirtuins themselves. In conclusion, based on the findings of this study, Ramadan fasting may be effective in reducing oxidative stress and inflammation in non-diabetic obese individuals through the activation of antioxidant genes (*TFAM*, *SOD2*, *Nrf2*). Consequently, it may contribute to delaying the onset of diabetes and other metabolic disorders⁶³. Conversely, there are also studies reporting the overexpression of SIRT1 and SIRT3 enzymes under conditions of prolonged fasting and caloric restriction^{65,66}. In a double-blind randomized study in which intermittent fasting (IF) was applied to 12 healthy individuals for three weeks, a slight increase (2.7%) in SIRT3 expression was observed. However, despite this increase, no significant changes were found in the expression of other genes related to aging and metabolism, nor in oxidative stress markers. Furthermore, no adverse clinical findings or changes in body weight were reported⁶⁷. In another study conducted by Ajabnoor et al.⁶⁴, it was found that RF caused significant changes in the circadian gene (CLOCK) and immune-regulating genes (DUSP1, IL-1 α) in healthy individuals compared to before Ramadan. Accordingly, RF has been shown to be associated with improvements in certain cardiometabolic risk factors such as GGT, hsCRP, and IL 1 gene expression. However, it was also noted that the disruption of sleep patterns due to RF could lead to diurnal rhythm disturbances and a reduction in the mentioned benefits⁶⁴. However, the effects of different intermittent fasting (IF) protocols on gene expression may not always result in metabolic benefits. In a study conducted on rats subjected to a long-term IF regimen—consisting of 3-day fasting and 3-day feeding cycles over 48 days—it was observed that lipid accumulation in white adipose tissue increased significantly. Notably, the expression of the Fsp27/Cidec gene, which is closely associated with lipid storage, was markedly upregulated. These findings suggest that certain IF patterns may exert adverse effects on lipid metabolism⁶⁸.

Precautions to Consider/ Side Effects

Despite the promising effects of intermittent fasting, potential side effects should not be overlooked. Unfortunately, evidence highlighting these adverse outcomes remains scarce, likely due to the limited duration over which intermittent fasting is typically evaluated. Commonly noted symptoms include hypoglycemia, dizziness, and fatigue⁶⁹. Hypoglycemia is the most significant side effect of intermittent fasting. A multi-country observational study by Beshyah et al. assessed the hypoglycemia risk during intermittent fasting in Ramadan. The study found that reduced caloric intake during fasting could lead to severe hypoglycemia⁷⁰. Also, a study conducted on rats with ADF observed diastolic dysfunction and reduced cardiac reserve⁷¹. In the experiments conducted by Munhoz et al., IF demonstrated effectiveness in weight loss; however, its long-term safety has raised concerns⁷².

In addition, the effects of long-term IF during pregnancy preparation and pregnancy on fetal metabolism remain unknown. However, appropriate nutrition before and during pregnancy is critical for both maternal health and fetal development⁷³. During pregnancy, the placenta, fetal development, blood volume, and brain development have specific metabolic needs therefore, maternal nutrition plays a critical role in fetal health. Additionally, overnutrition, malnutrition, or obesity in pregnant mothers can increase the risk of metabolic diseases in their children during adulthood^{74,75}. It is stated that maternal fasting during Ramadan can impair fetal growth and that maternal undernutrition during pregnancy can lead to epigenetic changes associated with impaired physiological functions in children⁷⁶⁻⁷⁹. In a study conducted by Yin et al.⁷⁶, the effects of IF applied to female mice before mating on the metabolism of their offspring were investigated. As a result, it was shown that maternal IF led to lower birth weight and impaired glucose metabolism in the offspring. Additionally, it was found that maternal IF applied before mating altered 2869 differentially methylated DNA regions in the liver of the offspring⁷⁶. In another study that investigated the mechanism underlying the effects of long-term maternal IF on the metabolism of offspring in more detail, the effects of 24:24 IF applied to female mice for 12 weeks before mating were examined. The offspring of female mice that underwent long-term IF before pregnancy were found to have lower placental and birth weights compared to the offspring of mothers that were fed ad libitum. Over time, it was observed that the IF offspring caught up in weight to the control group offspring, closing the initial gap. Additionally, it was found that the IF offspring had increased adipose tissue and consequently impaired glucose tolerance. The presence of hepatic steatosis was observed with increased lipid and triglyceride levels in the liver. The underlying mechanism for these findings was shown to be the suppression of mTORC1 signalling, which is involved in cell growth and metabolism, due to decreased levels of DNA methyltransferases in the liver of IF offspring⁷⁸. In a study conducted by Hussain et al.⁷⁹, 14 pregnant mice were divided into two groups, with half subjected to 16:8 nighttime IF for 21 days, while the other half were fed ad libitum. At the end of the 21 days, a significant decrease in the weight of the fetus, placenta, and yolk sac was observed in the IF group. Additionally, the tissues showed high levels of Folr1 gene expression and FR α protein. The findings indicated that maternal IF, despite hindering fetal growth, contributed to the transfer of folate from the

mother to the fetus by increasing folate gene expression⁷⁹. Consequently, women planning pregnancy are encouraged to steer clear of long-term intermittent fasting because of its negative effects on fetal health and the metabolic stability of the offspring⁷⁸.

Conclusions

Intermittent fasting (IF) encompasses various dietary patterns such as alternate-day fasting, whole-day fasting, time-restricted feeding, and Ramadan fasting. Accumulating evidence indicates that IF exerts both beneficial and adverse effects on health through epigenetic mechanisms. On the positive side, IF has been associated with enhanced lipid metabolism, apoptosis regulation, delayed cognitive decline, promotion of healthy aging, obesity prevention, and anti-inflammatory effects. These benefits are thought to be mediated via epigenetic modifications, including DNA methylation and demethylation, histone modifications, non-coding RNAs, and altered gene expression.

However, emerging findings also highlight potential adverse outcomes of IF. Notably, maternal intermittent fasting has been shown to negatively affect the offspring's development and metabolism through epigenetic inheritance. Furthermore, prolonged fasting or suboptimal nutrient intake during feeding windows may lead to micronutrient deficiencies, impaired glucose homeostasis, hormonal imbalances, and increased susceptibility to metabolic disorders—not only in individuals planning pregnancy but also across broader populations, particularly those with preexisting health vulnerabilities.

Therefore, health professionals should provide personalized guidance regarding IF practices, taking into account individual health status, age, lifestyle, and nutritional needs. It is essential to consider the duration and frequency of fasting, as well as diet quality during feeding periods. Overall, more comprehensive and longitudinal human studies are needed to clarify the dual role of IF - both protective and potentially harmful - on health via modifiable epigenetic mechanisms.

REFERENCES

1. Hoddy KK, Marlatt KL, Çetinkaya H, Ravussin E. Intermittent fasting and metabolic health: From religious fast to time restricted feeding. *Obesity*. 2020;28(S1).
2. Asif S, Morrow NM, Mulvihill EE, Kim KH. Understanding dietary intervention-mediated epigenetic modifications in metabolic diseases. *Front Genet*. 2020;11.
3. Varady KA, Cienfuegos S, Ezpeleta M, Gabel K. Clinical application of intermittent fasting for weight loss: Progress and future directions. *Nat Rev Endocrinol*. 2022;18(5):309–21.
4. Tinsley GM, La Bounty PM. Effects of intermittent fasting on body composition and clinical health markers in humans. *Nutr Rev*. 2015;73(10):661–74.
5. Nowosad K, Sujka M. Effect of various types of intermittent fasting (if) on weight loss and improvement of diabetic parameters in human. *Curr Nutr Rep*. 2021;10(2):146–54.
6. Elortegui Pascual P, Rolands MR, Eldridge AL, et al. A meta-analysis comparing the effectiveness of alternate day fasting, the 5:2 diet, and time-restricted eating

- for weight loss [published correction appears in *Obesity* (Silver Spring). 2025;33(5):817-1011. doi: 10.1002/oby.24266.]. *Obesity* (Silver Spring). 2023;31Suppl1(Suppl1):9-21. doi: 10.1002/oby.23568.
7. Moro T, Tinsley G, Bianco A, et al. Effects of eight weeks of time-restricted feeding (16/8) on basal metabolism, maximal strength, body composition, inflammation, and cardiovascular risk factors in resistance-trained males. *J Transl Med*. 2016;14(1):290.
8. Venegas-Borsellino C, Sonikpreet, Martindale RG. From religion to secularism: The benefits of fasting. *Curr Nutr Rep*. 2018;7:131–138. doi: 10.1007/s13668-018-0233-2.
9. Trepanowski JF, Bloomer RJ. The impact of religious fasting on human health. *Nutr J*. 2010;9:57. doi: 10.1186/1475-2891-9-57.
10. Lessan N, Ali T. Energy metabolism and intermittent fasting: The Ramadan perspective. *Nutrients*. 2019;11(5):1192. doi: 10.3390/nu11051192.
11. Alghafli Z, Hatch TG, Rose AH, Abo-Zena MM, Marks LD, Dollahite DC. A qualitative study of Ramadan: A month of fasting, family, and faith. *Religions*. 2019;10(2):123.
12. Al-Arouj M, Assaad-Khalil S, Buse J, et al. Recommendations for management of diabetes during Ramadan: Update 2010. *Diabetes Care*. 2010;33(8):1895-1902.
13. Boccardi V, Pigliautile M, Guazzarini AG, Mecocci P. The potential of fasting-mimicking diet as a preventive and curative strategy for alzheimer's disease. *Biomolecules*. 2023;13(7):1133. doi: 10.3390/biom13071133.
14. Roos PR, van den Burg EL, Schoonakker MP, et al. Fasting-mimicking diet in type 2 diabetes reduces myocardial triglyceride content: A 12-month randomised controlled trial. *Nutr Metab Cardiovasc Dis*. 2025;35(7):103860
15. Van den Burg EL, Schoonakker MP, van Peet PG, et al. A fasting-mimicking diet programme reduces liver fat and liver inflammation/fibrosis measured by magnetic resonance imaging in patients with type 2 diabetes. *Clin Nutr*. 2025;47:136-145.
16. Chaix A, Lin T, Le HD, Chang MW, Panda S. Time-restricted feeding prevents obesity and metabolic syndrome in mice lacking a circadian clock. *Cell Metab*. 2019;29(2):303-319.e4.
17. Das M, Ellies LG, Kumar D, et al. Time-restricted feeding normalizes hyperinsulinemia to inhibit breast cancer in obese postmenopausal mouse models. *Nat Commun*. 2021;12(1):565. doi: 10.1038/s41467-020-20743-7.
18. Guo Y, Luo S, Ye Y, Yin S, Fan J, Xia M. Intermittent fasting improves cardiometabolic risk factors and alters gut microbiota in metabolic syndrome patients. *J Clin Endocrinol Metab*. 2021;106(1):64-79. doi: 10.1210/clinem/dgaa644.
19. Kord Varkaneh H, Salehi Sahlabadi A, Găman MA, et al. Effects of the 5:2 intermittent fasting diet on non-alcoholic fatty liver disease: A randomized controlled trial. *Front Nutr*. 2022;9:948655. doi: 10.3389/fnut.2022.948655.
20. Sulaj A, Kopf S, von Rauchhaupt E, et al. Six-month periodic fasting in patients with type 2 diabetes and diabetic nephropathy: A proof-of-concept study. *J Clin Endocrinol Metab*. 2022;107(8):2167-2181. doi: 10.1210/clinem/dgac197.

21. Mitchell SJ, Bernier M, Mattison JA, et al. Daily fasting improves health and survival in male mice independent of diet composition and calories. *Cell Metab.* 2019;29(1):221-228.e3. doi: 10.1016/j.cmet.2018.08.011.
22. Sutton EF, Beyl R, Early KS, Cefalu WT, Ravussin E, Peterson CM. Early time-restricted feeding improves insulin sensitivity, blood pressure, and oxidative stress even without weight loss in men with prediabetes. *Cell Metab.* 2018;27(6):1212-1221.e3.
23. Weng ML, Chen WK, Chen XY, et al. Fasting inhibits aerobic glycolysis and proliferation in colorectal cancer via the Fdft1-mediated AKT/mTOR/HIF1 α pathway suppression. *Nat Commun.* 2020;11(1):1869. doi: 10.1038/s41467-020-15795-8.
24. Longo VD, Di Tano M, Mattson MP, Guidi N. Intermittent and periodic fasting, longevity and disease. *Nat Aging.* 2021;1(1):47–59. doi: 10.1038/s43587-020-00013-3.
25. Joseph B, Shimojo G, Li Z, et al. Glucose activates vagal control of hyperglycemia and inflammation in fasted mice. *Sci Rep.* 2019;9(1). doi: 10.1038/s41598-018-36298-z.
26. Stekovic S, Hofer SJ, Tripolt N, et al. Alternate day fasting improves physiological and molecular markers of aging in healthy, non-obese humans. *Cell Metab.* 2019;30(3).
27. Wei M, Brandhorst S, Shelehchi M, et al. Fasting-mimicking diet and markers/ risk factors for aging, diabetes, cancer, and cardiovascular disease. *Sci Transl Med.* 2017;9(377):eaai8700. doi: 10.1126/scitranslmed.aai8700.
28. Schroder JD, Falqueto H, Mânica A, et al. Effects of time-restricted feeding in weight loss, metabolic syndrome and cardiovascular risk in obese women. *J Transl Med.* 2021;19(1).
29. Wilkinson MJ, Manoogian ENC, Zadourian A, et al. Ten-hour time-restricted eating reduces weight, blood pressure, and atherogenic lipids in patients with metabolic syndrome. *Cell Metab.* 2020;31(1):92-104.e5. doi: 10.1016/j.cmet.2019.11.004.
30. Yuan X, Wang J, Yang S, et al. Effect of intermittent fasting diet on glucose and lipid metabolism and insulin resistance in patients with impaired glucose and lipid metabolism: A systematic review and meta-analysis. *Int J Endocrinol.* 2022;2022:6999907.
31. de Groot S, Lugtenberg RT, Cohen D, et al. Fasting mimicking diet as an adjunct to neoadjuvant chemotherapy for breast cancer in the multicentre randomized phase 2 direct trial. *Nat Commun.* 2020;11(1). doi: 10.1038/s41467-020-16138-3.
32. Brandhorst S, Choi IY, Wei M, et al. A periodic diet that mimics fasting promotes multi-system regeneration, enhanced cognitive performance, and Healthspan. *Cell Metab.* 2015;22(1):86–99. doi: 10.1016/j.cmet.2015.05.012.
33. Li G, Xie C, Lu S, et al. Intermittent fasting promotes white adipose browning and decreases obesity by shaping the gut microbiota. *Cell Metab.* 2017;26(5):801.
34. Liu H, Javaheri A, Godar RJ, et al. Intermittent fasting preserves beta-cell mass in obesity-induced diabetes via the autophagy-lysosome pathway. *Autophagy.* 2017;13(11):1952–68.

35. Goede P, Wüst RC, Schomakers BV, et al. Time restricted feeding during the inactive phase abolishes the daily rhythm in mitochondrial respiration in rat skeletal muscle. *FASEB J.* 2022;36(2). doi: 10.1096/fj.202100707r.
36. Regmi P, Chaudhary R, Page AJ, et al. Early or delayed time-restricted feeding prevents metabolic impact of obesity in mice. *J Endocrinol.* 2021;248(1):75-86.
37. Ng GYQ, Sheng DP, Bae HG, et al. Integrative epigenomic and transcriptomic analyses reveal metabolic switching by intermittent fasting in brain. *GeroScience.* 2022;44(4):2171–94. doi: 10.1007/s11357-022-00537-z.
38. Vemuganti R, Arumugam TV. Molecular mechanisms of intermittent fasting-induced ischemic tolerance. *Cond Med.* 2020;3(1):9-17.
39. Lorenzo PM, Izquierdo AG, Rodriguez-Carnero G, et al. Epigenetic effects of healthy foods and lifestyle habits from the Southern European Atlantic Diet Pattern: A narrative review. *Adv Nutr.* 2022;13(5):1725–47. doi: 10.1093/advances/nmac038.
40. Farsetti A, Illi B, Gaetano C. How epigenetics impacts on human diseases. *Eur J Intern Med.* 2023;114:15-22. doi: 10.1016/j.ejim.2023.05.036.
41. Zhang B, Jiang H, Dong Z, Sun A, Ge J. The critical roles of m6A modification in metabolic abnormality and cardiovascular diseases. *Genes Dis.* 2020;8(6):746-758.
42. Xu Z, Qin Y, Lv B, Tian Z, Zhang B. Intermittent fasting improves high-fat diet-induced obesity cardiomyopathy via alleviating lipid deposition and apoptosis and decreasing M6A methylation in the heart. *Nutrients.* 2022;14(2):251. doi: 10.3390/nu14020251.
43. Godar RJ, Ma X, Liu H, et al. Repetitive stimulation of autophagy-lysosome machinery by intermittent fasting preconditions the myocardium to ischemia-reperfusion injury. *Autophagy.* 2015;11(9):1537-60. doi: 10.1080/15548627.2015.1063768.
44. Ahmet I, Wan R, Mattson MP, Lakatta EG, Talan MI. Chronic alternate-day fasting results in reduced diastolic compliance and diminished systolic reserve in rats. *J Card Fail.* 2010;16(10):843-853. doi: 10.1016/j.cardfail.2010.05.007.
45. Maloney B, Lahiri DK. Epigenetics of dementia: Understanding the disease as a transformation rather than a state. *Lancet Neurol.* 2016;15(7):760-774.
46. Selvaraji S, Efthymios M, Foo RS, et al. Time-restricted feeding modulates the DNA methylation landscape, attenuates Hallmark Neuropathology and cognitive impairment in a mouse model of vascular dementia. *Theranostics.* 2022;12(7):3007–23.
47. Mattson MP, Arumugam TV. Hallmarks of brain aging: Adaptive and pathological modification by metabolic states. *Cell Metab.* 2018;27(6):1176-1199.
48. Le Bras A. (2020). Dietary restriction exacerbates alzheimer's features in mice. *Lab Animal.* 2020;49(3):76. doi: 1038/s41684-020-0493-5.
49. Lazic D, Tesic V, Jovanovic M, et al. Every-other-day feeding exacerbates inflammation and neuronal deficits in 5XFAD mouse model of Alzheimer's disease. *Neurobiol Dis.* 2020;136:104745. doi: 10.1016/j.nbd.2020.104745.

50. Byun S, Seok S, Kim YC, et al. Fasting-induced FGF21 signaling activates hepatic autophagy and lipid degradation via JMJD3 histone demethylase. *Nat Commun.* 2020;11(1). doi: 10.1038/s41467-020-14384-z.
51. Seok S, Kim YC, Byun S, et al. Fasting-induced JMJD3 histone demethylase epigenetically activates mitochondrial fatty acid β -oxidation. *J Clin Invest.* 2018;128(7):3144–59.
52. Purushotham A, Schug TT, Xu Q, Surapureddi S, Guo X, Li X. Hepatocyte-specific deletion of SIRT1 alters fatty acid metabolism and results in hepatic steatosis and inflammation. *Cell Metab.* 2009;9(4):327–38. doi: 10.1016/j.cmet.2009.02.006.
53. Fazeli PK, Lun M, Kim SM, Bredella MA, Wright S, Zhang Y, et al. FGF21 and the late adaptive response to starvation in humans. *J Clin Invest.* 2015;125(12):4601–11.
54. Boutant M, Kulkarni SS, Joffraud M, Raymond F, Métaïron S, Descombes P, et al. SIRT1 gain of function does not mimic or enhance the adaptations to intermittent fasting. *Cell Rep.* 2016;14(9):2068–2075. doi: 10.1016/j.celrep.2016.02.007.
55. Du W, Liu G, Shi N, et al. A microRNA checkpoint for Ca²⁺ signaling and overload in acute pancreatitis. *Mol Ther.* 2022;30(4):1754–1774. doi: 10.1016/j.ymthe.2022.01.033.
56. Ali SA, Peffers MJ, Ormseth MJ, Jurisica I, Kapoor M. The non-coding RNA interactome in joint health and disease. *Nat Rev Rheumatol.* 2021;17(11):692–705.
57. Landrier JF, Derghal A, Mounien L. MicroRNAs in obesity and related metabolic disorders. *Cells.* 2019;8(8):859. doi: 10.3390/cells8080859.
58. Saini SK, Singh A, Saini M, Gonzalez-Freire M, Leeuwenburgh C, Anton SD. Time-restricted eating regimen differentially affects circulatory MIRNA expression in older overweight adults. *Nutrients.* 2022;14(9):1843. doi: 10.3390/nu14091843.
59. Ruan X, Li P, Cangelosi A, Yang L, Cao H. A long non-coding RNA, lncLGR, regulates hepatic glucokinase expression and glycogen storage during fasting. *Cell Rep.* 2016;14(8):1867–75. doi: 10.1016/j.celrep.2016.01.062.
60. Brocker CN, Kim D, Melia T, et al. Long non-coding RNA GM15441 attenuates hepatic inflammasome activation in response to PPARA agonism and fasting. *Nat Commun.* 2020;11(1). doi: 10.1038/s41467-020-19554-7.
61. Liu B, Hutchison AT, Thompson CH, Lange K, Heilbronn LK. Markers of adipose tissue inflammation are transiently elevated during intermittent fasting in women who are overweight or obese. *Obes Res Clin Pract.* 2019;13(4):408–415.
62. Madkour MI, Malhab LJ, Abdel-Rahman WM, Abdelrahim DN, Saber-Ayad M, Faris ME. Ramadan diurnal intermittent fasting is associated with attenuated FTO gene expression in subjects with overweight and obesity: A prospective cohort study. *Front Nutr.* 2022;8.
63. Madkour MI, T. El-Serafi A, Jahrami HA, et al. Ramadan diurnal intermittent fasting modulates SOD2, TFAM, NRF2, and Sirtuins (SIRT1, SIRT3) gene expressions in subjects with overweight and obesity. *Diabetes Res Clin Pract.* 2019;155:107801.

64. Ajabnoor GM, Bahijri S, Shaik NA, et al. Ramadan fasting in Saudi Arabia is associated with altered expression of clock, DUSP and il-1alpha genes, as well as changes in cardiometabolic risk factors. *PLoS One*. 2017;12(4). doi: 10.1371/journal.pone.0174342.
65. Zhu Y, Yan Y, Gius DR, Vassilopoulos A. Metabolic regulation of Sirtuins upon fasting and the implication for cancer. *Curr Opin Oncol*. 2013;25(6):630-636.
66. Zullo A, Simone E, Grimaldi M, Musto V, Mancini FP. Sirtuins as mediator of the anti-ageing effects of calorie restriction in skeletal and cardiac muscle. *Int J Mol Sci*. 2018;19(4):928. doi: 10.3390/ijms19040928.
67. Wegman MP, Guo MH, Bennion DM, et al. Practicality of intermittent fasting in humans and its effect on oxidative stress and genes related to aging and metabolism. *Rejuvenation Res*. 2015;18(2):162-72.
68. Karbowska J, Kochan Z. Intermittent fasting up-regulates Fsp27/Cidec gene expression in white adipose tissue. *Nutrition*. 2012;28(3):294-9. doi: 10.1016/j.nut.2011.06.009.
69. Vasim I, Majeed CN, DeBoer MD. Intermittent fasting and metabolic health. *Nutrients*. 2022;14(3):631. doi: 10.3390/nu14030631.
70. Beshyah SA, Hassanein M, Ahmedani MY, et al. Diabetic hypoglycaemia during Ramadan fasting: A trans-national observational real-world study. *Diabetes Res Clin Pract*. 2019;150:315-321. doi: 10.1016/j.diabres.2019.01.039.
71. Ahmet I, Wan R, Mattson MP, Lakatta EG, Talan MI. Chronic alternate-day fasting results in reduced diastolic compliance and diminished systolic reserve in rats. *J Card Fail*. 2010;16(10):843-853. doi: 10.1016/j.cardfail.2010.05.007.
72. Munhoz AC, Vilas-Boas EA, Panveloski-Costa AC, et al. Intermittent fasting for twelve weeks leads to increases in fat mass and hyperinsulinemia in young female wistar rats. *Nutrients*. 2020;12(4):1029. doi: 10.3390/nu12041029.
73. Neves PAR, Gatica-Domínguez G, Santos IS, et al. Poor maternal nutritional status before and during pregnancy is associated with suspected child developmental delay in 2-year old Brazilian children. *Sci Rep*. 2020;10(1):1851. doi: 10.1038/s41598-020-59034-y.
74. Masibo PK, Humwa F, Macharia TN. The double burden of overnutrition and undernutrition in mother-child dyads in Kenya: Demographic and health survey data, 2014. *J Nutr Sci*. 2020;9:e5. doi: 10.1017/jns.2019.39.
75. Krishnaveni GV, Srinivasan K. Maternal nutrition and offspring stress response-implications for future development of non-communicable disease: A perspective from India. *Front Psychiatry*. 2019;10:795. doi: 10.3389/fpsy.2019.00795.
76. Yin W, Liang Y, Sun L, Yin Y, Zhang W. Maternal intermittent fasting before mating alters hepatic DNA methylation in offspring. *Epigenomics*. 2021;13(5):341-56.
77. Alkhalefah A, Dunn WB, Allwood JW, et al. Maternal intermittent fasting during pregnancy induces fetal growth restriction and down-regulated placental system a amino acid transport in the rat. *Clin Sci (Lond)*. 2021;135(11):1445-66. doi: 10.1042/cs20210137.
78. Yin W, Sun L, Liang Y, et al. Maternal intermittent fasting deteriorates offspring metabolism via suppression of hepatic mtorc1 signaling. *FASEB J*. 2023;37(4).

79. Hussain R, Tassabehji M, Ashton N, Glazier J. A rat model of maternal intermittent fasting during pregnancy impairs fetal growth but does not alter maternofetal folate transport. *Placenta*. 2017;57:286. doi: 10.1016/j.placenta.2017.07.201.

Gebelik Döneminde Beslenme ve Yeme Bozukluklarının Fetal ve Maternal Sağlık Üzerine Etkileri

Sümeyye Begüm ATALAN*, Aylin AÇIKGÖZ PINAR**

Öz

Gebelik, maternal metabolizmada meydana gelen fizyolojik, psikolojik ve çeşitli değişiklikler ile karakterize benzersiz bir metabolik durumdur. Kadınlar arasında yeme bozuklukları yaygın olup, doğurganlık çağındaki ve gebelik dönemindeki kadınlar açısından risk teşkil eder. Gebelik döneminde yeme bozuklukları üreme sağlığı, bir dizi olumsuz doğum sonuçları, fetal büyüme ve gelişmede gerilik ve yeme bozukluklarının nesiller arası geçişinde rol alır. Gebelik öncesi beslenme danışmanlığı, maternal sağlığı optimize etmek ve gebelik öncesi beden kitle indeksini optimal aralıkta tutmak için önemlidir. Özellikle anoreksiya nervozalı kadınların optimal beden kitle indeksi aralığına ulaşmadan gebe kalmaması konusunda dikkatli olunmalıdır. Gebelik döneminde Tıp Enstitüsü tarafından belirlenen sınırlar dahilinde ağırlık kazanımı sağlanmalıdır. Yeme bozukluklarının semptomlarının gebelikte azaldığı, ancak postpartum dönemde tekrar ortaya çıkabileceği bulguları göz önüne alındığında, yeme bozukluğu öyküsü olan kadınların gebelik sonrası dönemde de izlemi gerekmektedir. Ayrıca anne sütünün uzun vadeli etkileri göz önüne alınarak anne sütünün önemi ve koruyucu özellikleri anlatılarak emzirme için anneler teşvik edilmelidir.

Anahtar Sözcükler: Gebelik, anoreksiya nervoza, bulimia nervoza, yeme bozuklukları.

The Effects of Feeding and Eating Disorders on Fetal and Maternal Health During Pregnancy

Abstract

Pregnancy is a unique metabolic state characterized by physiological, psychological, and various changes in maternal metabolism. Eating disorders are common among women and pose a risk for women of reproductive age, including those during pregnancy. Eating disorders during pregnancy play a role in reproductive health, adverse birth outcomes, fetal growth and development retardation, and the intergenerational transmission of eating disorders. Pre-pregnancy nutritional counseling is crucial to optimize maternal health and maintain pre-pregnancy body mass index within the optimal range. Special attention should be given to women with anorexia nervosa, ensuring they achieve an optimal body mass index range before conceiving. Weight gain within the limits set by the Institute of Medicine should be achieved during pregnancy. Considering findings that eating disorder symptoms tend to decrease during pregnancy but may re-emerge in the postpartum period, women with a history of eating disorders require follow-up in the postpartum phase as well. Furthermore, given the long-term benefits of breastfeeding, mothers should be encouraged to breastfeed by highlighting the protective properties and importance of breast milk.

Keywords: Pregnancy, anorexia nervosa, bulimia nervosa, eating disorders.

Giriş

Ruhsal Bozuklukların Tanısal ve Sayımsal El Kitabı 5. Baskı (The Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition-DSM-V) tanı kriterlerine göre yeme

Derleme Makale (Review Article)

Geliş / Received: 08.08.2023 & **Kabul / Accepted:** 07.07.2025

DOI: <https://doi.org/10.38079/igusabder.1339464>

* Arş. Gör., Kastamonu Üniversitesi, Sağlık Bilimleri Fakültesi, Beslenme ve Diyetetik Bölümü, Kastamonu, Türkiye.

E-posta: begumatalan@kastamonu.edu.tr [ORCID https://orcid.org/0000-0001-8015-2765](https://orcid.org/0000-0001-8015-2765)

** Doç. Dr., Hacettepe Üniversitesi, Sağlık Bilimleri Fakültesi, Beslenme ve Diyetetik Bölümü, Ankara, Türkiye.

E-posta: aylinn@hacettepe.edu.tr [ORCID https://orcid.org/0000-0002-8847-9305](https://orcid.org/0000-0002-8847-9305)

bozuklukları, “besin tüketiminin değişmesine neden olan, fiziksel sağlığı ve psikososyal işlevselliği önemli ölçüde bozan yeme davranışında bozukluklar” olarak tanımlanmaktadır. DSM-V’te, “Yeme bozuklukları” terminolojisi “Beslenme ve Yeme Bozuklukları” olarak değiştirilmiştir¹. Tedavideki ilerlemelere rağmen, dünya çapında yeme bozuklukları nedeniyle tahminen yılda 3,3 milyon sağlıklı yaşam yılı kaybedilmektedir².

Gebelik döneminde ağırlık artışını kontrol altına almak için enerji alımının azaltılması ve aşırı egzersiz yapılması ise pregoreksiya olarak tanımlanmaktadır³. Pregoreksiya literatürde tıbbi bir tanı olarak kabul edilmese de, yeme bozuklukları ile ilişkili semptomların eşlik etmesi nedeniyle gebelikte görülen yeme bozukluğu olarak tanımlanabilmektedir⁴. Yeme bozukluğu olan gebelerde depresyon, anksiyete, kasıtlı olarak kendine zarar verme veya intihara teşebbüs öyküsünün yaygın olduğu ve yeme bozukluklarının belirlenmesinin düşük oranda olduğu bildirilmiştir⁵. Yeme bozukluklarının prevalansının incelendiği sistematik bir derlemede, yaşam boyu yeme bozukluğu sıklığı kadınlarda %8,4, erkeklerde %2,2 olarak belirlenmiş ve bu bozuklukların özellikle kadınlarda yaygın olduğu gösterilmiştir⁶. Londra merkezli bir araştırmada, gebelikte yeme bozukluğu prevalansı %7,5, gebelik öncesi ise %9,2 olarak saptanmıştır⁷. Yeme bozukluğu olan gebeler, eşlik eden ruhsal bozukluklar (psikolojik stres vb.) ve yetersiz beslenme nedeniyle stres yaşamaktadırlar. Stres, fetüsün büyümesini ve nörogelişimini etkileyen artmış glukokortikoidlere maruz bırakmakta ve ilerleyen dönemlerde yeme bozukluğu ve diğer psikiyatrik bozuklukların gelişim riskini artırmaktadır⁸. Yeme bozukluğu olan ebeveynlerin çocuklarında beslenme ve yeme davranışlarında daha fazla sorunlar olduğu, yeme bozukluğu semptomlarının daha fazla görüldüğü, psikolojik ve sosyo-duygusal zorlukların olduğu bildirilmektedir⁹. Ayrıca doğum sonrası dönemde anne sütü ile beslenmenin önemi göz önünde bulundurulduğunda, yeme bozukluğu olan kadınların emzirme sürelerine ilişkin bulgular literatürde tutarsız olmakla birlikte, bu bireylerin emzirme sürecinde daha fazla olumsuz deneyim ve duygusal sorunlar gösterdiği saptanmıştır¹⁰.

Bu derleme yazının amacı; gebelik döneminde görülen yeme bozukluklarının fetal ve maternal sağlık üzerine etkilerini güncel literatür eşliğinde incelemektir.

Yeme Bozuklukları Risk Faktörleri

Beslenme ve yeme bozuklukları risk faktörleri arasında; beyaz ırk, ebeveynin yüksek eğitim düzeyi, daha genç anne yaşı, çocukluk döneminde besin güvencesizliği, travmatik bir olay yaşanması, yeme bozukluğu olan bir kız kardeşe sahip olmak ve yüksek fiziksel aktivite düzeyleri yer almaktadır¹¹. Yeme bozukluğunun gelişiminde prenatal ve perinatal risk faktörlerini inceleyen bir sistematik derlemede ise, Anoreksiya Nervoza (AN) ile güçlü ilişki gösteren faktörler arasında farklı olarak; anne yaşının ileri olması, preeklampsi ve eklampsi, multiparite, hipoksik komplikasyonlar, prematürelite veya erken doğum (<32 hafta), gestasyonel yaşa göre küçük doğum ağırlığı (small for gestational age-SGA) ve daha düşük doğum boyutu bulunurken; Bulimia Nervoza (BN) sadece gebelik sürecinde anne stresi ile ilişkilendirilmiştir¹². Ayrıca polikistik over sendromu (PKOS) tanılı kadınlar da yeme bozuklukları açısından yüksek risk altındadır. Geniş örneklemli bir kesitsel çalışmada, PKOS’lu kadınlarda yeme bozukluğu prevalansının, düşük benlik saygısı ve yüksek düzeyde psikolojik sorunlar ile ilişkili

olduğu gösterilmiş ve bu faktörlerin yeme bozukluğu riskini artırdığı belirlenmiştir. Bu doğrultuda, PKOS'lu bireylerin yeme bozuklukları açısından rutin taranması önerilmektedir¹³.

Gebelik Döneminde Yeme Bozuklukları Semptomlarının Değerlendirilmesi

Gebelikte bozulmuş yeme davranışlarını belirlemenin en zorlu yönlerinden biri, bozulmuş yeme davranışlarının klinik özelliklerini normal gebelik deneyimlerinden ayırmaktır. Çünkü kendi kendini kusturma (ağırlık artışı önlemek veya yemenin etkisini ortadan kaldırmak için), aşırı yeme ve düşük vücut ağırlığına sahip olma gibi yeme bozuklukları semptomlarının, gebelik döneminde görülen kusma ve ağırlık artışı gibi gebeliğin tipik özelliklerinin varlığından dolayı tespit edilmesi daha zor olabilmektedir⁷. Bannatyne ve ark.¹⁴'nın araştırmalarında, gebelikte yeme bozukluğunun olası semptomlarını değerlendirirken dikkate alınması gereken konulara Tablo 1'de yer verilmiştir.

Tablo 1. Gebelikte Yeme Bozukluğunun Olası Semptomlarını Değerlendirirken Dikkate Alınması Gereken Sorular¹⁴

Semptomlar ne sıklıkla ve hangi yoğunlukta ortaya çıkıyor?
Semptomun içeriği ve/veya amacı nedir? (Örneğin, mide bulantısını azaltmak veya gebelikte ağırlık artışı en aza indirmek için diyet kısıtlaması mı?)
Semptom, gebelik sürecinde klinik önerilerden sapıyor mu? (Örneğin, diyet alımında eksiklikler, egzersiz davranışlarında fazlalık gibi)
Kadının vücut ağırlığı gebeliğin aşamasına göre sağlıklı bir aralıktadır mı?
Semptom gebelikte ağırlık artışı olumsuz etkileyebilir mi?
Anne ve/veya çocuk için beklenen bir sağlık riski var mı?
Kadının ailesi semptom/semptomlarla ilgili endişelerini dile getiriyor mu?
Kadının geçmişinde gebelik komplikasyonları var mı? (Örneğin, düşük yapma, erken doğum gibi)
Belirtiler kadın için fiziksel, psikolojik, sosyal ve/veya ilişkisel bozulmaya/zorluğa neden oluyor mu?
Kadın semptomunun/semptomlarının varlığı ve etkisi hakkında fikir sahibi mi?
Kadın endişeyi dile getirmeye açık mı?
Kadının kendi bildirdiği durum ile tıbbi testlerin/gözlemlerin sonuçları arasında bir tutarsızlık var mı?
Kadının bildirdiği durum ile eşin/ailenin bildirdiği durum arasında bir tutarsızlık var mı?
Kadının, özellikle yeme bozuklukları/bozulmuş yeme davranışları olmak üzere zihinsel sağlık sorunları geçmişi var mı?
Kadının ailesinde bozulmuş yeme davranışları öyküsü var mı?

Yeme bozukluğu değerlendirme ölçeğinin gebelik versiyonunun (Pregnancy Version of Eating Disorder Examination-EDE-PV) kullanımının, gebelikte ilgili normal yeme tutumlarını ve davranışlarını, bozulmuş yeme davranışlarından ayırt etmede olumlu etkisi gösterilmiştir. Emery ve ark.¹⁵'nin bu değerlendirme yöntemini kullanırken dikkat edilmesi gereken dört nokta Tablo 2'de belirtilmiştir.

Tablo 2. Yeme bozukluğu değerlendirme ölçeğinin gebelik versiyonunun kullanımında dikkat edilmesi gereken noktalar¹⁵

Diyet kısıtlaması	Sağlıklı bir gebelik dönemi geçirmek için bazı besinlerden kaçınma halini (diyet kısıtlamasını temsil etmeyen) veya sağlık profesyonelleri tarafınca önerilen diyet yönergelerine uymaya yönelik motivasyonu, ağırlık kaybetme veya var olan ağırlığı sürdürme çabasıyla enerji alımını kontrol etme arzusundan (diyet kısıtlamasını temsil eder) ayırt etmek önemlidir.
Ağırlık kaygısı	Kadınlar, gebelikte aşırı veya yetersiz ağırlık kazanımı nedeniyle vücut ağırlıklarından memnun olmadıklarını bildirebilmekte ve fetal gelişim üzerindeki etkilerinden endişe duyabilmektedirler. Ağırlık artışı ile ilgili sıkıntı ve endişelerini fark etmek önemlidir.
Vücut şekli kaygısı	Kaygılar, özellikle gebeliğin ilk aylarında ağırlık artışı yaşamış gibi görünmelerinden kaynaklanabilmektedir. Bu duygularla ilişkili sıkıntı veya rahatsızlık düzeyini değerlendirmek önemlidir. Vücut şeklinin aktif olarak izlenmesi, hamile kıyafetlerini denemek gibi gebelik boyunca meydana gelen vücut değişikliklerini izlemekle karıştırılmamalıdır. Bu izlemin müdahaleci mi (şekil endişesini temsil ediyor) yoksa yalnızca gebelik sürecinde vücut şeklindeki değişikliklerini belirlemek için mi (şekil endişesini temsil etmiyor) olduğunu tespit etmek gerekmektedir.
Yeme kaygısı	Gebelik sürecindeki iştah değişiklikleri, fiziksel koşulların varlığı veya sağlık profesyonellerinin yönergelerine uyma çabası sonucunda yemek yeme ile ilgili endişeler veya suçluluk duygusu ortaya çıkabilmektedir. Bu durumda, suçluluğun şiddetli olup olmadığı ve yanlış bir şey yaptığının göstergesi mi (yeme endişesini temsil eder) yoksa daha az pişmanlık duygusu mu (yeme endişesini temsil etmeyen) olduğunun belirlenmesi gerekmektedir.

Doğum sonrası dönemde, pregestasyon dönemine göre vücut şekli ve ağırlığı ile ilgili endişelerin daha fazla olduğu bildirilmektedir. Gebelik ve postpartum dönem ise pregestasyon dönemi ile karşılaştırıldığında, tıkanırcasına yeme ve kendi kendini kusturma davranışlarının azaldığı görülmüştür¹⁶. Bununla birlikte küçük bir örneklem üzerine yapılan bir araştırmada, yeme bozukluğu öyküsü (AN ve BN) olan ancak tam remisyon dönemindeki kadınların, gebelik sürecinde ve doğumdan sonra yeme bozukluğu nüks oranlarının yüksek olduğu ve doğum sonrası depresyona yatkın oldukları gösterilmiştir. Çalışmanın sonunda yeme bozukluğu öyküsü olan bireylerde hem gebelik hem de doğum sonrası dönemde yakın izlemin gerekliliği araştırmacılar tarafından savunulmuştur¹⁷. Bu bakımdan erken tanı, malnütrisiyonu, mental ve somatik komorbiditeleri, gebelik sürecinde semptomların nüksünü ve buna bağlı olumsuz obstetrik ve fetal sonuçları önlemek açısından oldukça önemlidir. Erken bir müdahale hem anne hem de fetus için ömür boyu sürecek morbiditeyi önlemeye yardımcı olacaktır¹⁸. Ayrıca sağlık profesyonellerine gebelik döneminde yeme bozukluklarının nasıl belirleneceği konusunda daha fazla eğitim verilmesi, semptomların belirlenmesine ve komorbiditelerden kaynaklanan uzun vadeli hastalık yükünün azaltılmasına yardımcı olabilmektedir¹⁹.

Gebelik Döneminde Pika

Pika, gebeler, çocuklar ve zihinsel engelliler arasında yaygın olan; bireyin, tebeşir, toprak, sabun, buz, kâğıt, saç gibi besin dışı maddelere karşı duyulan yeme isteği olarak tanımlanan bir yeme bozukluğudur²⁰. DSM-V, pikayı en az bir aylık bir süre boyunca besleyici olmayan, besin dışı maddelerin yenilmesi olarak tanımlamaktadır¹. Pika'nın

etiyojisi net olarak bilinmemekle birlikte, pika gelişimi için bildirilen risk faktörleri arasında; stres, kültürel faktörler, öğrenilmiş davranış, düşük sosyoekonomik durum, altta yatan ruh sağlığı bozuklukları, beslenme yetersizliği, çocuk istismarı ve ihmali, gebelik, epilepsi ve ailesel psikopatoloji yer almaktadır²¹.

Dünya çapında gebelik ve postpartum dönemde pika prevalansını araştıran bir meta-analiz çalışmasında, pika prevalansının %27,8 olduğu bulunmuştur. Aynı çalışmada Afrika'da pika prevalansının diğer ülkelere kıyasla daha yüksek olduğu, prevalansın anemi prevalansı ile pozitif; eğitim düzeyi ile ise negatif ilişkili olduğu saptanmıştır²².

Özellikle toprak yeme davranışı olarak bilinen jeofaji, Afrika'da gebe kadınlarda oldukça yaygın olarak gözlenmektedir. Bu davranışın nedenleri arasında; temel olarak açıklanamayan aşırma bulunmakla birlikte, toprağın bir demir takviyesi görevi gördüğü inancı, gebelikte mide yanması ve sabah bulantılarına yardımcı olduğu düşüncesi gösterilmiştir²³. Gebelerde jeofajinin, potansiyel sağlık risklerini değerlendiren bir araştırmada, Gana'nın Volta adlı bölgesinden alınan beyaz killi toprakta arsenik, kurşun ve civa gibi toksik metallerin bulunduğu ve gebeler tarafından maruz kalınan tahmini ağır metal seviyelerinin, Dünya Sağlık Örgütü/Gıda ve Tarım Örgütü tarafından belirlenen maksimum tolere edilebilir günlük alım miktarının üzerinde olduğu tespit edilmiştir. Araştırmacılar, gebelerde uzun süre tüketimi sonucunda potansiyel bir sağlık tehdidi oluşturan biyolojik birikme olasılığının bulunduğunu belirtmiştir²⁴.

Sağlıklı beslenme alışkanlıkları ile ilgili yetersiz bilgi düzeyi, bazı toplumlarda pikanın yaygın görülmesinin nedeni olarak gösterilmektedir²¹. Alışkanlığın potansiyel olarak zararlı sağlık etkilerinden kaçınmak için doğum öncesi bakıma dikkat gösterilmeli²³ ve doğum öncesi bakım eğitiminin bir parçası olarak özellikle ilk trimesterde bulantı ve kusmayı önlemenin alternatif yolları, verilen eğitimlere dahil edilmelidir. Sağlık çalışanları, pikanın anne ve fetus sağlığı üzerindeki olumsuz etkileri konusunda sağlık eğitimini yoğunlaştırmalıdır²⁵.

Gebelikte Yeme Bozukluklarının Maternal ve Fetal Sağlık Üzerine Etkileri

Yeme bozukluklarının genel sağlık ve üreme sağlığı üzerinde uzun vadeli etkilere sahip olabileceği bildirilmektedir¹¹. Aşırı yeme, anksiyete ve depresyon, yeme bozukluklarının en yaygın komorbiditeleri arasında yer almaktadır. Çoğu vakada ağırlık artışına ilişkin aşırı endişe eşlik etmekte ve bu durum da hem anne hem de fetus için olumsuz sonuçlar doğurabilmektedir²⁶.

Yapılan bir çalışmada yeme bozukluklarının gebelik öncesi Beden Kütle İndeksini (BKİ) ve gebelik sürecinde ağırlık artışını etkilediği; doğum komplikasyonlarına ve olumsuz neonatal sonuçlara yol açtığı bildirilmiştir²⁷. Mantel ve ark.²⁸ araştırmalarında, alt tipine bakılmaksızın, aktif veya yeme bozukluğu öyküsü olan kadınların, olumsuz gebelik ve neonatal sonuçlar açısından yüksek risk altında oldukları ve bu bireylerin doğum öncesi ve doğum sürecinde daha fazla yakın izleme ihtiyaç duyduklarını gözlemiştir. Doğurganlık çağındaki kadınlar arasında yeme bozukluğu öyküsü olan ve olmayanların karşılaştırıldığı bir başka araştırmada ise, gebelik sürecinde kanama, bulantı, kusma, düşük ve istemli düşük yapma olasılığının yeme bozukluğu öyküsü olan kadınlarda daha yüksek olduğu bulunmuştur¹¹. Başka bir çalışmada da aktif AN'lı kadınlarda gebelikte

anemi riski 2 katına çıkarken; maternal AN, antepartum hemorajinin artmış riski ile ilişkili bulunmuştur²⁸.

Gebelikte aşırı ağırlık artışı, sağlıksız yeme davranışlarının ve diyet bozukluklarının uyarıcı bir göstergesidir²⁹. Maternal obezite, fetüsün büyümesi ve gelişmesi için metabolik olarak zorlu bir ortam yaratmaktadır³⁰. Obezitesi olan ve fazla kilolu kadınlar doğumlarında, mortalite ve morbidite açısından artmış riskle karşı karşıyadır³¹. Aynı zamanda bu durumun fetal, neonatal, çocukluk ve adolesan dönem üzerine hem kısa hemde uzun vadede olumsuz etkileri vardır³⁰. Bunun yanı sıra gebelik döneminde yetersiz ağırlık kazanımının ise ciddi olumsuz doğum sonuçları riskinde artışla ve özellikle anne ölümü ve perinatal ölümle ilişkili olduğu bildirilmiştir ve potansiyel olarak değiştirilebilir bir risk faktörüdür³². Gebelik öncesi BKİ'ye göre gestasyonel ağırlık kazanımının optimal aralıkları Tıp Enstitüsü (Institute of Medicine-IOM) tarafından bildirilmiştir. Buna göre gebelik öncesi BKİ'si zayıf olan ($BKİ < 18,5 \text{ kg/m}^2$) bireyler 12,5-18 kg; normal ($BKİ \geq 18,5-24,9 \text{ kg/m}^2$) olan bireyler 11,5-16 kg; fazla kilolu ($BKİ \geq 25,0-29,9 \text{ kg/m}^2$) olan bireyler 7-11,5 kg; obez ($BKİ \geq 30,0 \text{ kg/m}^2$) olan bireyler için 5-9 kg total ağırlık kazanımı önerilmektedir³³.

Yeme bozukluklarına sahip gebelerde ise bu durum çok daha düşük BKİ ve gestasyonel ağırlık artışı ile sonuçlanabilmektedir. Boylamsal bir kohort çalışmasında, daha önce AN öyküsü olan kadınların gebelik döneminde, BN öyküsü olanlardan veya kontrol grubundan istatistiksel olarak anlamlı şekilde daha düşük BKİ'ye sahip oldukları ve daha düşük gestasyonel ağırlık artışları olduğu gösterilmiştir³⁴. Anne ve term doğan bebek çiftlerini içeren prospektif kohort çalışmasında, postpartum 2. günde annelerin Yeme Tutum Testi-26 (Eating Attitude Test-26-EAT-26) global puanları; sırasıyla yetersiz, yeterli ve aşırı gestasyonel ağırlık artışı olan kadınlarda anlamlı olarak yükselmiştir. Diyet skorlarında da benzer bir eğilimin olduğu gözlenmiştir²⁹.

Pozitif enerji dengesi düzenli menstruasyon için oldukça önemlidir ve özellikle üst düzey sporcular, aşırı egzersiz ve vücudun enerji ihtiyacını karşılayamama durumları nedeniyle hipotalamik amenore geliştirme riski altındadır³⁵. Kadınlarda kronik enerji eksikliği, hipotalamik-hipofiz-gonadal eksenini bozabilmekte ve zayıf kadınlarda hipotalamik anovulasyona yol açabilmekte; bu durum da özellikle AN'lı kadınlarda infertilitenin en yaygın nedenini oluşturmaktadır³⁶. Yeme bozukluklarının uzun vadede üreme sonuçları üzerine etkilerini inceleyen bir araştırmada doğurganlık oranları; AN için %18, BN için %23,3 ve diğer yeme bozuklukları için %18,6 iken, yaşa göre eşleştirilmiş genel popülasyon kontrol grubunda %48,3 olduğu belirlenmiştir³⁷. İnfertilite tedavisi için sağlık kurumlarına başvuran bireylerde yeme bozukluğu tespit edildiğinde, yeme bozukluğu olan kadınlarda çok sayıda obstetrik ve jinekolojik komplikasyonlar geliştiğinden hastaların olası sonuçlar hakkında bilgilendirilmesi ve gerekli psikolojik desteğe yönlendirilmesi gerekmektedir^{38,39}. Tedavide multidisipliner yaklaşımın, komplikasyonsuz ve başarılı infertilite tedavisi sağlayacağı bildirilmektedir³⁸. Bu bakımdan infertilite tedavisi için yardımcı üreme teknolojilerini uygulamadan önce, infertilitesi ve adet düzensizliği olan tüm kadınlar, mevcut besin ögesi eksiklikleri, uygulanan diyet modelleri ve diğer beslenme alışkanlıkları açısından değerlendirilmelidir³⁶. Egzersiz, beslenme alışkanlıkları, gebelikte kullanımı güvenli olmayan müshil yapıcı etkiye sahip ilaçlar, iştah kesiciler ve idrar söktürücülerin

kullanım durumu gibi ayrıntılı bir tıbbi öykünün alınması, antropometrik ölçümlerin belirlenmesi ve aralıklarla takip edilmesi oldukça önemlidir^{36,40}.

Olumsuz fetal gelişim çok faktörlü olabilse de maternal malnütrisyon, değişen hormonlar, gebelik öncesi düşük BKİ, gebelikte düşük ağırlık kazanımı, maternal psikopatoloji ve stres gebeliğin gelişimini bozabilmektedir. Yetersiz beslenme veya madde kullanımı gibi çevresel faktörler, fetal epigenomda çocuklarda ömür boyu sürecek sağlık sorunlarına yol açabilecek epigenetik değişikliklere neden olabilmektedir¹⁸. İsveç'te yapılan popülasyon temelli bir kohort çalışmasında, maternal yeme bozukluklarının tüm alt tipleri, erken doğum, yenidoğanda mikrosefali ve gebelik sürecinde yaklaşık iki kat artmış hiperemesis riski ile ilişkilendirilmiştir²⁸. Prospektif bir araştırmada ise, gebelik dönemlerine yakın zamanda AN olan kadınlarda erken doğum prevalansının, geçmişte AN öyküsü olan kadınların neredeyse iki katı olduğu belirlenmiştir⁴¹.

Maternal diyet kalitesinin doğum ağırlığını, SGA ve gebelik yaşına göre büyük doğum ağırlığı olan (Large for gestational age-LGA) bebek doğma riskini etkileyebileceği bildirilmiştir⁴². Yaşam boyu AN'lı veya BN'lı kadınların sağlıklı kadınlara kıyasla daha düşük plasenta ağırlığına ve SGA bebeklere sahip olma risklerinin yüksek; LGA bebeklere sahip olma risklerinin düşük olduğu; hem aktif hem de geçmişte AN öyküsü olan kadınların ise kontrol grubuna kıyasla SGA bebeklere sahip olma olasılıklarının daha yüksek olduğu belirlenmiştir⁴¹.

AN'lı bireylerde özellikle kadınların gebelikleri düşük bir BKİ ile başladığında, bebeğin düşük doğum ağırlıklı doğma olasılığının arttığı bulunmuştur²⁷. Gebelik öncesinde düşük vücut ağırlığı olan aktif AN'lı kadınların geçmişte AN öyküsü olan kadınlara kıyasla doğum sonuçlarından; düşük plasenta ağırlığı, bebeklerde düşük doğum ağırlığı, boy uzunluğu, baş ve karın çevresinin görüldüğü bildirilmiştir^{27,41}; bu durum, gebelik öncesi optimal BKİ'nin bu popülasyonda fetal büyüme için önemli bir rol oynadığını göstermektedir⁴¹. Önlenebilir bir risk faktörü olduğu göz önüne alındığında, yeme bozukluğu olan kadınların gebelik öncesi sağlıklı bir vücut ağırlığına sahip olmaları gerekmektedir ve gebelik öncesi düşük BKİ, doğum öncesi dönemde sağlık profesyonelleri için önemli bir risk belirteci olmalıdır^{27,41}.

Yaşamın erken döneminde beslenme, miyelinizasyonu ve dolayısıyla bilişsel gelişimi etkileyen önemli ve değiştirilebilir bir faktördür⁴³. Yeme bozukluğu olan annelerin çocuklarında (18-42 ay) nörogelişimsel sonuçları araştıran bir çalışmada, kontrol grubuna kıyasla annelerinde yeme bozukluğu olan çocukların zihinsel ve psikomotor gelişiminde gecikmeler görülmüştür⁴⁴. Aktif yeme bozukluğu olan annelerin yenidoğan bebeklerinin, sağlıklı kontrollerin yenidoğanlarına kıyasla daha kötü otonomik stabiliteye sahip olduğu, daha zayıf dil ve motor gelişimi olduğu belirlenmiştir⁴⁵. Spektrumun karşıt uçlarında yer almasına rağmen, maternal yetersiz beslenme ve aşırı beslenme, çocuklarda çarpıcı şekilde benzer bilişsel sonuçlar verdiği görülmektedir⁴⁶.

Gebelikteki Yeme Bozukluklarının Uzun Dönem Etkileri

Annelerdeki yeme bozukluğunun, çocuklarda hem çevresel hem de genetik faktörlerin etkileşimi ile ortaya çıkan karmaşık bir etki mekanizmasına sahip olduğu ileri sürülmektedir⁴⁷. Ebeveynlerdeki yeme bozukluklarının çocuklarda yeme bozuklukları

için güçlü bir risk faktörü olabileceği ve çocuğun psikolojik, bilişsel ve fizyolojik gelişimi üzerinde bir etkiye sahip olduğu belirlenmiştir^{47,48}. Bu çocuklarda beslenme ve yeme davranışlarında zorluklar, nörogelişimsel düzensizlikler, bilişsel gelişim gerilikleri ve psikopatolojik belirtiler daha sık görülmekte ve sosyo-duygusal gelişimlerinde olumsuz etkiler gözlenmektedir⁴⁷.

Yeme davranış bozukluklarının, çocukluk çağı psikolojik, fiziksel ve ebeveyn risk faktörleri ile ilişkilerinin incelendiği büyük çaplı bir adolesan kohortunda, yeme bozuklukları için risk faktörlerinin cinsiyete göre farklılık gösterdiği belirtilmiştir. Maternal yeme bozukluğunun, kızlarda beden memnuniyetsizliği ve vücut ağırlığı/şekli kaygısı ile; erkeklerde ise diyet yapma davranışıyla ilişkili olduğu bildirilmiştir⁴⁹. Başka bir çalışmada da 5-15 yaş arasındaki çocuklar ve ebeveynleri incelenmiş ve tıkanırcasına yeme bozukluğu olan ebeveynlerin çocuklarının, obezitesi olan ancak yeme bozukluğu bulunmayan ebeveynlerin çocuklarına kıyasla daha sık tıkanırcasına yeme bozukluğu geliştirdiği saptanmıştır. Ek olarak aynı çalışmada tıkanırcasına yeme bozukluğu olan ebeveynlerin, çocuklarının beslenmesi hakkında daha fazla sorumlu ve endişeli hissettiği gözlenmiştir⁵⁰. Mevcut bulgular, ebeveynlerdeki yeme bozuklukları ve beslenme uygulamalarının çocukların yeme davranışları ve beden algısı üzerindeki etkisini vurgulamaktadır^{49,50}.

Bu bağlamda yeme bozukluğu olan annelerin çocuklarının nörogelişimsel işlevlerini etkileyen gelişim süreçlerinin yakından izlenmesi gerekliliği⁴⁴ ve çocukluk döneminde cinsiyete özgü risk faktörlerinin belirlenmesinin, erken müdahale stratejilerinin geliştirilmesinde önemli rol oynadığı belirtilmektedir^{49,50}.

Tedavi ve Müdahale

Yeme bozukluğu ve özellikle AN öyküsü olan kadınlar, gebelik sürecinde çeşitli komorbiditeler açısından riskli hastalar olarak kabul edilmeli ve çocuklarda gelişebilecek olumsuz sonuçları önlemek için tedavi edilmelidir³⁴. Aktif bir yeme bozukluğu mevcut iken gebelik gelişmesi durumunda, komplikasyon riskinin daha yüksek olabileceği ve hem utero hem de doğum sonrası dönemde çocuğun gelişiminin olumsuz etkilenebileceği bildirilmiştir³⁹. Bu bakımdan doğurganlık çağındaki kadınlarda değişen yeme alışkanlıklarının saptanması zorunluluk haline gelmektedir. Tanı konulduktan sonra, multidisipliner bir ekibin, tespit edilen yeme bozukluğu için beslenme desteği sağlaması, alkol ve kötüye kullanılan ilaçlarla ilgili bir tarama yapılması, psikoterapötik teknikler ve gerekirse psikotropaların kullanımını içeren tedaviye başlaması konusunda öneriler bulunmaktadır¹⁸. Ayrıca, multidisipliner bir yaklaşımın parçası olarak, yeterli ağırlık kazanımı, mikro ve makro besin öğeleri gereksinimleri ile ilgili beslenme danışmanlığı bir diyetisyen tarafından en erken zamanda yapılmalıdır⁵¹. Sağlık profesyonelleri, bireylerde yeme bozukluklarını remisyon dönemine geçiren ve kadınların gebelikten önce daha sağlıklı bir vücut ağırlığının kazanılmasını, böylelikle doğum sonuçlarını iyileştiren gebelik öncesi müdahaleleri hedeflemelidir²⁷.

Paslakis ve ark.⁵¹ gebelerde yeme bozukluğunun yönetimi için daha önce belirlenen bir algoritmayı esas alarak yeni bir algoritma oluşturmuştur. Bu algoritmada; hızlı ve uygulaması kolay bir tarama aracı kullanılarak yapılan taramada, sonucu negatif olan kadınlarda gestasyonel ağırlık artışının takip edilmesi gerekliliği vurgulanmaktadır. Düşük veya yetersiz gestasyonel ağırlık kazanımı olduğunda veya tarama sonucu pozitif

olan kadınlarda, psikiyatri tarafından kapsamlı bir değerlendirme gerekmede ve önerilmektedir. Bu noktada aktif bir yeme bozukluğunun varlığının veya yeme bozukluğunun geçmiş bir öyküsünün olduğunun tespiti oldukça önemlidir. Aktif bir yeme bozukluğu mevcutsa, psikiyatri hekimi tarafından yakın bir izlem ve uyumlu bir tedavi gerekmektedir. Bir yeme bozukluğu öyküsü varsa, ağırlık artışının takibi gibi klinik izlem yeterlidir, ancak akut yeme bozukluklarının veya postpartum depresyonun belirtileri takip edilmelidir.

Yeme bozukluğuna sahip gebelerde, bebeğin optimal büyüme ve gelişimi için sağlıklı beslenmenin önemi vurgulanmalıdır. Bu bireyler, sağlıklı ve dengeli beslenmenin tanımlanmasına, düzenli bir öğünün içeriği, besin öğeleri ile ilgili bilinen yanlışlar ve normal porsiyon boyutu konusunda bilgilendirmeye gereksinim duyabilirler. Ayrıca gebeler ağırlık artışı konusunda endişeli olabileceklerinden, gebelikte kazanılması gereken optimal ağırlık aralıkları konusunda bilgilendirilmelidir⁴⁰.

Sonuç ve Öneriler

Gebelik döneminde yeme bozukluklarının tanısı oldukça zor konulmakta ve düşük oranlardadır, bu durum olumsuz sonuçlarla karşılaşılmasına neden olabilmektedir. Özellikle aktif yeme bozukluğuna sahip bireylerde, olumsuz doğum sonuçları risklerinin yeme bozukluğu öyküsüne sahip bireylerden daha yüksek olduğu bilinmektedir. Aktif yeme bozukluğu olan kadınlara, iyileşene kadar gebeliği ertelemeleri tavsiye edilmeli; özellikle AN için psikiyatri servisine erken sevk ile tedavi önerilmelidir. Özellikle gebelik öncesi dönemde yeme bozukluklarının erken tespiti dolayısıyla sağlanan beslenme desteği ve psikolojik tedaviden oluşan erken multidisipliner bir yaklaşımın hem anne hem de fetus için karşılaşılabilecek olumsuz sonuçların görülme sıklığının azalmasına yardım olacaktır.

Son olarak çocuk gelişimi üzerindeki potansiyel olumsuz etki göz önüne alındığında, sağlık profesyonelleri, annelerdeki yeme bozuklukları öyküsünün bebeğin besleme davranışları üzerindeki etkisi konusunda dikkatli olmalıdır. Bu durumun çocuğun büyüme ve gelişmesini ve daha sonra yeme davranışlarını etkilemesi muhtemeldir ve yeme bozukluklarının nesiller arası geçişini etkileyebilir.

KAYNAKLAR

1. American Psychiatric Association. *Diagnostic and Statistical Manual of Mental Disorders*. 5th ed. Arlington, VA: American Psychiatric Association; 2013.
2. GBD 2017 Disease and Injury Incidence and Prevalence Collaborators. Global, regional, and national incidence, prevalence, and years lived with disability for 354 diseases and injuries for 195 countries and territories, 1990–2017: A systematic analysis for the Global Burden of Disease Study 2017. *Lancet*. 2018;392(10159):1789-1858.
3. Mathieu J. What is pregorexia? *J Am Diet Assoc*. 2009;109(6):976-979.
4. Tuncer E, Gumus AB, Keser A. The importance of pregorexia awareness. *Clin Exp Health Sci*. 2020;10(3):186-190. doi:10.33808/clinexphealthsci.673306.

5. Bye A, Nath S, Ryan EG, et al. Prevalence and clinical characterisation of pregnant women with eating disorders. *Eur Eat Disord Rev.* 2020;28(2):141-155. doi: 10.1002/erv.2719.
6. Galmiche M, Dechelotte P, Lambert G, Tavoracci MP. Prevalence of eating disorders over the 2000-2018 period: A systematic literature review. *Am J Clin Nutr.* 2019;109(5):1402-1413. doi: 10.1093/ajcn/nqy342.
7. Easter A, Bye A, Taborelli E, et al. Recognising the symptoms: How common are eating disorders in pregnancy? *Eur Eat Disord Rev.* 2013;21(4):340-4. doi: 10.1002/erv.2229.
8. Jones C, Pearce B, Barrera I, Mummert A. Fetal programming and eating disorder risk. *J Theor Biol.* 2017;428:26-33. doi: 10.1016/j.jtbi.2017.05.028.
9. Watson HJ, O'Brien A, Sadeh-Sharvit S. Children of parents with eating disorders. *Curr Psychiatry Rep.* 2018;20(11):101. doi: 10.1007/s11920-018-0970-3.
10. Kass A, Dorsam AF, Weiss M, Zipfel S, Giel KE. The impact of maternal eating disorders on breastfeeding practices: A systematic review. *Arch Womens Ment Health.* 2021;24(5):693-708. doi: 10.1007/s00737-021-01103-w.
11. O'Brien KM, Whelan DR, Sandler DP, Hall JE, Weinberg CR. Predictors and long-term health outcomes of eating disorders. *PLoS One.* 2017;12(7):e0181104.
12. Marzola E, Cavallo F, Panero M, Porliod A, Amodeo L, Abbate-Daga G. The role of prenatal and perinatal factors in eating disorders: A systematic review. *Arch Womens Ment Health.* 2021;24(2):185-204. doi: 10.1007/s00737-020-01057-5.
13. Tay CT, Teede HJ, Hill B, Loxton D, Joham AE. Increased prevalence of eating disorders, low self-esteem, and psychological distress in women with polycystic ovary syndrome: A community-based cohort study. *Fertil Steril.* 2019;112(2):353-361.
14. Bannatyne AJ, Hughes R, Stapleton P, Watt B, MacKenzie-Shalders K. Signs and symptoms of disordered eating in pregnancy: A delphi consensus study. *BMC Pregnancy Childbirth.* 2018;18(1):262. doi: 10.1186/s12884-018-1849-3.
15. Emery RL, Grace JL, Kolko RP, Levine MD. Adapting the eating disorder examination for use during pregnancy: Preliminary results from a community sample of women with overweight and obesity. *Int J Eat Disord.* 2017;50(5):597-601. doi: 10.1002/eat.22646.
16. Nunes MA, Pinheiro AP, Hoffmann JF, Schmidt MI. Eating disorders symptoms in pregnancy and postpartum: A prospective study in a disadvantaged population in Brazil. *Int J Eat Disorder.* 2014;47(4):426-430. doi: 10.1002/eat.22236.
17. Makino M, Yasushi M, Tsutsui S. The risk of eating disorder relapse during pregnancy and after delivery and postpartum depression among women recovered from eating disorders. *BMC Pregnancy Childbirth.* 2020;20(1):323.
18. Sebastiani G, Andreu-Fernandez V, Herranz Barbero A, et al. Eating disorders during gestation: Implications for mother's health, fetal outcomes, and epigenetic changes. *Front Pediatr.* 2020;8:587. doi: 10.3389/fped.2020.00587.
19. Chua YW, Lewis G, Easter A, Lewis G, Solmi F. Eighteen-year trajectories of depressive symptoms in mothers with a lifetime eating disorder: Findings from

- the ALSPAC cohort. *Br J Psychiatry*. 2020;216(2):90-96. doi: 10.1192/bjp.2019.89.
20. Balasundaram P, Santhanam P. *Eating Disorders*. StatPearls. 2023.
 21. Al Nasser Y, Muco E, Alsaad AJ. *Pica*. StatPearls. 2023.
 22. Fawcett EJ, Fawcett JM, Mazmanian D. A meta-analysis of the worldwide prevalence of pica during pregnancy and the postpartum period. *Int J Gynaecol Obstet*. 2016;133(3):277-83. doi: 10.1016/j.ijgo.2015.10.012.
 23. Macheke LR, Olowoyo JO, Matsela L, Khine AA. Prevalence of geophagia and its contributing factors among pregnant women at Dr. George Mukhari Academic Hospital, Pretoria. *Afr Health Sci*. 2016;16(4):972-978. doi: 10.4314/ahs.v16i4.13.
 24. Kortei NK, Koryo-Dabrah A, Akonor PT, et al. Potential health risk assessment of toxic metals contamination in clay eaten as pica (geophagia) among pregnant women of Ho in the Volta Region of Ghana. *BMC Pregnancy Childbirth*. 2020;20(1):160.
 25. Konlan KD, Abdulai JA, Konlan KD, Amoah RM, Doat AR. Practices of pica among pregnant women in a tertiary healthcare facility in Ghana. *Nurs Open*. May 2020;7(3):783-792. doi: 10.1002/nop2.451.
 26. Martinez-Olcina M, Rubio-Arias JA, Reche-Garcia C, et al. Eating disorders in pregnant and breastfeeding women: A systematic review. *Medicina (Kaunas)*. 2020;56(7).
 27. Charbonneau KD, Seabrook JA. Adverse birth outcomes associated with types of eating disorders: A review. *Can J Diet Pract Res*. 2019;80(3):131-136.
 28. Mantel A, Hirschberg AL, Stephansson O. Association of maternal eating disorders with pregnancy and neonatal outcomes. *JAMA Psychiatry*. 2020;77(3):285-293.
 29. Zanardo V, Cavaliere A, Giliberti E, et al. Gestational weight gain and eating-related disorders. *J Obstet Gynaecol*. 2021;41(8):1205-1209.
 30. Santangeli L, Sattar N, Huda SS. Impact of maternal obesity on perinatal and childhood outcomes. *Best Pract Res Clin Obstet Gynaecol*. 2015;29(3):438-48.
 31. Catalano PM, Shankar K. Obesity and pregnancy: Mechanisms of short term and long term adverse consequences for mother and child. *BMJ*. 2017;356:j1.
 32. Ukah UV, Bayrampour H, Sabr Y, et al. Association between gestational weight gain and severe adverse birth outcomes in Washington State, US: A population-based retrospective cohort study, 2004-2013. *Plos Med*. 2019;16(12). doi: 10.1371/journal.pmed.1003009.
 33. Institute of Medicine; National Research Council. *Weight Gain During Pregnancy: Reexamining the Guidelines*. Washington, DC: National Academies Press; 2009.
 34. Koubaa S, Hallstrom T, Brismar K, Hellstrom PM, Hirschberg AL. Biomarkers of nutrition and stress in pregnant women with a history of eating disorders in relation to head circumference and neurocognitive function of the offspring. *BMC Pregnancy Childbirth*. 2015;15:318. doi: 10.1186/s12884-015-0741-7.
 35. Huhmann K. Menses requires energy: A review of how disordered eating, excessive exercise, and high stress lead to menstrual irregularities. *Clin Ther*. 2020;42(3):401-407.

36. Boutari C, Pappas PD, Mintziori G, et al. The effect of underweight on female and male reproduction. *Metabolism*. 2020;107:154229. doi: 10.1016/j.metabol.2020.154229.
37. Tabler J, Utz RL, Smith KR, Hanson HA, Geist C. Variation in reproductive outcomes of women with histories of bulimia nervosa, anorexia nervosa, or eating disorder not otherwise specified relative to the general population and closest-aged sisters. *Int J Eat Disord*. 2018;51(2):102-111. doi: 10.1002/eat.22827.
38. Galiger-Dobos K, Tury F. Eating disorders and fertility. *Psychiatr Hung*. 2018;33(4):331-9.
39. Kimmel MC, Ferguson EH, Zerwas S, Bulik CM, Meltzer-Brody S. Obstetric and gynecologic problems associated with eating disorders. *Int J Eat Disord*. 2016;49(3):260-75. doi: 10.1002/eat.22483.
40. Ward VB. Eating disorders in pregnancy. *BMJ*. 2008;336(7635):93-6.
41. Micali N, Larsen PS, Strandberg-Larsen K, Andersen AMN. Size at birth and preterm birth in women with lifetime eating disorders: A prospective population-based study. *Bjog-Int J Obstet Gy*. 2016;123(8):1301-1310. doi: 10.1111/1471-0528.13825.
42. Englund-Ogge L, Brantsaeter AL, Juodakis J, et al. Associations between maternal dietary patterns and infant birth weight, small and large for gestational age in the Norwegian Mother and Child Cohort Study. *Eur J Clin Nutr*. 2019;73(9):1270-1282.
43. Deoni S, Dean D, Joelson S, O'Regan J, Schneider N. Early nutrition influences developmental myelination and cognition in infants and young children. *Neuroimage*. 2018;178:649-659. doi: 10.1016/j.neuroimage.2017.12.056.
44. Sadeh-Sharvit S, Levy-Shiff R, Lock JD. Maternal eating disorder history and toddlers' neurodevelopmental outcomes: A brief report. *Eat Disord*. 2016;24(2):198-205.
45. Barona M, Taborelli E, Corfield F, et al. Neurobehavioural and cognitive development in infants born to mothers with eating disorders. *J Child Psychol Psychiatry*. 2017;58(8):931-398. doi: 10.1111/jcpp.12736.
46. Moody L, Chen H, Pan YX. Early-life nutritional programming of cognition-the fundamental role of epigenetic mechanisms in mediating the relation between early-life environment and learning and memory process. *Adv Nutr*. 2017;8(2):337-350.
47. Martini MG, Barona-Martinez M, Micali N. Eating disorders mothers and their children: A systematic review of the literature. *Arch Womens Ment Hlth*. 2020;23(4):449-467.
48. Bould H, Sovio U, Koupil I, et al. Do eating disorders in parents predict eating disorders in children? Evidence from a Swedish cohort. *Acta Psychiatr Scand*. 2015;132(1):51-59.
49. Micali N, De Stavola B, Ploubidis G, Simonoff E, Treasure J, Field AE. Adolescent eating disorder behaviours and cognitions: Gender-specific effects of child, maternal and family risk factors. *Br J Psychiatry*. 2015;207(4):320-7. doi: 10.1192/bjp.bp.114.152371.

50. Lydecker JA, Grilo CM. Children of parents with BED have more eating behavior disturbance than children of parents with obesity or healthy weight. *Int J Eat Disord.* 2017;50(6):648-656. doi: 10.1002/eat.22648.
51. Paslakis G, de Zwaan M. Clinical management of females seeking fertility treatment and of pregnant females with eating disorders. *Eur Eat Disord Rev.* 2019;27(3):215-223.

Empowering Women in the Digital Age: A Narrative Review of Technological Opportunities and Barriers

Hülya YAMAN*, Gökay ÇAKIROĞLU**

Abstract

Digitalization profoundly impacts women's lifestyles, presenting both opportunities and challenges. While access to online platforms empowers women with knowledge, education, and economic opportunities, the digital divide deepens existing inequalities and limits the participation of women in disadvantaged communities in the digital economy. Furthermore, issues such as cyberbullying and gender-based violence online negatively affect women's participation in digital spaces. Digital technologies also play an important role in healthcare, and artificial intelligence applications have the potential to improve women's health outcomes and reduce health inequalities. Digitalization in occupational therapy practice focuses on providing opportunities and proactive solutions to better meet women's health needs, and digital applications for women's health are increasing access to information on menstrual and reproductive health. However, there is a need for standardized guidelines for reliability and effectiveness.

Keywords: Digital technology, women's health, lifestyle, artificial intelligence.

Dijital Çağda Kadınların Güçlendirilmesi: Teknolojik Fırsatlar ve Engellerin Anlatsal Derlemesi

Öz

Dijitalleşme, kadınların yaşam tarzlarını derinden etkileyerek hem fırsatlar hem de zorluklar sunmaktadır. Çevrimiçi platformlara erişim, kadınları bilgi, eğitim ve ekonomik fırsatlarla güçlendirirken, dijital uçurum mevcut eşitsizlikleri derinleştirmekte ve dezavantajlı topluluklardaki kadınların dijital ekonomiye katılımını sınırlamaktadır. Ayrıca, çevrimiçi ortamda siber zorbalık ve cinsiyete dayalı şiddet gibi sorunlar, kadınların dijital alanlardaki katılımlarını olumsuz etkilemektedir. Dijital teknolojiler, sağlık hizmetlerinde de önemli bir rol oynamakta; yapay zekâ uygulamaları, kadınların sağlık sonuçlarını iyileştirmekte ve sağlık eşitsizliklerini azaltma potansiyeli taşımaktadır. Ergoterapi pratiğinde dijitalleşme, kadınların sağlık ihtiyaçlarını daha iyi karşılamak için fırsatlar sunmaya ve proaktif çözümler üretmeye odaklanmaktadır. Kadın sağlığına yönelik dijital uygulamalar, menstrüel sağlık ve üreme sağlığı konularında bilgiye erişimi artırmakta, ancak güvenilirlik ve etkililik açısından standartlaştırılmış kılavuzlara ihtiyaç duyulmaktadır.

Anahtar Sözcükler: Dijital teknolojiler, kadın sağlığı, yaşam tarzı, yapay zeka.

Introduction

The advent of online platforms has facilitated unprecedented access to information, education, and economic opportunities for women, while simultaneously exacerbating pre-existing inequalities¹. The digital divide, characterized by unequal access to technology and the internet, has a disproportionate impact on women in disadvantaged communities, impeding their capacity to participate fully in the digital economy and hindering their social and economic mobility². Furthermore, the online environment is

Derleme Makale (Review Article)

Geliş / Received: 30.01.2025 & **Kabul / Accepted:** 07.07.2025

DOI: <https://doi.org/10.38079/igusabder.1629806>

* Res. Asst., Istanbul Medipol University, Department of Occupational Therapy, Istanbul, Türkiye.

E-mail: ergoterapisthulya@gmail.com [ORCID https://orcid.org/0000-0002-8521-2445](https://orcid.org/0000-0002-8521-2445)

** Res. Asst., Istanbul Gelisim University, Department of Physical Therapy and Rehabilitation, Istanbul, Türkiye.

E-mail: gokay.cakiroglu657@gmail.com [ORCID https://orcid.org/0009-0005-8732-0764](https://orcid.org/0009-0005-8732-0764)

characterized by incidents of gender-based violence, including cyberbullying, harassment, and the dissemination of misogynistic content, which not only suppresses women's voices but also generates a hostile environment that limits their participation in online spaces. The idealized portrayals and constant comparisons often found on social media platforms can have a detrimental effect on women's body image, self-esteem, and subjective well-being. The increasing ubiquity of technology has the potential to blur the boundaries between work and private life, leading to increased stress and burnout, particularly for women who bear a disproportionate burden of domestic responsibilities³⁻⁶. The constant connectivity provided by technology can lead to a sense of pressure to always be available, which can have a detrimental effect on mental and physical health. In addition, the rapid pace of technological progress can exacerbate women's feelings of inadequacy and anxiety, creating a sense of pressure to keep up^{7,8}. It is therefore vital to address these challenges, including the digital divide and online violence against women, to ensure that the transformative potential of digitalization is fully realized for all women⁹.

Recent studies have demonstrated artificial intelligence (AI), together with digitalization, has the potential to reduce health inequalities and increase access to healthcare in resource-constrained settings. A recent systematic review and meta-analysis of empirical studies found that AI chatbots effectively improved women's physical, psychological, and cognitive health outcomes and significantly reduced anxiety levels. These chatbots addressed a range of health issues, including breast cancer care, prenatal mental health, and eating disorders, demonstrating their versatility and potential to support women with different health needs¹⁰. However, to fully realize this potential, approaches should be adopted that aim to build the capacity of health workers and develop pragmatic implementation strategies that prioritize equity and inclusion¹¹. Another study demonstrated that, although an AI model trained on a large-scale dataset achieved a balanced accuracy of 74.62% in Visual Inspection with Acetic Acid (VIA)-based cervical cancer screening, its current performance remains limited for clinical reliability. The findings suggest promising potential, yet emphasize the need for expanded data, improved labeling consistency, and further system enhancements to ensure real-world effectiveness¹².

This includes addressing concerns around data privacy, algorithmic bias, and the responsible development and use of AI in healthcare^{11,12}.

Given these developments, digital technology is also increasingly recognized as a vital component of contemporary occupational therapy practice, offering new opportunities to address women's health needs within evolving digital landscapes. Fischl et al. argue that current occupational therapy practice models should be updated to incorporate digital technology, noting that such integration can increase literacy engagement among individuals¹³. Larsson-Lund and Nyman further support this perspective, stating that occupational therapists should proactively embrace digitalization to promote literacy, justice, and health in a rapidly changing society¹⁴. Margot-Cattin emphasizes the growing importance of digital literacy among clients and highlights the increasing incorporation of digital literacy training into therapy plans by occupational therapists to better serve their clients¹⁵. These developments enhance the efficiency of occupational therapy

services and empower women to achieve recovery and participation in activities of daily living¹⁶. Consequently, from an occupational therapy perspective, digitalization presents both opportunities and challenges for improving the care offered to women. By integrating digital tools into therapy processes and promoting digital literacy, occupational therapists can more effectively address the specific health needs of women, particularly in the context of recovery. In light of the ongoing evolution of the field, it is crucial for occupational therapists to proactively adapt their practice to leverage the benefits of digitalization.

Increased access to health services has the potential to improve health outcomes, reduce health inequalities, and improve women's overall health^{17,18}. Telemedicine platforms and health apps are empowering women by offering them greater autonomy in the management of their health through the provision of personalized services, the facilitation of appointment scheduling, and the offering of tools for self-monitoring and disease management¹⁸. For instance, a study by Lyons et al. (2024) tested a telephone-based counselling intervention based on behavioral activation therapy and problem solving for nine sessions over 20 weeks to increase activity participation. Among 284 women who had completed breast cancer treatment within the last year and reported participation limitations, the intervention significantly increased self-selected activity participation and satisfaction, but overall recovery and quality of life outcomes did not show significant differences compared to the control group¹⁹. Similarly, Akechi et al. (2022) investigated a fully decentralized smartphone-based intervention providing problem-solving therapy and behavioral activation to 447 breast cancer survivors²⁰. The intervention led to a substantial reduction in fear of cancer recurrence, depression, and unmet psychological needs in comparison to the control group. Another study evaluated the feasibility and efficacy of smartphone-based problem-solving therapy (PST) in reducing fear of cancer recurrence (FCR) among breast cancer survivors, finding significant reductions in FCR after 8 weeks and achieving high engagement and completion rates²¹. The existing body of research has demonstrated the potential of scalable digital therapies to address psychological challenges in cancer survivors²⁰. In addition, digital platforms have been shown to play an important role in disseminating information and raising awareness on reproductive health issues, facilitating access to information on contraception, family planning, and safe abortion practices^{17,18}. In particular, the proliferation of mobile applications that provide contraception education demonstrates the potential offered by digital solutions in this field. However, these applications are currently unable to provide comprehensive information on the effectiveness, side effects, and contraindications of different contraceptive methods, resulting in a significant information gap in existing systems. This highlights the need for the development of standardized guidelines to enhance the reliability and effectiveness of digital solutions. Recent studies have demonstrated the efficacy of combining urine pregnancy testing with telephone counselling in reliably detecting ongoing pregnancies and reducing unnecessary clinic visits²². Furthermore, integrating semi-quantitative pregnancy tests and symptom checklists into remote follow-up protocols has been shown to provide reassurance to patients and offer a highly effective solution by increasing access²³.

The utilization of menstrual health applications has seen a surge in popularity, with these digital tools now playing a pivotal role in women's health management. A pilot randomized controlled trial was conducted to assess the efficacy of the Flo mobile application in enhancing menstrual health outcomes. The study involved two groups: women who solely monitor their cycles and women experiencing Premenstrual Syndrome (PMS) or Premenstrual Dysphoric Disorder (PMDD) and who also track their cycles. The study appraised a range of health outcomes before and after a three-month period of app usage. The findings indicated substantial enhancements in health literacy, menstrual health awareness, and subjective well-being in both groups. Notably, women afflicted with PMS/PMDD exhibited a marked reduction in symptom burden. Secondary outcomes included an increased sense of control over health, improved health-related communication, reduced menstrual cycle stigma, reduced fear of unplanned pregnancy, and reduced absenteeism from work or education due to PMS/PMDD²⁴. In another study evaluating menstrual tracking apps, researchers evaluated 34 apps from both the healthcare provider and consumer perspectives using the Mobile App Rating Scale (MARS). The study revealed that most apps were found to predict menstrual cycles, but only a few provided information on health screening. The apps with high MARS scores typically offered symptom recording and personalized notifications. The study found no significant correlation between healthcare provider and consumer assessments of app quality, highlighting the need for collaborative development processes that include input from both groups²⁵. In a further study, an online survey of 330 women aged 14-54 years explored experiences with menstrual tracking apps²⁶. This mixed-methods study utilized 50 multiple-choice and open-ended questions to understand user attitudes, motivations for app use, perceptions of ovulation prediction accuracy, and the emotional and behavioral effects of inaccurate menstrual onset date predictions. The study's key findings indicated that the primary motivator for app usage was ovulation prediction, yet it was observed that prediction errors were prevalent. Specifically, 54.9% of participants reported that their menstrual cycle commenced earlier than the predicted date, while 72.1% reported a later start than the predicted date. Subsequent qualitative analysis unveiled a spectrum of emotional responses to these discrepancies, encompassing frustration, anxiety, stress, pregnancy-related concerns, and exasperation. These findings underscore the necessity for enhancing the accuracy and transparency of such applications to mitigate adverse emotional consequences and optimize user support²⁶. Although menstrual tracking applications offer notable advantages such as enhanced health literacy, self-management, and emotional empowerment, substantial deficiencies persist. Future research should prioritize the following: firstly, ensuring the accuracy of the algorithms employed; secondly, designing the user interface in a way that is centered on the needs of the individual user; and thirdly, aligning the features of the app with both clinical standards and the diverse needs of the user. It is only by realizing the potential of these technologies for women's health that we can begin to address the challenges currently faced by many women in relation to their menstrual health.

Building on the growing success of digital health tools in menstrual health, emerging evidence also supports the viability of remote methods in other aspects of women's healthcare. For instance, telephone follow-up after medical abortion has been shown to constitute a robust alternative to conventional clinic-based approaches. A significant

proportion of women express a preference for remote follow-up methods over in-person clinic visits, citing the reduction in logistical and financial burdens as a key factor in this preference^{27,28}. A study conducted in South Africa offers an illustrative example of this preference. The study utilized mobile phone text messages as a means of providing psychological support following abortion, resulting in a reduction in anxiety levels and an enhancement in preparedness for symptom management. This finding underscores the potential of straightforward, cost-effective interventions to enhance the quality of medical abortion care²⁹. In the context of family planning, telemedicine has demonstrated efficacy in promoting contraceptive continence and accessibility. However, the full potential of these approaches in direct-to-patient models of care remains to be fully realized.

The digitalization of women's health has brought meaningful changes in how women access information, understand their own bodies, and care for their families. With the growing availability of genomics, transcriptomics, and electronic health records, it has become increasingly possible to investigate female-specific conditions such as endometriosis and preterm birth which are areas that have long been underrepresented in clinical research³⁰. Yet, not all women have equal access to these technologies. Concerns about privacy, limited infrastructure, financial hardship, and gender-based inequalities continue to prevent many from benefiting fully from digital health tools³¹. Even so, many women actively use resources ranging from search engines and health websites to mobile applications, social media platforms, and wearable devices—not only to manage their own health but also to monitor the health of their children, partners, and elderly family members³². This highlights that digital health is not only a tool for personal empowerment but also a reflection of women's broader caregiving roles within both private and social spheres.

Digital technologies hold considerable promise in enhancing women's safety and security by facilitating access to assistance, resources, and resilience-building opportunities. Mobile applications offering features such as real-time location sharing, emergency alerts and self-defense training can empower women to navigate their environments more safely³³. Tools like WoSApp enable discreet location transmission to authorities, addressing barriers such as delayed police response or victims' inability to seek help³⁴. Additionally, platforms such as AyudaMujer offer survivors of gender-based violence access to counselling, support networks and chatbot-based assessments, contributing to a 19.43% reduction in the risk of violence within weeks³⁵. Systematic reviews affirm that digital interventions effectively reduce depression, anxiety, and physical violence among intimate partner violence victims. Nonetheless, such tools should complement, rather than replace, traditional care methods, with ongoing research needed to refine intervention components and adapt them to diverse sociocultural contexts³³.

Digital technologies present important opportunities for advancing women's participation in education and employment. Online learning platforms offer flexible and accessible pathways for skill development and career advancement, particularly for women facing geographic or socioeconomic barriers. Research on the digital transformation of households emphasizes the positive impact of internet-based learning on women's employment outcomes, notably through gains in human capital and more

efficient job search processes³⁶. However, persistent challenges remain. The digital divide continues to limit access for women in low-income and rural settings, while gendered design in educational technologies often reinforces existing inequalities. Security and privacy risks, including cyberbullying and data breaches, pose additional obstacles to women's full engagement in online learning. Addressing these issues requires systemic and evidence-based approaches. Community-driven initiatives that provide subsidized internet access and shared digital devices have been effective in expanding women's access to education³⁷. Programs focusing on digital literacy and online safety have further strengthened women's ability to engage meaningfully with digital platforms. Moreover, the integration of gender-sensitive content and increased representation of women in STEM fields have been linked to improved enrolment and retention. Ensuring privacy through secure platforms and data protection policies remains essential to creating inclusive and supportive digital learning environments.

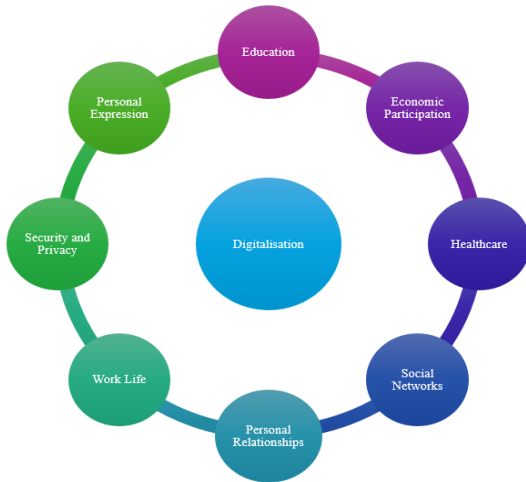
The digital age has significantly expanded opportunities for women in the labor force by offering previously unattainable flexibility and accessibility. Digital technologies are facilitating women's participation in the labor force by enabling remote work, stimulating the growth of the gig economy, and providing access to online markets for entrepreneurship. The study also demonstrates that digital transformation has the potential to reduce gender discrimination in employment by reducing knowledge inequalities and leveraging women's soft skills, which are highly relevant for sectors that require interpersonal communication and adaptability³⁶. Taken together, digital technologies help to bridge the gender gap in education and employment by fostering a more equitable and inclusive economic environment for women. For instance, teleworking allows women to balance caring responsibilities with professional pursuits, thereby enabling greater participation in the labor market. Furthermore, the emergence of the digital economy has given rise to new sectors that are conducive to the flourishing of careers for women, including e-commerce, digital marketing, and remote healthcare. The advent of digital tools and platforms has also served to reduce barriers to entrepreneurship, thereby empowering women to start and develop their own businesses. Additionally, the proliferation of online courses and resources has encouraged personal and professional development by offering accessible avenues for women to acquire new skills.

However, it is important to acknowledge that digitalization also poses significant challenges for women in the workforce. The flexibility offered by remote work is beneficial, but it can also result in a blurring of boundaries between professional and personal life, which can lead to increased workload and challenges in achieving a healthy work-life balance. These challenges underline the need for targeted interventions to ensure that the benefits of digitalization are accessible to all women, such as ensuring equal access to technology, implementing mentoring programs, and formulating policies that promote work-life balance.

In this context, targeted interventions have been proposed and examined in order to address the challenges women face in the digital workforce. A scoping review by Tricco et al. (2024) examined various strategies aimed at promoting gender equality in workplace settings. The research emphasized the importance of interventions that are

flexible and take into account the diversity among women and suggested moving away from a 'one-size-fits-all' approach³⁸. In a similar manner, Quesenberry and Trauth (2012) emphasized that organizational interventions should be adaptable to the diverse career values of women in the IT workforce and suggested that tailored strategies are more effective in supporting women's participation and retention in digital roles³⁹. Furthermore, Guthridge et al. (2022) conducted a systematic review identifying effective interventions that show promise in reducing gender bias and promoting equality, such as mentoring programs, cognitive and behavioral change strategies, and social justice initiatives⁴⁰. These studies underline the need to implement multifaceted and adaptive interventions to effectively support and empower women in the digital economy.

Figure 1. Women and digitalization: key areas of domain



Conclusion

As digital transformation accelerates, it becomes increasingly evident that digitalization presents both opportunities and challenges for women's access to healthcare, education, safety, and labor market participation. Digital health tools, remote services, and artificial intelligence-based applications hold considerable potential to improve healthcare accessibility, particularly for women living in rural or underserved areas. These tools contribute to enhancing health literacy, facilitating individual monitoring, and enabling women to manage their overall and reproductive health more effectively. Solutions such as menstrual tracking applications and remote follow-up after medical abortion support the personalization and accessibility of healthcare services. However, data privacy concerns, infrastructural deficiencies, and disparities in digital literacy continue to pose significant barriers, especially for women from vulnerable groups.

Moreover, women often assume responsibility not only for their own health but also for the health of family members, shouldering a disproportionate burden of digital caregiving. While this may foster empowerment, it also increases the risk of digital fatigue and mental overload. Additionally, online gender-based violence, appearance-related pressures, and the expectation of constant connectivity can have adverse effects on women's psychological and physical well-being. Therefore, gender-sensitive and culturally responsive approaches should be integrated into the development and implementation of digital health solutions.

Within the field of occupational therapy, digitalization offers important opportunities to develop innovative and inclusive service models. The integration of digital tools into therapeutic processes, along with the promotion of digital literacy, enables women to become more resilient in the face of challenges encountered in digital environments. Interventions should be designed with attention to women's individual and social roles to ensure meaningful engagement. When these issues are addressed effectively, occupational therapists can assist women in navigating the complexities of the digital age and empower them to thrive in a technology-driven world.

From a health systems perspective, policies that prioritize infrastructure investment, digital literacy training, and data protection are essential to ensure equitable and accessible dissemination of digital health tools. Community-based, culturally sensitive, and trust-oriented digital programs will play a crucial role in fostering sustainable progress in this field.

To overcome barriers to care, especially in low- and middle-income countries, further comprehensive studies are required to facilitate more effective implementation of these methods. For digital solutions to truly benefit women, they must be adapted to their life stages, social circumstances, and specific health needs. Ultimately, digitalization can only become a transformative force in women's lives when it is grounded in principles of accessibility, inclusivity, and dignity.

REFERENCES

1. Khaliqi H, Qaderi K, Akrami S, Akrami K, Quraishi T. Breaking barriers: Women's empowerment through online education platforms. *Room of Civil Society Development*. 2024;3(2):43-58. doi: 10.59110/rcsd.325.
2. Perifanou MA, Economides A. Gender digital divide in Europe. *International Journal of Business, Humanities and Technology*. 2020;10(4). doi: 10.30845/ijbht.v10n4p2.
3. Hayes SW, Priestley JL, Moore BA, Ray HE. Perceived stress, work-related burnout, and working from home before and during COVID-19: An examination of workers in the United States. *Sage Open*. 2021;11(4). doi: 10.1177/21582440211058193
4. Alotaibi A, Aldossry T. Work-life balance of working mothers in the healthcare industry in Riyadh, Saudi Arabia. *J Soc Serv Res*. 2024;50(1):14-24.
5. Riyono B, Rezki G. Burnout among working mothers: The role of work-life balance and perceived organizational support. *Humanitas: Indonesian Psychological Journal*. 2022:109-121. doi: 10.26555/humanitas.v19i2.31.
6. Begum V, Anwer Arshi T, Said Arman A, Saleem Butt A, Latheef S. A study on work-family life imbalance among women administrators in UAE higher education institutions. *Heliyon*. 2024;10(6):e28286. doi: 10.1016/j.heliyon.2024.e28286.
7. Hu Y, Qian Y. Gendering digital labor: Work and family digital communication across 29 countries. *Community Work Fam*. 2024;27(5):588-611.
8. Chung H, Booker C. Flexible working and the division of housework and childcare: examining divisions across arrangement and occupational lines. *Work*,

Employment and Society. 2023;37(1):236-256. doi: 10.1177/09500170221096586.

9. Sarışın M. Toplumsal cinsiyete dayalı şiddetin yeni yüzü dijital şiddete ilişkin bir değerlendirme. *KADEM Kadın Araştırmaları Dergisi*. 2022;8(2):257-85.
10. Kim HK. The Effects of Artificial intelligence chatbots on women's health: A systematic review and meta-analysis. *Healthcare*. 2024;12(5):534.
11. Gbagbo FY, Ameyaw EK, Yaya S. Artificial intelligence and sexual reproductive health and rights: A technological leap towards achieving sustainable development goal target 3.7. *Reproductive Health*. 2024;21(1). doi: 10.1186/s12978-024-01924-9.
12. Poudel K, Poudel L, Shakya PR, Poudel A, Shrestha A, Khanal B. AI-assisted cervical cancer screening. *arXiv preprint arXiv:2403.11936*. <http://arxiv.org/abs/2403.11936>.
13. Fischl C, Blusi M, Lindgren H, Nilsson I. Tailoring to support digital technology-mediated occupational engagement for older adults – a multiple case study. *Scand J Occup Ther*. 2020;27(8):577-590. doi: 10.1080/11038128.2020.1760347.
14. Larsson-Lund M, Nyman A. Occupational challenges in a digital society: A discussion inspiring occupational therapy to cross thresholds and embrace possibilities. *Scand J Occup Ther*. 2020;27(8):550-553. doi: 10.1080/11038128.2018.1523457.
15. Margot-Cattin I, Deblock-Bellamy A, Wassmer J, Ledgerd R, von Zweck C, World Federation of Occupational Therapists (WFOT). Worldwide survey on digital assistive technology (DAT) provision. *Occup Ther Int*. 2024;2024(1). doi: 10.1155/2024/9536020.
16. Ajayi KV, Wachira E, Onyeaka HK, Montour T, Olowolaju S, Garney W. The use of digital health tools for health promotion among women with and without chronic diseases: Insights from the 2017-2020 health information national trends survey. *JMIR Mhealth Uhealth*. 2022;10(8):e39520. doi: 10.2196/39520.
17. Corey L, Vezina A, Gala RB. Using technology to improve women's health care. *Ochsner Journal*. 2020;20(4):422-425. doi: 10.31486/toj.19.0113.
18. Karim JL, Wan R, Tabet RS, Chiu DS, Talhouk A. Person-generated health data in women's health: Scoping review. *J Med Internet Res*. 2024;26:e53327. doi: 10.2196/53327.
19. Lyons KD, Wechsler SB, Ejem DB, et al. Telephone-based rehabilitation intervention to optimize activity participation after breast cancer. *JAMA Netw Open*. 2024;7(3):e242478.
20. Akechi T, Yamaguchi T, Uchida M, et al. Smartphone psychotherapy reduces fear of cancer recurrence among breast cancer survivors: A fully decentralized randomized controlled clinical trial (J-SUPPORT 1703 Study). *J Clin Oncol*. 2022;41:1069-1078.
21. Imai F, Momino K, Katsuki F, et al. Smartphone problem-solving therapy to reduce fear of cancer recurrence among breast cancer survivors: An open single-arm pilot study. *Jpn J Clin Oncol*. 2019;49(6):537-544. doi: 10.1093/jjco/hyz005.
22. Michie L, Cameron ST. Simplified follow-up after early medical abortion: 12-month experience of a telephone call and self-performed low-sensitivity urine

- pregnancy test. *Contraception*. 2014;89(5):440-445. doi: 10.1016/j.contraception.2014.01.010.
23. Platais I, Tsereteli T, Comendant R, Kurbanbekova D, Winikoff B. Acceptability and feasibility of phone follow-up with a semiquantitative urine pregnancy test after medical abortion in Moldova and Uzbekistan. *Contraception*. 2015;91(2):178-183.
 24. Cunningham AC, Prentice C, Peven K, et al. efficacy of the flo app in improving health literacy, menstrual and general health, and well-being in women: Pilot randomized controlled trial. *JMIR Mhealth Uhealth*. 2024;12:e54124. doi: 10.2196/54124.
 25. Ko S, Lee J, An D, Woo H. Menstrual tracking mobile app review by consumers and health care providers: quality evaluations study. *JMIR Mhealth Uhealth*. 2023;11:e40921.
 26. Broad A, Biswakarma R, Harper JC. A survey of women's experiences of using period tracker applications: Attitudes, ovulation prediction and how the accuracy of the app in predicting period start dates affects their feelings and behaviours. *Women's Health*. 2022;18. doi: 10.1177/17455057221095246.
 27. Bracken H, Lohr PA, Taylor J, Morroni C, Winikoff B. RU OK? The acceptability and feasibility of remote technologies for follow-up after early medical abortion. *Contraception*. 2014;90(1):29-35. doi: 10.1016/j.contraception.2014.03.016.
 28. Ehrenreich K, Kaller S, Raifman S, Grossman D. Women's experiences using telemedicine to attend abortion information visits in Utah: A qualitative study. *Women's Health Issues*. 2019;29(5):407-413. doi: 10.1016/j.whi.2019.04.009.
 29. Constant D, De Tolly K, Harries J, Myer L. Mobile phone messages to provide support to women during the home phase of medical abortion in South Africa: A randomised controlled trial. *Contraception*. 2014;90(3):226-233.
 30. Oskotsky TT, Yin O, Khan U, Arnaout L, Sirota M. Data-driven insights can transform women's reproductive health. *NPJ Women's Health*. 2024;2(1).
 31. Moulaei K, Moulaei R, Bahaadinbeigy K. Barriers and facilitators of using health information technologies by women: A scoping review. *BMC Med Inform Decis Mak*. 2023;23(1). doi: 10.1186/s12911-023-02280-7.
 32. Lupton D, Maslen S. How women use digital technologies for health: Qualitative interview and focus group study. *J Med Internet Res*. 2019;21(1). doi: 10.2196/11481.
 33. Emezue C, Chase JD, Udmuangpia T, Bloom TL. Technology-based and digital interventions for intimate partner violence: A systematic review and meta-analysis. *Campbell Systematic Reviews*. 2022;18(3). doi: 10.1002/cl2.1271.
 34. Ashwini K, Perla SN. An Integrated Mobile Applications for Enhancing Women's Safety – A Comprehensive Approach. In: *2024 IEEE International Conference for Women in Innovation, Technology & Entrepreneurship (ICWITE)*. IEEE; 2024:223-228.
 35. Mauricio D, Zeña A, Avila U, Castañeda P, García L, Maculan N. AyudaMujer: A mobile application for the treatment of violence against women in Peru. *J Technol Hum Serv*. 2024;42(2):85-103. doi: 10.1080/15228835.2024.2343694.

- 36.** Ye R, Cai X. Digital transformation, gender discrimination, and female employment. *Systems*. 2024;12(5). doi: 10.3390/systems12050162.
- 37.** Bheemeshwar Reddy A, Jose S, Vaidehi R. Of access and inclusivity digital divide in online education. *Econ Polit Wkly*. 2021;55(36):23-26.
- 38.** Tricco AC, Parker A, Khan PA, et al. Interventions on gender equity in the workplace: A scoping review. *BMC Med*. 2024;22(1):1-12.
- 39.** Quesenberry JL, Trauth EM. The (dis)placement of women in the IT workforce: An investigation of individual career values and organisational interventions. *Information Systems Journal*. 2012;22(6):457-473. doi: 10.1111/J.1365-2575.2012.00416.X.
- 40.** Guthridge M, Kirkman M, Penovic T, Giummarra MJ. Promoting gender equality: A systematic review of interventions. *Soc Justice Res*. 2022;35(3):318-343.

The Effects of Balance and Proprioceptive Training on Falling in Older Adults

Havva Ezgi ALBAYRAK*, Hande Besna GÖÇEN**, Suzan AYDIN***, Mustafa Oğuz KETHÜDAOĞLU****, Aygül KÖSEOĞLU KURT****, Mehmet Kaan ALTUNOK*****
Bülent Abut ÖZSEZİKLİ*****

Abstract

Physiological changes and physical inactivity are observed in older individuals due to the gradual slowing down of body systems. These changes in the systems lead to a reduction in bodily functions. Falls and fall-related injuries are considered significant problems in adults aged 65 and above, with an even higher prevalence in those aged 75 and above. Proprioceptive systems are among the impaired systems. Dysfunctions of these systems include balance and proprioceptive systems, and dysfunctions in these systems increase with advancing age. Balance and coordination problems have been identified as important risk factors for falls among older adults. Additionally, proprioception decreases with age. Studies have shown that diminished proprioception is a significant contributing factor to falls in the elderly. The disruption of the body's balance and coordination system, along with the weakening of the proprioceptive system, leads to an increased risk of falls, which is a significant cause of mortality and morbidity in the elderly population. This review aims to investigate the impact of balance and proprioception training on fall prevention in elderly populations.

Keywords: Elderly, balance, proprioception, falls, physical inactivity.

Yaşlı Bireylerde Denge ve Proprioseptif Eğitimin Düşme Üzerine Etkileri

Öz

İleri yaşlı bireylerde vücut sistemlerinin zamanla yavaşlamasıyla fizyolojik değişiklikler ve fiziksel inaktiviteler görülür. Sistemlerde meydana gelen her türlü değişim vücut fonksiyonlarında olumlu veya olumsuz etkileşim yaratır. 65 yaş üstü yaşlı yetişkinlerde düşmeler ve düşmeye bağlı yaralanmalar önemli bir sorun olarak kabul edilmektedir. 75 yaş üstü yaşlı yetişkinler de ise bu sorunlar daha da yaygın

Derleme Makale (Review Article)

Geliş / Received: 03.07.2023 & **Kabul / Accepted:** 07.07.2025

DOI: <https://doi.org/10.38079/igusabder.1321884>

* MSc. Pt. PhD (c); Bahçeşehir University, Graduate Education Institute, Physiotherapy and Rehabilitation Department, Istanbul, Türkiye ; Lecturer; Avrasya University, Vocational School of Health Services, Occupational Therapy Department, Trabzon, Türkiye. E-mail: ezgi.karas@gmail.com [ORCID https://orcid.org/0000-0002-4595-2043](https://orcid.org/0000-0002-4595-2043)

** MSc. Pt. PhD (c); Bahçeşehir University, Graduate Education Institute, Physiotherapy and Rehabilitation Department, Istanbul, Türkiye ; Lecturer; İstanbul Gelisim University, Vocational School of Health Services, Physiotherapy Department, Istanbul, Türkiye. E-mail: handegocen@outlook.com [ORCID https://orcid.org/0000-0002-4208-0366](https://orcid.org/0000-0002-4208-0366)

*** MSc. Pt. PhD (c); Bahçeşehir University, Graduate Education Institute, Physiotherapy and Rehabilitation Department, Istanbul, Türkiye ; Lecturer; İstanbul Gelisim University, Vocational School of Health Services, Physiotherapy Department, Istanbul, Türkiye. E-mail: suzanaltinkeser@gmail.com [ORCID https://orcid.org/0000-0002-8470-9425](https://orcid.org/0000-0002-8470-9425)

**** MSc. Pt. PhD (c); Bahçeşehir University, Graduate Education Institute, Physiotherapy and Rehabilitation Department, Istanbul, Türkiye ; Lecturer; Cumhuriyet University, Health Sciences Faculty, Physiotherapy and Rehabilitation Department, Sivas, Türkiye. E-mail: mustafaoguzkethudaoglu@gmail.com [ORCID https://orcid.org/0000-0001-9723-9680](https://orcid.org/0000-0001-9723-9680)

***** MSc. Pt. PhD (c); Bahçeşehir University, Graduate Education Institute, Physiotherapy and Rehabilitation Department, Istanbul, Türkiye ; MSc. Pt.; Uropelvic Solutions, Istanbul, Türkiye. E-mail: aygulkoseoglu@gmail.com [ORCID https://orcid.org/0000-0001-7180-3693](https://orcid.org/0000-0001-7180-3693)

***** MSc. Pt. PhD (c); Bahçeşehir University, Graduate Education Institute, Physiotherapy and Rehabilitation Department, Istanbul, Türkiye ; Lecturer; Selçuk University, Health Sciences Faculty, Physiotherapy and Rehabilitation Department, Konya, Türkiye. E-mail: mehmetkaan.altunok@selcuk.edu.tr [ORCID https://orcid.org/0000-0002-3851-0685](https://orcid.org/0000-0002-3851-0685)

***** Asst. Prof., Bahçeşehir University, Graduate Education Institute, Physiotherapy and Rehabilitation Department, Istanbul, Türkiye. E-mail: bulent@ozsezikli.com [ORCID https://orcid.org/0000-0003-0805-8146](https://orcid.org/0000-0003-0805-8146)

görülmektedir. Bozulan sistemlerin başında postüral kontrol mekanizmaları gelir. Bu mekanizmaların içerisinde denge ve propriyoseptif sistem yer alır ve bu sistemlerdeki disfonksiyonlar ilerleyen yaş ile artmaktadır. Denge ve koordinasyon problemleri yaşlı yetişkinler arasında düşmeler için önemli bir risk faktörü olarak belirtilmiştir. Aynı zamanda propriyosepsiyon da yaşla birlikte azalmaktadır. Çalışmalar azalan propriyosepsiyonun yaşlılarda düşmelere neden olan önemli bir faktör olduğunu göstermiştir. Vücudun denge koordinasyon sisteminin bozulması ve propriyoseptif sistemin zayıflaması, yaşlı popülasyonda önemli bir mortalite ve morbidite nedeni olan düşme riskinin artmasına neden olur. Bu derlemede ileri yaşlı bireylerde denge ve propriyosepsiyon eğitiminin düşme üzerine olan etkilerinin ortaya konması amaçlanmıştır.

Anahtar Sözcükler: İleri yaşlı bireyler, denge, propriyosepsiyon, düşme, inaktivite.

Introduction

With the increasing life expectancy, it is important to identify transitions into later years and recognize the heterogeneity among older adults¹. Falls and fall-related injuries are a significant public health concern, being a leading cause of death and morbidity among adults aged 65 and above², and the primary cause of accidental death among individuals aged 75 and above³.

Balance is essential for maintaining one's posture and responding to voluntary movements. To preserve balance, an individual's center of mass must remain within a changing base of support⁴. Balance and coordination problems have been recognized as important risk factors for falls among older adults⁵. They are achieved through complex interactions among multiple sensory, motor, and integrative systems⁶. Aging can lead to impairments in any of these systems, resulting in balance disturbances⁷. Disruption of the body's balance and coordination system contributes to an increased risk of falls, which is a significant cause of mortality and morbidity in the elderly population⁸. This review article will discuss the effects of balance and proprioceptive training on falls in older individuals.

With aging, there is an increasing need for classification due to structural and functional changes^{9,10}. The basis of classification is to analyze the changes that occur among different age groups. Therefore, a classification based on chronological age has been established for older adults. According to this classification, the age range of 65-74 is referred to as "Young-Old," the age range of 75-84 is referred to as "Middle-Old," and the age of 85 and above is referred to as "Old-Old"¹¹.

According to the World Population Prospects 2022 report, there were 771 million elderly individuals worldwide in 2022, which corresponds to three times the size in 1980 (258 million). It is estimated that the elderly population could reach 994 million by 2030 and 1.6 billion by 2050¹¹. In Turkey, the population of individuals aged 65 and above, defined as the elderly population, increased by 24% between 2016 and 2021¹². After 2021, it is known that 64,7% of the elderly in Turkey are in the age range of 65-74, 27,3% are in the age range of 75-84 and %8 are 85 years and older¹². In 2024, the elderly population in Turkey is equal to 10.6% of the total population. The elderly population increased by 20.7% between 2019 and 2024. The elderly population rate is expected to be 13.5% in 2030, 17.9% in 2040, and 27% in 2060¹³. Due to increasing life expectancy and declining fertility rates, the age composition of the global population exhibits unprecedented and constantly changing patterns. As life expectancy extends due to medical and

technological progress, the proportion and number of older adults within the total population increase rapidly, along with the emergence of various health conditions^{14,15}.

Old age is a period characterized by the maximum level of loss, such as the loss of relatives and friends, and increased social isolation. Individuals experience a impaired in their ability to continue their work, perform daily activities, and maintain independent mobility. The frequency of these conditions increases with aging and gives rise to significant health problems that contribute to mortality and morbidity in older individuals¹⁶.

Falling is one of the common problems associated with aging. As individuals age, it has been noted that one-third of them experience at least one fall per year, with the incidence increasing up to 60% among residents of nursing homes¹⁷.

Falls

Falls, individuals over the age of 65, constitute a significant public health issue due to their medical, psychological, and economic consequences¹⁸. More than 30% of all older adults experience at least one fall per year, making it the second leading cause of injury-related deaths worldwide¹⁹.

The World Health Organization (WHO) defines falls as unintentionally coming to the ground or lower levels, except when the individual intends to reach the ground or lower surfaces using different objects such as furniture or appliances for support and to rest. Fall risk is described as the transition of a person from one level to a lower surface, which can occur due to major events such as strokes or collision with objects. Falls, occurring in various ways, lead to a decrease in the independence of older individuals, placement in elderly care centers and nursing homes, and the emergence of unexpected problems²⁰.

Falls can be classified into three main categories: predictable falls, unpredictable falls, and falls resulting from accidents. Falls caused by accidents, such as slipping or tripping, account for 14% of all falls. Predictable falls, which are more likely to occur in individuals at risk, constitute 78% of all falls. Unpredictable falls, occur due to sudden physiological changes, fainting, dizziness, and account for 8% of all falls^{21,22}. As individuals age, approximately one-third of them experience at least one fall per year, with the rate increasing up to 60% among residents of nursing homes¹⁹.

Approximately %28-35 of individuals aged 65 and above experience falls every year, while this rate increases to %32-42 among those aged 70 and above. With an increase in financial costs, falls and fall-related injuries have become a significant global health problem in terms of their personal and societal impact and the interventions required to address these impacts for elderly individuals, their families, and society as a whole²³.

The aging process leads to biological, psychological, and physiological changes in individuals, resulting in dependence on daily life activities and a significant decrease in their quality of life²⁴. This transitional phase affects individuals' ability to maintain their livelihood, reduces their ability to perform tasks, and consequently leads to a significant increase in accidents²¹.

Fall-related injuries and deaths in old age have become a serious problem, especially in developed societies with an increasing elderly population. While the consequences of

falls can be simple, such as bruises, superficial cuts, and sprains, they can also lead to serious problems such as fractures and cracks. In Turkey, 75% of falls among individuals aged 65 and above occur during routine home activities, and 44% are primarily due to global hazards. Falls are caused by the ground in 44% of cases, by step elevations such as stairs in 16% of cases, and by wet surfaces such as bathrooms in 4% of cases. Fear of falling significantly affects individuals who have experienced falls, are at risk of falling, or perceive the danger of falling. Studies report that many individuals experience fear of falling, although its prevalence is not fully known and is estimated to range from 25% to 85%²⁵.

Fear of Falling

Fear of falling refers to the experience of exaggerated fears and concerns about a decrease in self-confidence and the inability to perform daily activities^{19,24}. When compared to falls, fear of falling should be carefully considered and recognized as a significant health issue due to the impairments it causes in maintaining daily life²⁶. Around 50% of individuals who have experienced a fall report that fear of falling becomes a serious problem, leading 25% of them to actively avoid engaging in physical activities²⁷.

In older adults, fear of falling alters their quality of life and results in losses in daily life activities and independence, accompanied by distressing emotions such as fear and anxiety²⁸. Additionally, as health problems increase, individuals perceive themselves as less capable, leading to a gradual decline in their movements and physical activities. Accidents become inevitable, restricting mobility and significantly impacting the quality of life of older individuals, particularly as age advances and movements slow down. This contributes to the increase of postural disorders and balance problems²⁹.

Balance

Postural control is the state of maintaining gravitational support on the supporting surface during rest and activity. In older adults, impairments in controlling postural stability lead to disturbances in both dynamic and static balance. The maintenance of balance is achieved through the coordinated functioning of three systems. The somatosensory system involves receiving information about the status of body parts such as muscles and joint capsules. It supports the coordination of eye, head, and neck movements, as well as posture and coordinated movement patterns. Hip and ankle strength are important because older adults at risk of falling are more likely to use ankle strategies to maintain postural stability³⁰. The visual system provides information about head position and movements. Pyokko et al. suggested that visual input is more crucial than proprioceptive input in older adults. They found that when visual input was removed, there was a 52% reduction in postural stability in individuals over 80 years compared to a 22% reduction in young participants over the age of 60³¹. The vestibular system provides information about the position and velocity of the head in space¹⁰. The prevalence of vestibular dysfunction increases with aging and can range from 29% to 45% in individuals aged 75 and above. In the context of aging, with the progressive loss of central and peripheral nerve cells, all components of postural control undergo changes^{32,33}, which in turn affect balance and result in a decrease in the quality of life for the elderly population³⁴.

Impairment in balance ability in older adults increases the risk of falls¹⁹, leading to increased healthcare costs and changes in morbidity. Falls in older adults are also associated with decreased confidence and fear, often leading to reduced physical activity^{35,36}. This, in turn, can negatively impact postural stability and result in a continuous decline in quality of life³⁷. Consequently, researchers have a strong interest in understanding the components that contribute to postural instability and falls in older individuals.

Postural control represents a complex interaction between sensory and motor systems and aims to perceive peripheral stimuli, respond to the body's orientations within the environment, and maintain the center of mass within the base of support. Sensory information about the body's position within the environment primarily relies on proprioceptive, cutaneous, visual, and vestibular systems. Researchers have noted that individuals primarily rely on proprioceptive inputs to maintain their normal posture and safely perform most of their daily basic and instrumental activities³⁸.

Proprioception

Proprioception is defined as the perception of the body's position and movement in space³⁹. It plays a significant role in maintaining balance during activities such as standing upright, different phases of walking, and purposeful limb movements. Sensory information utilized for postural control primarily stems from the inner ear, vision, and proprioception. Proprioception encompasses the signals received from mechanoreceptors located in muscles, tendons, and joint capsules⁴⁰.

There is information suggesting that proprioceptive signals from the leg muscles provide primary information in the postural control mechanism. This is because they are sensitive in detecting body sway during undisturbed balance. Falls and fall-related injuries increase with advancing age. In the context of falls, studies suggest that older adults rely more on proprioception rather than visual or vestibular cues to maintain postural control compared to young and middle-aged adults⁴¹.

Proprioception represents an intervention area that can reduce the risk of falls in older adults. Exercises that improve proprioception attempt to develop the ability to perceive body movement and the position of joints, both at rest and in motion. Proprioceptive sensory input influences balance and the individual's perception of posture and is also associated with the coordination and responsiveness of the nervous system⁴². In this regard, its development differs from exercise interventions with multiple components⁴³. When done correctly, proprioceptive exercises can be beneficial in improving outcomes related to frailty, function, and incidence of falls in older community-dwelling individuals. Pérez-Ros et al., who focused on proprioception to reduce falls in older adults, reported that home exercises given decreased the incidence of falls, the time allocated to physical activity increased, and the fear of falling decreased⁴³. Espejo-Antúnez et al., in a randomized controlled study evaluating the effect of proprioceptive exercises on balance and physical function, reported that the exercise program showed significant improvements in areas such as functional mobility, balance, walking, and fall risk compared to the control group⁴⁴.

Conclusion and Recommendations

With aging, changes occur in all systems of the body. These changes result in balance impairments and proprioceptive deficiencies. The balance impairments and proprioceptive deficiencies that arise with aging contribute to falls. Falls significantly impact the quality of life in older adults and pose health problems. Since the risk of falling in the elderly is quite high, it is necessary to take precautions for this. In this way, problems that may occur will be reduced. Balance and proprioceptive training in older adults has been found to reduce the risk of falls and positively impact their quality of life and physical performance. For older adults with a history of falls, more comprehensive approaches are necessary. Identifying the underlying cause of falls can help in reducing the risk of recurrent falls, and through these measures, it is believed that the morbidity and mortality associated with falls can be reduced.

REFERENCES

1. Alterovitz SS, Mendelsohn GA. Relationship goals of middle-aged, young-old, and old-old internet daters: An analysis of online personal ads. *Journal of Aging Studies*. 2013;27(2):159-165.
2. Cuevas-Trisan R. Balance problems and fall risks in the elderly. *Clinics in Geriatric Medicine*. 2019;35(2):173-183.
3. Meyer M, Constancias F, Vogel T, Kaltenbach G, Schmitt E. Gait disorder among elderly people, psychomotor disadaptation syndrome: Post-fall syndrome, risk factors and follow-up—a cohort study of 70 patients. *Gerontology*. 2021;67(1):17-24.
4. Osoba MY, Rao AK, Agrawal SK, Lalwani AK. Balance and gait in the elderly: A contemporary review. *Laryngoscope Investig Otolaryngol*. 2019;4(1):143-53.
5. Preszner-Domjan A, Nagy E, Szíver E, Feher-Kiss A, Horvath G, Kranicz J. When does mechanical plantar stimulation promote sensory re-weighting: standing on a firm or compliant surface? *European Journal of Applied Physiology*. 2012;112:2979-2987.
6. Menz HB, Morris ME, Lord SR. Foot and ankle characteristics associated with impaired balance and functional ability in older people. *The Journals of Gerontology Series A: Biological Sciences and Medical Sciences*. 2005;60(12):1546-1552.
7. Geoba Sa. The World: Life Expectancy. URL: <http://geoba.se/population.php?pe=world&type=015&page=2> Yayınlanma Tarihi: 12.03.2015. Accessed April 21, 2025.
8. Ambrose AF, Paul G, Hausdorff JM. Risk factors for falls among older adults: a review of the literature. *Maturitas*. 2013;75:51-61.
9. Etxeberria I, Etxebarria I, Urdaneta E, Yanguas JJ. Age differences among older adults in the use of emotion regulation strategies. What happens among over 85s and centenarians? *Agging Ment Health*. 2016;20(9):974–980.

10. Jacobs J, Horak F. Cortical control of postural responses. *J. Neural Transm.* 2007;114:1339–1348.
11. World Health Organization. World report on Ageing And Health. URL: www.who.int Yayınlanma Tarihi: 20.12.2015. Accessed April 20, 2025.
12. Türkiye İstatistik Kurumu. TÜİK Kurumsal. URL: <https://www.tuik.gov.tr/> Yayınlanma Tarihi: 19.12.2022. Accessed June 25, 2023.
13. Türkiye İstatistik Kurumu. TÜİK Kurumsal. URL: <https://data.tuik.gov.tr/Bulten/Index?p=Elderly-Statistics>. Accessed March 28, 2025.
14. Gaigbe-Togbe V, Bassarsky L, Gu D, Spoorenberg T, Zeifman L. World population prospects 2022. *Department of Economic and Social Affairs, Population Division*: New York, NY, USA.
15. Nations Department of Economics Affairs Population Division. World Population Ageing 2020 Highlights. URL: <https://www.un.org/development/desa/pd>. Accessed April 25, 2025.
16. Aslan C, Ulus Y, Akyol Y, Bilgici A, Kuru Ö. Fear of falling in community-dwelling older people: relationship with sleep quality, depression and quality of life. *J PMR Sci.* 2021;24(1):8-16.
17. Duray M. Farklı Fiziksel Aktivite Düzeyine Sahip Olan Yaşlılarda Fiziksel Uygunluk, Düşme Riski ve Düşme Korkusu İlişkisinin İncelenmesi [doctorate thesis]. İzmir, Türkiye: Dokuz Eylül Üniversitesi, 2013.
18. Chang CJ, Yang TF, Yang SW, Chern JS. Cortical modulation of motor control biofeedback among the elderly with high fall risk during a posture perturbation task with augmented reality. *Frontiers in Aging Neuroscience.* 2016;8:80.
19. Tinetti ME, Richman D, Powell L. Falls efficacy as a measure of fear of falling. *Journal of Gerontology.* 1990;45(6):239-243.
20. Rosen T, Mack KA, Noonan RK. Slipping and tripping: Fall injuries in adults associated with rugs and carpets. *J Inj Violence Res.* 2013;5(1):61-65.
21. Çınarlı T, Zeliha K. 65 yaş ve üzeri yaşlılarda düşme risk ve korkusunun günlük yaşam aktiviteleri ve yaşam kalitesi üzerine etkisi. *Gümüşhane Üniversitesi Sağlık Bilimleri Dergisi.* 2015;4(4):660-679.
22. Özkul K. Diyabetli yaşlılarda düşme korkusunun yaşam kalitesine etkisinin değerlendirilmesi [master's thesis]. Bursa, Türkiye: Uludağ Üniversitesi, 2019.
23. Biçer S, Demir G. Yaşlı bireylerde düşme ve kazalar. *Yaşlı Sorunları Araştırma Dergisi.* 2018;11(2):37-40.
24. Sapmaz M. Yaşlılarda Düşme Korkusunun Denge ve Çift Görev Performasına Etkisi [doctorate thesis]. Ankara, Türkiye: Yıldırım Beyazıt Üniversitesi, 2018.
25. Kara B, Yıldırım Y, Genç A, Ekizler S. Geriatriklerde ev ortamı ve yaşam memnuniyetinin değerlendirilmesi ve düşme korkusu ile ilişkisinin incelenmesi. *Fizyoterapi Rehabilitasyon.* 2009;20(3):190-200.

26. Zijlstra GAR, van Haastregt JCM, van Eijk JThM, van Rossum E, Stalenhoef PA, Kempen GJIM. Prevalence and correlates of fear of falling, and associated avoidance of activity in the general population of community-living older people. *Age and Ageing*. 2007;36(3):304-9.
27. Scheffer AC, Schuurmans MJ, van Dijk N, van der Hooft T, de Rooij SE. Fear of falling: measurement strategy, prevalence, risk factors and consequences among older persons. *Age and Ageing*. 2008;37(1):19-24.
28. Akdeniz M, Yaman A, Kılıç S, Yaman H. Aile hekimliğinde önlenebilen sorunlar: Yaşlılarda düşmeler. *GeroFam*. 2010;1(1).
29. Güneş-Gencer GY, İpek L, Kara DS, Uzun F, Çetin SY. Türkiye’de yaşlılarda düşme ve denge ile ilgili yapılmış çalışmaların incelenmesi. *Yaşlı Sorunları Araştırma Dergisi*. 2021;14(2):70-83.
30. Caídas. URL: <https://www.who.int/es/news-room/fact-sheets/detail/falls>. Yayınlanma Tarihi: 15.07.2019. Accessed April 26, 2025.
31. Pyrkko I, Jantti P, Aalto H. Postural control in elderly subjects. *Age Ageing*. 1990;19(3):215-221.
32. Eyigör S, Şahin S. Denge Problemleri. In: Göksel SÜ, Saraç F, eds. *Geriatride 5 'D'ler*. İzmir: Ege Üniversitesi Basımevi, 2011.
33. Ruiz GT, Pedroso MD, de la Piedad EC, Vázquez RS, Regalado BS, Ugena ER. Guided home-based vestibular rehabilitation assisted by audiovisual media. *Acta Otorrinolaringologica (English Edition)*. 2010;61(6):397-404.
34. Steinmetz HM, Hobson SJ. Prevention of falls among the community-dwelling elderly: An overview. *Phys Occup Ther Geriatr*. 1995;12(4):13-29.
35. Stolze H, Klebe S, Zechlin C, Baecker C, Friege L, Deuschl G. Falls in frequent neurological diseases. *J Neurol*. 2004;251(1):79-84.
36. Fletcher PC, Hirdes JP. Restriction in activity associated with fear of falling among community-based seniors using home care services. *Age Ageing*. 2004;33(3):273-279.
37. Lord SR, Clark RD, Webster IW. Postural stability and associated physiological factors in a population of aged persons. *J Gerontol*. 1991;46(3):69-76.
38. Ko SU, Simonsick EM, Despande N, Studenski S, Ferrucci L. Ankle proprioception associated gait patterns in older adults: results from the BLSA. *Medicine and Science in Sports and Exercise*. 2016;48(11):2190.
39. Tuthill JC, Azim E. Proprioception. *Current Biology*. 2018;28(5):194-203.
40. Antcliff SR, Witchalls JB, Wallwork SB, Welvaert M, Waddington GS. Developing a multivariate prediction model of falls among older community-dwelling adults using measures of neuromuscular control and proprioceptive acuity: A pilot study. *Australasian Journal on Ageing*. 2023;00:1-9.
41. Kojima G. Frailty as a predictor of future falls among community-dwelling older people: A systematic review and meta-analysis. *Journal of the American Medical Directors Association*. 2015;16 (12):1027-1033.

42. Low DC, Walsh GS, Arkesteijn M. Effectiveness of exercise interventions to improve postural control in older adults: A systematic review and meta-analyses of centre of pressure measurements. *Sports Medicine*. 2017;47:101-112.
43. Pérez-Ros P, Vila-Candel R, Martínez-Arnau FM. A home-based exercise program focused on proprioception to reduce falls in frail and pre-frail community-dwelling older adults. *Geriatric Nursing*. 2020;41(4):436-444.
44. Espejo-Antúnez L, Pérez-Mármol JM, de los Ángeles Cardero-Durán M, Toledo-Marhuenda JV, Albornoz-Cabello M. The effect of proprioceptive exercises on balance and physical function in institutionalized older adults: A randomized controlled trial. *Archives of Physical Medicine and Rehabilitation*. 2020;101(10):1780-1788.

The Effect of Auricular Vagus Nerve Stimulation on Heart Rate Variability

Gülşah KONAĞOĞLU*, Ayşem Ecem ÖZDEMİR**, Öznur KAYA SAĞLAM***, Büşra SAYIR****

Abstract

Autonomic nervous system (ANS) is a structure which operates involuntarily and controls vital functions. Vagus Nerve Stimulation (VNS) is a novel treatment method focused on addressing ANS dysfunctions in cases of imbalance between sympathetic and parasympathetic nervous system activation. With VNS, parasympathetic activity (PA) increases while sympathetic activity (SA) decreases, affecting cardiovascular parameters. Heart rate fluctuates with each beat, reflecting the influence of PA and SA signals on the sinoatrial node. Research indicates that as individuals age, PA in the heart diminishes, while SA tone increases. When heart rate variability (HRV) and respiratory sinus arrhythmia are used to assess vagal tone, reduced PA control over the heart is revealed. This shift in autonomic balance is linked to a higher risk of developing cardiovascular disease. Therefore, it is important to consider the restoration of this balance as a therapeutic goal. Heart rate variability is the most used method for evaluating ANS functions. In this review, studies investigating the effect of auricular VNS on HRV are evaluated. It has been observed that there is a need for research investigating the short- and long-term effects of stimulations performed with different parameters from different ears on cardiovascular parameters in healthy individuals and/or individuals with various clinical conditions. Thus, a more specific and effective use of auricular VNS for different clinical situations can be achieved.

Keywords: Auricular vagus nerve stimulation, heart rate variability, autonomic dysfunction.

Auriküler Vagus Sinir Uyarımının Kalp Hızı Değişkenliği Üzerindeki Etkisi

Öz

Otonom sinir sistemi (OSS), istemsiz olarak çalışan ve hayati fonksiyonları kontrol eden bir yapıdır. Vagus Sinir Uyarımı (VSU), sempatik ve parasempatik sinir sistemi aktivasyonu arasındaki dengesizlik durumlarında OSS işlev bozukluklarını ele almaya odaklanan yeni bir tedavi yöntemidir. VSU ile parasempatik aktivite (PA) artarken sempatik aktivite (SA) azalır ve bu durum kardiyovasküler parametreleri etkiler. Kalp hızı her atışta dalgalanır ve dolayısıyla PA ve SA sinyallerinin sinoatriyal düğüm üzerindeki etkisini yansıtır. Araştırmalar, bireyler yaşlandıkça kalpteki PA tonunun azaldığını, SA tonunun ise arttığını göstermektedir. Vagal tonu değerlendirmek için kalp hızı değişkenliği (KHD) ve solunum sinüs aritmisi kullanıldığında, PA'nın kalp üzerindeki kontrolünde bir düşüş gösterirler. Otonom dengedeki bu değişim, kardiyovasküler hastalık geliştirme riskinin artmasıyla bağlantılıdır. Bu nedenle, bu dengenin yeniden sağlanmasını terapötik bir hedef olarak düşünmek önemlidir. Kalp hızı değişkenliği, OSS fonksiyonlarını değerlendirmek için en çok kullanılan yöntemdir. Bu derlemede, auriküler VSU'nun HRV üzerindeki etkisini araştıran çalışmalar değerlendirilmiştir. Sağlıklı bireylerde ve/veya çeşitli klinik rahatsızlıkları olan bireylerde, farklı kulaklardan farklı parametrelerle yapılan uyarımların kardiyovasküler parametreler üzerindeki kısa ve uzun vadeli etkilerini araştıran araştırmalara ihtiyaç olduğu gözlemlenmiştir. Böylece, farklı klinik durumlar için auriküler VSU'nun daha spesifik ve etkili bir şekilde kullanılması sağlanabilir.

Derleme Makale (Review Article)

Geliş / Received: 24.06.2024 & **Kabul / Accepted:** 24.02.2025

DOI: <https://doi.org/10.38079/igusabder.1660696>

* Asst. Prof., Istanbul Gelisim University, Faculty of Health Sciences, Physical Therapy and Rehabilitation, Istanbul, Türkiye. E-mail: gulsahkonakoglu@gmail.com ORCID <https://orcid.org/0000-0002-0051-0137>

** MSc. Pt., Istanbul Gelisim University, Faculty of Health Sciences, Physical Therapy and Rehabilitation, Istanbul, Türkiye. E-mail: ecemozdemir6@gmail.com ORCID <https://orcid.org/0000-0002-6930-9490>

*** MSc. Pt., Istanbul Gelisim University, Faculty of Health Sciences, Physical Therapy and Rehabilitation, Istanbul, Türkiye. E-mail: oznurkayasaglam@gmail.com ORCID <https://orcid.org/0000-0003-0178-0363>

**** MSc. Pt., Istanbul Gelisim University, Faculty of Health Sciences, Physical Therapy and Rehabilitation, Istanbul, Türkiye. E-mail: busrasayir@gmail.com ORCID <https://orcid.org/0000-0002-7200-0830>

Anahtar Sözcükler: Auriküler vagus sinir uyarımı, kalp hızı değişkenliği, otonomik disfonksiyon.

Introduction

The autonomic nervous system (ANS) affects the functions of many organs, glands and involuntary muscles with its sympathetic and parasympathetic divisions. The vagus nerve (VN), the longest and 10th cranial nerve, serves as a crucial component of the parasympathetic nervous system (PNS), forming a significant bidirectional channel between the body and the brain, greatly contributing to maintaining homeostasis in the body. The VN, which means 'wanderer' in Latin and extends from the brainstem to the proximal two-thirds of the colon, reaches and innervates many thoracic and abdominal organs. It is a complex nerve consisting of 20% efferent and 80% afferent fibers¹. Vagus Nerve Stimulation (VNS) encompasses all techniques used to stimulate the VN. The historical development of VNS dates back to the 19th century². Both surgically implanted invasive methods and noninvasive transcutaneous VNS (tVNS) techniques are available. With invasive VNS, a programmable stimulation generator device is surgically implanted into the chest wall. Typically, electrodes are placed around the left cervical VN due to cardiac side effects. Invasive methods are performed under anesthesia and by surgeons, but can lead to many complications³. Despite the complications, considering the essential role of VNS in treatment, non-invasive methods come to the forefront. Non-invasive systems activate VN afferents in the outer ear (auricle) with their cutaneous distributions. Somatosensory innervation is provided by the auricular branch. Its functionality is greater compared to cervical VNS⁴. The ANS regulates its functions through chemical messengers known as neurotransmitters, with Acetylcholine (ACh) being one of the primary ones. Regardless of whether they belong to the PNS or the sympathetic nervous system (SNS), all preganglionic neurons release ACh, playing a crucial role in neural signaling and communication⁵. The excitability level of various target organs, which must be kept within homeostatic limits, is determined by the activity of sympathetic preganglionic neurons. There are several parameters that influence sympathetic preganglionic activity. Sensory information from specific receptors, whether due to stretching of baroreceptors as a result of changes in blood pressure (BP) or from external harmful stimuli, leads to reflex changes in the ANS to ensure appropriate SNS responses. Other descending pathways in the brain contribute to the regulation of overall neural activity, with these activity levels fluctuating in response to factors such as mental stress, pathological conditions like heart failure, or circadian rhythms⁶. Many of these pathways are composed of interneurons, some of which are located near sympathetic outputs⁷. Sympathetic preganglionic neurons are electrically interconnected through gap junctions composed of connexin protein subunits, allowing for synchronized responses to specific disturbances⁸. Disabling these connexin protein subunits increases variability in BP and heart rate (HR) in conscious mice, particularly when they are placed in cages with a spinning wheel. Furthermore, activation of peripheral chemoreceptors or sensory stimulation such as harmful pinching significantly reduces sympathetic or cardiovascular responses in animals under anesthesia or in awake brainstem preparations. It appears that SA is controlled by internal and external mechanisms. This means that the activation of different inputs can modulate this activity when necessary⁹. Cardiovascular parameters, including exercise response, BP, and heart

function, are influenced by fluctuations in autonomic activity. The role of different branches of the ANS in cardiovascular function is typically assessed in humans using noninvasive heart rate variability (HRV) analysis. HR reflects the PA and SA inputs to the sinoatrial node, with each beat differing slightly from the next. A high frequency (HF) of HRV is thought to be linked to vagally mediated respiratory sinus arrhythmia (RSA), which is associated with rapid changes in HR¹⁰. Research indicates that as people age, PA in the heart diminishes, while sympathetic tone rises. Changes in HRV and RSA, used as indicators of vagal tone, suggest a reduction in parasympathetic control of the heart with advancing age^{11,12}. In the study of He et al. (2016), the importance of VNS, which accelerates the transition to the PNS and provides a new perspective on cardiovascular diseases (CVD), is emphasized. Evaluations regarding CVD indicate an increased risk of developing these diseases when the SNS is dominant¹³.

To determine whether tVNS could be effective in treating conditions such as heart failure, it is essential to clarify the pathways it activates. Recent clinical trials have indicated that all VNS applications, particularly for treating conditions like cardiac failure, have produced results that fall short of expectations. These suboptimal outcomes are believed to be associated with stimulation parameters, such as the amplitude of the current and the duration of stimulation¹⁴.

ANS assessments utilize various measurement methods, with HRV being one that is quantitative, cost-effective, and reliable¹⁵. While HR indicates the number of pulses measured per minute, HRV is defined as the fluctuation in the time intervals between consecutive heartbeats¹⁶. HRV provides information about neurocardiac function and is generated by dynamic, nonlinear ANS processes, reflecting interactions between the heart and the brain. Therefore, HRV is considered a measure of neurocardiac function reflecting cardiac-brain interactions and the ANS¹⁷. HRV is a characteristic influenced by various interrelated regulatory systems that affect autonomic balance, gas exchange, intestinal function, BP, and vascular tone that affects blood flow to the heart and facial muscles, adapting to environmental and psychological changes¹⁸.

During rest, the R-R interval (the interval between two heartbeats) generally varies around a mean value. These variations are associated with the interaction of the PNS and SNS. Although the HR tends to have similar beats at rest, even within what is considered a rhythmic beat, there are fluctuations, termed physiological arrhythmia¹⁹. In other words, the heart of a healthy individual is not rhythmically consistent like a metronome; rather, the variations observed in the heart are complex and nonlinear²⁰. The variability of nonlinear systems allows for flexibility in coping with an uncertain and changing environment²¹. These cyclic fluctuations in HR reveal changes in the autonomic system²², and they play a significant role in determining prognosis in pathological events²³.

Heart rate variability values can be measured using Electrocardiography (ECG) devices. However, analyzing HRV values in ECG measurements is quite challenging. Thanks to technological advancements, software programs have been developed to enable automatic analysis of these measurements²⁴. The Kubios software program is the most widely used tool for HRV data analysis. The square root (SR) of the differences between consecutive normal NN intervals (RMSSD) and PNS Index provide information about PNS activation, while the Stress Index and SNS Index represent numerical values

indicating SNS activation²⁵. The PNS Index and SNS Index, determined by Nunan et al. (2010) from a study conducted on more than 21,000 individuals, form the basis of the current Kubios software program²⁶. This software is capable of calculating all commonly used time-domain (TD) and frequency-domain (FD) HRV parameters^{27,28}.

Heart Rate Variability Parameters

Heart rate variability parameters are primarily based on the differences in time between consecutive heartbeats, so an increase in HRV is generally considered positive, while a decrease is considered negative in the literature. However, when examining HRV parameters, numerical increases do not always indicate an increase in PA. Decreases in certain FD parameters derived from interbeat intervals (IBI) can also indicate an increase in PA. Additionally, growth in TD parameters can sometimes be pathological and is considered an indicator of mortality risk. Therefore, instead of referring to increases or decreases in measured parameters when interpreting HRV, it may be more accurate to use the concepts of improvement or deterioration²⁹. Heart rate variability is classified into TD parameters, FD parameters, and nonlinear parameters.

Time-Domain (TD) Parameters: TD parameters measure the amount of variation in the IBI between consecutive heartbeats. They allow for the quantitative expression of HRV values obtained over periods ranging from one minute to 24 seconds (sometimes even longer intervals are used). These parameters can be expressed in their measured units or, to obtain a more normal distribution, by taking the natural logarithm (ln) of these units²⁵. The most commonly used and important TD parameters in long-term recordings are Standard Deviation of Normal to Normal intervals (SDNN), SDNN Index (SDNNI), and Root Mean Square of Successive Differences (RMSSD). In short-term recordings, the Maximal and Minimal Heart Rate (HRmax, Hrmin), SDNN, RMSSD, and percentage of pairs of successive N-N intervals differing > 50 ms (pNN50) values are typically used¹⁷.

Interbeat intervals, also known as the "interval between beats," represents the temporal distance between each heartbeat and is used interchangeably as RR or NN interval in various sources. There is a distinction between RR and NN: RR denotes the temporal interval between "all" consecutive QRS complexes, or R peaks, occurring within a specific time frame, whereas NN, meaning "normal to normal," indicates only the "normal accepted" RR intervals within this time frame²⁹.

Standard Deviation of Normal to Normal intervals (SDNN): The standard deviation (SD) of normal sinus intervals, typically expressed in milliseconds (ms), is abbreviated as SDNN. It is commonly obtained from short-term measurements lasting around 5 minutes, although some researchers also recommend very short-term measurements (between 60-240 seconds)³⁰. When recorded over 24 hours or longer, SDNN has been reported as the gold standard for identifying cardiac risk and predicting both morbidity and mortality¹⁵. Standard Deviation of Normal to Normal interval values have been categorized to indicate health status: individuals with an SDNN below 50 ms are considered unhealthy, those with values between 50-100 ms are classified as at moderate risk, and individuals with SDNN values exceeding 100 ms are regarded as healthy. Additionally, individuals with SDNN values between 50-100 ms have a mortality risk that is 400% lower than those with SDNN values below 50 ms. Similarly, among

individuals who have experienced a heart attack, those with a 24-hour SDNN measurement exceeding 100 ms exhibit a mortality rate 5.3 times lower than those whose SDNN is below 50 ms³¹.

Standard Deviation of Normal to Normal intervals Index (SDNNI): This metric represents the average of the SD of NN intervals within each 5-minute segment of a 24-hour HRV recording and thus measures HRV variability specifically in 5-minute intervals. To compute SDNNI, the 24-hour period is divided into 288 five-minute segments, with the SD of NN intervals calculated for each segment. The SDNNI is obtained by averaging these 288 segment values, providing an indication of the autonomic influence on HRV¹⁷.

Number of pairs of successive NN intervals differing > 50 ms (NN50): During a recording period of at least two minutes, it denotes the number of consecutive NN intervals differing by more than 50 ms from each other²⁵.

Percentage of NN50 (pNN50): While some studies suggest measurements as short as 60 seconds³², pNN50 generally requires a recording period of at least two minutes, similar to NN50, and it represents the percentage of consecutive NN intervals differing by more than 50 ms from each other. It is considered a robust indicator of PNS activity³³. However, compared to pNN50, RMSSD is found to be more effective, especially in assessing RSA in older adults³⁴. It is believed that pNN50 may be more reliable than short-term SDNN measurements in providing short-term biofeedback²⁵.

Root Mean Square of Successive Differences (RMSSD): This measure is the SR of the average of the squared differences between successive RR intervals. It reflects the variability in HR from beat to beat and is a key TD index used to assess vagally mediated changes in HRV. To calculate RMSSD, the differences between adjacent RR intervals are squared, the average of these squared differences is computed, and then the SR of this average is taken to yield the final result²⁵. Since the PNS has a greater impact on RMSSD than on SDNN, lower RMSSD values are linked to higher risk scores for sudden and unexplained death in epilepsy (SUDEP) patients³⁵.

Maximal and Minimal Heart Rate (HRmax-HRmin): The difference between the highest and lowest heartbeats observed in each respiratory cycle, particularly sensitive to the effects of respiratory rate independently of VN activity. This measure can be derived from recordings of at least two minutes and primarily reflects RSA rather than serving as a direct indicator of vagal tone. Slower respiratory rates are said to produce higher RSA values because longer expirations activate acetylcholine (ACh) metabolism more actively²⁵.

Frequency-Domain (FD) Parameters: The spectral analysis of HRV converts time signals into frequency signals. Therefore, FD parameters are power spectral densities that predict the distribution of signal energy between frequency bands, either in absolute or relative terms, across four frequency bands. These bands are ultra-low frequency (ULF), very low frequency (VLF), low frequency (LF), and HF. Although measurements are often taken for shorter durations in the literature, fundamentally, 5-minute measurements are recommended for these band values¹⁵.

Ultra-Low Frequency (ULF) Band: Fluctuations with a frequency of ≤ 0.0033 Hz in the interbeat interval²³. There is no clear consensus on the effects of the SNS and PNS on the ULF band²⁵.

Very-Low Frequency (VLF) Band: This band includes rhythms with periods ranging from 25 to 300 seconds, corresponding to frequencies of 0.0033-0.04 Hz, and is strongly correlated with SDNNI^{17,25}. Low VLF levels have been linked to arrhythmia-related death³⁶, post-traumatic stress disorder³⁷, inflammation³⁸, and low testosterone levels³⁹. The physiological mechanisms influencing VLF remain uncertain²³, but it is thought that the heart's intrinsic nervous system and the SNS affect VLF amplitude and frequency¹⁷. Additionally, it has been observed that while parasympathetic blockade nearly eliminates VLF⁴⁰, sympathetic blockade does not have an impact on VLF^{15,41}.

Low Frequency (LF) Band: Ranges between 0.04 and 0.15 Hz, corresponding to rhythmic cycles lasting approximately 7 to 25 seconds. This parameter is influenced by respiratory cycles occurring approximately every ~3-9 breaths per minute. A five-minute measurement typically contains 12-45 complete oscillation cycles³⁰. The LF band value obtained from measurements of at least 2 minutes reflects baroreceptor activity during rest. It has been noted that the SNS does not generate rhythms much higher than 0.1 Hz, while the PNS affects heart rhythms up to 0.05 Hz (20-second rhythm). Moreover, under resting conditions, the LF component of heart rhythms is primarily associated with baroreflex activity rather than direct cardiac sympathetic innervation¹⁷. When respiration slows, vagal activity may generate oscillations within the LF band of heart rhythms^{42,43}. Thus, respiratory-related vagal effects are prominent in the LF band when the respiratory rate drops below 8.5 breaths per minute (a 7-second period) or during deep breaths^{44,45}.

High Frequency (HF) Band: Typically measured over periods of at least one minute, the HF, or respiratory, band ranges between 0.15 and 0.4 Hz. This band is influenced by respiration rates ranging from 9 to 24 breaths per minute¹⁵. HF, associated with HRV influenced by respiratory cycles, is considered an indicator of PA and hence also referred to as the respiratory band. HRV changes in this phase are known as RSA and are not considered a pure indicator of cardiac vagal control⁴⁶. During inspiration, the cardiovascular center inhibits vagal output to accelerate HR. Conversely, during expiration, vagal output is reinstated to slow HR through ACh release⁴⁷. Total vagal blockade nearly abolishes HF oscillations and reduces power in the LF range¹⁷. It has been observed that HF is higher at night and lower during the day, with lower HF values linked to anxiety, stress, and panic¹⁶. Vagal tone modulation plays a crucial role in maintaining dynamic autonomic regulation, which is essential for cardiovascular health, whereas insufficient vagal inhibition is associated with increased morbidity⁴⁸. Variations in respiratory rate and volume can significantly impact HRV indices without altering vagal tone⁴⁴. Nevertheless, under controlled conditions with normal respiratory rates, the LF/HF ratio has been proposed as a potential predictor of vagal tone⁴⁹.

Low Frequency / High Frequency Ratio (LF/HF) ratio: This ratio is used to estimate the balance between SNS and PNS activity in controlled measurements. The purpose of this measurement, primarily based on 24-hour recordings of LF influenced by both PNS and SNS and HF influenced by PNS, is to predict the ratio between SNS and

PNS¹⁷. However, it has been reported that measurement conditions also significantly influence the outcome. For instance, the primary influence on the LF band value obtained while sitting upright is not from the SNS but rather from the PNS and baroreflex activity⁵⁰. Therefore, it has been noted that measurement conditions such as sitting position should be considered for their impact on the LF/HF ratio²⁵.

Nonlinear Parameters: Nonlinear measurements provide the opportunity to quantitatively determine the unpredictable nature of a certain time interval⁵¹. An ECG recording displays the time series of consecutive RR intervals. Nonlinear analysis methods, unlike traditional HRV methods, evaluate the quality of signals, scaling, and correlation properties rather than the magnitude of variability, focusing on the unpredictability, breakability, and complexity of the signal⁵².

Studies Investigating the Effect of Auricular VNS on HRV in the Literature

The studies in the literature associate the preservation of ANS activation with the maintenance of overall health and organ functions. Diseases, aging, and decreased exercise capacity are correlated with decreased ANS function⁵³. The results of the study conducted by Deuchars et al. (2018) indicate contributions of the ANS to the preservation of cardiovascular variability parameters⁹. Additionally, Stanley et al. (2013) highlight the importance of maintaining the integrity of the blood-brain barrier for cardiovascular homeostasis. The study also demonstrates that the blood-brain barrier becomes compromised in conditions with increased sympathetic activation, such as heart failure and hypertension. Consequently, impaired cardiovascular system indicates predominance in the SNS⁵⁴.

Blood pressure and the SNS are interconnected. An increase in BP through the baroreflex mechanism leads to a decrease in SNS activation, while a decrease in BP leads to an increase in SNS activation. Dysfunction in baroreflex can result in an increase in SNS activation and consequently may cause an elevation in BP⁵⁵. Studies have primarily associated the increase in SNS activation with an increase in systolic BP⁵⁶. However, more studies are needed in the literature to search for the effectiveness of VNS in the treatment of hypertension.

When the PNS is stimulated electrically, it increases PA and suppresses SA. This method is a strategy that can be used to treat CVD. Clancy et al. (2014) reported that auricular VNS (aVNS), when applied with specific stimulation parameters (30 Hz, pulses at 10-50 mA with a 200 μ s duration) to the tragus of the ear, enhanced PA and significantly decreased the firing rate of sympathetic fibers. During aVNS, an increase in parasympathetic dominance was observed with respect to autonomic function, as evidenced by an increase in HRV⁵⁷. In the study conducted by De Couck et al. (2017), healthy individuals were divided into two groups and subjected to acute (10 minutes) or prolonged (1 hour) aVNS. As a result, a consistent change in HRV was not detected; however, it was reported that right aVNS had a greater effect on HRV, and furthermore, more consistent changes were recorded in females compared to males⁵⁸. In another study, conducted with 13 healthy males, electrodes were placed on the ear tragus to deliver continuous tVNS using a TENS device. Stimulation was applied continuously for 15 minutes at intensities ranging from 10 to 50 mA, with a pulse width of 200 μ s and a pulse frequency of 30 Hz. A control group was included using a sham technique, where

electrodes were placed on the earlobe, an area lacking cutaneous vagal nerve endings. According to the results of the study, it was reported that HRV during active tVNS decreased resting HR and LF/HF ratio and increased baroreflex sensitivity, thus providing an acute improvement in autonomic modulation and baroreflex sensitivity⁵⁹.

In his study, Billman (2013) provided a different perspective on the idea that the LF/HF ratio measures "sympatho-vagal balance". It has been reported that the LF band does not exclusively reflect SNS activity, with about half of the variability in this frequency range coming from the PNS and a small portion attributed to other unspecified factors. Additionally, it has been noted that interactions between the SNS and PNS are not linear but rather complex, and their activations often do not correspond reciprocally⁶⁰.

In the study of Sclocco et al. (2019), responses in the medulla oblongata during inhalation and exhalation following aVNS were examined using fMRI, and HRV was determined to measure the application's cardiobagal responses. According to the results of the study, VNS performed during exhalation increased stimulation factors transmitted to the nucleus tractus solitarius (NTS) and also increased HRV by providing cardiovagal modulation⁶¹.

In a study where ECG and electroencephalography (EEG) measurements were taken simultaneously from 13 healthy participants, researchers aimed to detect concurrent changes in HRV and cortical activation patterns during aVNS. Stimulation was administered at two different ear locations: the inner tragus/cymba concha and the outer tragus/crus helices. The study found a correlation between increased theta band power in the frontal region and enhanced HRV at both stimulation sites. However, stimulation at the inner tragus/cymba concha resulted in limited increases in alpha and beta band power and a notable reduction in fronto-parietal gamma band power⁶². There are studies indicating a neurocardiac association between the activity of LF brain waves (delta/theta) in the frontal cortex, which demonstrates an increase in PNS, and HRV parameters⁶³. In the study by Patron et al. (2019), ECG and EEG measurements were recorded for 5 minutes while 38 healthy participants were at rest. To measure the impact of cortical control on vagal activity via heartbeats, the interval between each participant's longest and shortest heartbeats was measured. It was reported that as the delta power in the prefrontal and frontocentral regions of the brain decreases before the R wave in the ECG signal, the interval between heartbeats increases the likelihood of being longer. The phasic activation/deactivation of prefrontal areas, by modulating vagal control of HR at rest, supported the view that the prefrontal cortex acts as a cardiac brake⁶⁴. Keute et al. (2021) assessed the cardiac effects of aVNS in 44 healthy adults. By using the "neurocardiac coupling score," which measures the relationship between HR length and delta power, they found that aVNS indicates PA⁶⁵.

Conclusion

The impaired cardiovascular system mostly indicates predominance of the SNS. Research in the literature demonstrates that aVNS positively affects cardiovascular parameters by increasing PA and decreasing SA. However, the immediate effects of VNS on beat-to-beat HR dynamics have not been systematically studied in humans. Moreover, in many studies, vagal stimulation from the left side has been limited due to the potential risk of cardiac side effects, which further constrains research in this field.

There is a requirement for further studies to investigate both the short- and long-term effects of stimulation with varying parameters from different ears on cardiovascular parameters in healthy individuals as well as those with various clinical conditions. This would enable a more specific and effective use of aVNS for each disease and patient.

REFERENCES

1. Bonaz B, Bazin T, Pellissier S. The vagus nerve at the interface of the microbiota-gut-brain axis. *Frontiers in Neuroscience*. 2018;12:336-468. doi: 10.3389/fnins.2018.00049.
2. Yuan H, Silberstein S. Vagus nerve and vagus nerve stimulation, a comprehensive review: part I. Headache: *The Journal of Head and Face Pain*. 2015;56(1):71-78.
3. Buturak V, Bakar B. A new therapy modality for treatment-resistant depression: Vagal nerve stimulation. *Journal of Mood Disorders*. 2014;4(4):167-74.
4. Butt M, Albusoda A, Farmer A, Aziz Q. The anatomical basis for transcutaneous auricular vagus nerve stimulation. *Journal of Anatomy*. 2020;236(4):588-611.
5. LeBouef T, Yaker Z, Whited L. Physiology, autonomic nervous system. In: *StatPearls [Internet]*. StatPearls Publishing, 2023.
6. Grassi G, Bombelli M, Seravalle G, Dell'Oro R, Quarti-Trevano F. Diurnal blood pressure variation and sympathetic activity. *Hypertension Research*. 2010;33(5):381-385.
7. Deuchars SA, Lall VK. Sympathetic preganglionic neurons: Properties and inputs. *Comprehensive Physiology*. 2015;5(2):829-869. doi: 10.1002/cphy.c140020.
8. Lall VK, Bruce G, Voytenko L, et al. Physiologic regulation of heart rate and blood pressure involves connexin 36-containing gap junctions. *The FASEB Journal*. 2017;31(9):3966-77.
9. Deuchars SA, Lall VK, Clancy J, et al. Mechanisms underpinning sympathetic nervous activity and its modulation using transcutaneous vagus nerve stimulation. *Experimental Physiology*. 2018;103(3):326-331. doi: 10.1113/EP086433.
10. Malliani A. Heart rate variability: from bench to bedside. *European Journal of Internal Medicine*. 2005;16(1):12-20. doi: 10.1016/j.ejim.2004.06.016.
11. De Meersman RE, Stein PK. Vagal modulation and aging. *Biological Psychology*. 2007;74(2):165-173. doi: 10.1016/j.biopsycho.2006.04.008.
12. Abhishekh HA, Nisarga P, Kisan R, et al. Influence of age and gender on autonomic regulation of heart. *Journal of Clinical Monitoring and Computing*. 2013;27:259-264.
13. He B, Lu Z, He W, Huang B, Jiang H. Autonomic modulation by electrical stimulation of the parasympathetic nervous system: an emerging intervention for cardiovascular diseases. *Cardiovascular Therapeutics*. 2016;34(3):167-171.
14. Byku M, Mann DL. Neuromodulation of the failing heart: lost in translation? *JACC: Basic to Translational Science*. 2016;1(3):95-106. doi: 10.1016/j.jacbts.2016.03.004.

15. Task Force of the European Society of Cardiology the North American Society of Pacing Electrophysiology, Heart rate variability: standards of measurement, physiological interpretation and clinical use. *Circulation*. 1996;93(5):1043–1065.
16. McCraty R, Shaffer F. Heart rate variability: new perspectives on physiological mechanisms, assessment of self-regulatory capacity, and health risk. *Global Advances in Health And Medicine*. 2015;4(1):46–61. doi: 10.7453/gahmj.2014.073.
17. Shaffer F, McCraty R, Zerr CL. A healthy heart is not a metronome: An integrative review of the heart's anatomy and heart rate variability. *Frontiers in Psychology*. 2014;5:1040.
18. Gevirtz RN, Lehrer PM, Schwartz MS. Cardiorespiratory biofeedback. *Biofeedback: A Practitioner's Guide*, The Guilford Press, New York, USA. 2016;196-213.
19. Hayano J. Part II: Heart rate variability. *Clinical Assesment of the Autonomic Nervous System*. Japan, Springer. 2017;109-127.
20. Goldberger AL. Is the normal heartbeat chaotic or homeostatic? *News in Physiological Sciences*. 1991;6:87–91. doi: 10.1152/physiologyonline.1991.6.2.87.
21. Beckers F, Verheyden B, Aubert AE. Aging and nonlinear heart rate control in a healthy population. *American Journal of Physiology-Heart and Circulatory Physiology*. 2006;290(6):H2560–H2570. doi: 10.1152/ajpheart.00903.2005.
22. Zygmunt A, Stanczyk J. Methods of evaluation of autonomic nervous system function. *Archives of Medical Science*. 2010;6(1):11-18. doi: 10.5114/aoms.2010.13500.
23. Kleiger RE, Stein PK, Bigger JT Jr. Heart rate variability: measurement and clinical utility. *Annals of Noninvasive Electrocardiology*. 2005;10(1):88-101.
24. Laborde S, Mosley E, Thayer JF. Heart rate variability and cardiac vagal tone in psychophysiological research - recommendations for experiment planning, data analysis, and data reporting. *Frontiers in Psychology*. 2017;8:213. doi: 10.3389/fpsyg.2017.00213.
25. Shaffer F, Ginsberg JP. An overview of heart rate variability metrics and norms. *Frontiers in Public Health*. 2017;5:258. doi: 10.3389/fpubh.2017.00258.
26. Nunan D, Sandercock GR, Brodie DA. A quantitative systematic review of normal values for short-term heart rate variability in healthy adults. *Pacing and Clinical Electrophysiology*. 2010;33(11):1407-1417. doi: 10.1111/j.1540-8159.2010.02841.x.
27. Cakir A, Alptekin K, Özden A, Öncü J. Immediate effects of chiropractic thoracic manipulations on the autonomic nervous system. *J. Orthop. Trauma Surg. Relat. Res*. 2019;14(3):7-14.
28. Tarvainen MP, Lipponen J, Niskanen JP, Ranta-Aho P. *Kubios HRV Version 3-User's Guide*. Kuopio, University of Eastern Finland, 2017.
29. Aras D, Erdoğan TN, Ayvaz Ö, Birol A. Kalp hızı değişkenliği ve egzersiz kronik yanıtları. *SPORMETRE The Journal of Physical Education and Sport Sciences*. 2022;20(4):1-40.
30. Kuusela T. Methodological aspects of heart rate variability analysis. *Heart Rate Variability (HRV) Signal Analysis*. CRC Press, Florida, USA, 2013.

31. Kleiger RE, Miller JP, Bigger JT Jr, Moss AJ. Decreased heart rate variability and its association with increased mortality after acute myocardial infarction. *The American Journal of Cardiology*. 1987;59(4): 256–262. doi: 10.1016/0002-9149(87)90795-8.
32. Baek HJ, Cho CH, Cho J, Woo JM. Reliability of ultra-short-term analysis as a surrogate of standard 5-min analysis of heart rate variability. *Telemedicine Journal and E-Health*. 2015;21(5):404–414. doi: 10.1089/tmj.2014.0104.
33. Umetani K, Singer DH, McCraty R, Atkinson M. Twenty-four hour time domain heart rate variability and heart rate: relations to age and gender over nine decades. *Journal of the American College of Cardiology*. 1998;31(3):593–601.
34. Otzenberger H, Gronfier C, Simon C, et al. Dynamic heart rate variability: A tool for exploring sympathovagal balance continuously during sleep in men. *The American Journal of Physiology*. 1998;275(3):946–950.
35. DeGiorgio CM, Miller P, Meymandi S. RMSSD, a measure of vagus-mediated heart rate variability, is associated with risk factors for SUDEP: The SUDEP-7 Inventory. *Epilepsy & Behavior*. 2010;19(1):78–81.
36. Bigger JT Jr, Fleiss JL, Steinman RC, Rolnitzky LM, Kleiger RE, Rottman JN. Frequency domain measures of heart period variability and mortality after myocardial infarction. *Circulation*. 1992;85(1):164–71. doi: 10.1161/01.CIR.85.1.164.
37. Shah AJ, Lampert R, Goldberg J, Veledar E, Bremner JD, Vaccarino V. Posttraumatic stress disorder and impaired autonomic modulation in male twins. *Biological Psychiatry*. 2013;73:1103–10. doi: 10.1016/j.biopsych.2013.01.019.
38. Lampert R, Bremner JD, Su S, et al. Decreased heart rate variability is associated with higher levels of inflammation in middle-aged men. *American Heart Journal*. 2008;156:759.e1–7.
39. Theorell T, Liljeholm-Johansson Y, Björk H, Ericson M. Saliva testosterone and heart rate variability in the professional symphony orchestra after “public faintings” of an orchestra member. *Psychoneuroendocrinology*. 2007;32:660–8.
40. Taylor JA, Carr DL, Myers CW, Eckberg DL. Mechanisms underlying very-low-frequency RR-interval oscillations in humans. *Circulation*. 1998;98:547–55.
41. Berntson GG, Bigger JT Jr, Eckberg DL, et al. Heart rate variability: Origins, methods, and interpretive caveats. *Psychophysiology*. 1997;34:623–48.
42. Ahmed AK, Harness JB, Mearns AJ. Respiratory control of heart rate. *European Journal of Applied Physiology*. 1982;50:95–104. doi: 10.1007/BF00952248.
43. Lehrer PM, Vaschillo E, Vaschillo B, et al. Heart rate variability biofeedback increases baroreflex gain and peak expiratory flow. *Psychosomatic Medicine*. 2003;65(5):796–805.
44. Brown TE, Beightol LA, Koh J, Eckberg DL. Important influence of respiration on human RR interval power spectra is largely ignored. *Journal Applied Physiology*. 1985;5:2310–7.
45. Tiller WA, McCraty R, Atkinson M. Cardiac coherence: A new, noninvasive measure of autonomic nervous system order. *Alternative Therapies in Health and Medicine*. 1996;2(1):52–65.

46. Grossman P, Taylor EW. Toward understanding respiratory sinus arrhythmia: Relations to cardiac vagal tone, evolution and biobehavioral functions. *Biological Psychology*. 2007;74:263-85. doi: 10.1016/j.biopsycho.2005.11.014.
47. Eckberg DL, Eckberg MJ. Human sinus node responses to repetitive, ramped carotid baroreceptor stimuli. *The American Journal of Physiology*. 1982;242(4):638–644.
48. Thayer JF, Yamamoto SS, Brosschot JF. The relationship of autonomic imbalance, heart rate variability and cardiovascular disease risk factors. *International Journal of Cardiology*. 2010;141:122-31. doi: 10.1016/j.ijcard.2009.09.543.
49. Egizio VB, Eddy M, Robinson M, Jennings JR. Efficient and cost-effective estimation of the influence of respiratory variables on respiratory sinus arrhythmia. *Psychophysiology*. 2011;48:488-94. doi: 10.1111/j.1469-8986.2010.01086.x.
50. Kember GC, Fenton GA, Armour JA, Kalyaniwalla N. Competition model for aperiodic stochastic resonance in a Fitzhugh-Nagumo model of cardiac sensory neurons. *Phys Rev E Stat Nonlin Soft Matter Phys*. 2001;63:041911. doi: 10.1103/PhysRevE.63.041911.
51. Stein PK, Reddy A. Non-linear heart rate variability and risk stratification in cardiovascular disease. *Indian Pacing And Electrophysiology Journal*. 2005;5(3):210–20.
52. De Godoy MF. Nonlinear analysis of heart rate variability: A comprehensive review. *Journal of Cardiology and Therapy*. 2016;3:528-533.
53. Machhada A, Trapp S, Marina N, et al. Vagal determinants of exercise capacity. *Nature Communications*. 2017;8(1):15097. doi: 10.1038/ncomms15097.
54. Stanley J, Peake JM, Buchheit M. Cardiac parasympathetic reactivation following exercise: Implications for training prescription. *Sports Medicine*. 2013;43(12):1259–1277.
55. Malliani A, Montano N. Antihypertensive treatment and sympathetic excitation. *Hypertension*. 2005;46(3):e8-e8. doi: 10.1161/01.hyp.0000176234.17554.co.
56. Pal G, Pal P, Lalitha V, Dutta T, Adithan C, Nanda N. Sympathovagal imbalance in young prehypertensives: Importance of male-female difference. *The American Journal of the Medical Sciences*. 2013;345(1):10-17. doi: 10.1097/maj.0b013e31824ba080.
57. Clancy J, Mary D, Witte K, Greenwood J, Deuchars S, Deuchars J. Non-invasive vagus nerve stimulation in healthy humans reduces sympathetic nerve activity. *Brain Stimulation*. 2014;7(6):871-877. doi: 10.1016/j.brs.2014.07.031.
58. De Couck M, Cserjesi R, Caers R, et al. Effects of short and prolonged transcutaneous vagus nerve stimulation on heart rate variability in healthy subjects. *Autonomic Neuroscience*. 2017;203:88-96. doi: 10.1016/j.autneu.2016.11.003.
59. Antonino D, Teixeira AL, Maia-Lopes PM, et al. Non-invasive vagus nerve stimulation acutely improves spontaneous cardiac baroreflex sensitivity in healthy young men: A randomized placebo-controlled trial. *Brain Stimulation*. 2017;10(5):875-881.

60. Billman GE. The LF/HF ratio does not accurately measure cardiac sympatho-vagal balance. *Front Physiol.* 2013;4:26. doi: 10.3389/fphys.2013.00026.
61. Sclocco R, Garcia RG, Kettner NW, et al. The influence of respiration on brainstem and cardiovagal response to auricular vagus nerve stimulation: a multimodal ultrahigh-field (7T) fMRI study. *Brain Stimulation.* 2019;12(4):911-921. doi: 10.1016/j.brs.2019.02.003.
62. Machetanz K, Berelidze L, Guggenberger R, Gharabaghi A. Brain–heart interaction during transcutaneous auricular vagus nerve stimulation. *Front. Neurosci.* 2021;15:632697.
63. Thayer JF, Åhs F, Fredrikson M, Sollers III JJ, Wager TD. A meta-analysis of heart rate variability and neuroimaging studies: Implications for heart rate variability as a marker of stress and health. *Neuroscience & Biobehavioral Reviews.* 2012;36(2):747-756.
64. Patron E, Mennella R, Benvenuti SM, Thayer JF. The frontal cortex is a heart-brake: Reduction in delta oscillations is associated with heart rate deceleration. *Neuroimage.* 2019;188:403-410.
65. Keute M, Machetanz K, Berelidze L, Guggenberger R, Gharabaghi A. Neuro-cardiac coupling predicts transcutaneous auricular vagus nerve stimulation effects. *Brain Stimulation.* 2021;14(2):209-216. doi: 10.1016/j.brs.2021.01.001.

Metaverse Applications in Healthcare: SWOT Analysis

Nurgül ERDAL*, Ali ÖZBEK**, Barış GELAL***

Abstract

Aim: This study aims to introduce the use of virtual reality and augmented reality technologies in the health field and to reveal the strengths, weaknesses, opportunities and threats of Metaverse through SWOT analysis.

Method: A detailed literature review was conducted on the subject, Metaverse studies in healthcare were examined, and the strengths, weaknesses, opportunities, and threats of metaverse applications in healthcare were revealed through SWOT analysis.

Results: The strengths of Metaverse in health services include all people, not a specific group. It has an important place in the economy and will positively affect individual and social health. Diagnosis, treatment and control of patients will be easier, their recovery will be accelerated and hospital-acquired infections will be prevented. Its weaknesses are that it requires internet access. It is one of the biggest factors in the inadequacy of Research & Development studies. The low literacy rate of the society and the reluctance to use technological tools are important. As for the opportunities, investing in Metaverse technologies provides a competitive advantage. Health and medical education will become easier and the harm to the patient will be minimized. As for the risks, the innovation of Metaverse applications may lead to some ethical problems.

Conclusion: Digital universal health system integrated with healthcare reduces the high costs of therapeutic healthcare services, improves public health and increases quality of life.

Keywords: Healthcare, health management, artificial intelligence, SWOT, Metaverse.

Sağlık Hizmetlerinde Metaverse Uygulamaları: SWOT Analizi

Öz

Amaç: Bu çalışma, sanal gerçeklik ve artırılmış gerçeklik teknolojilerinin sağlık alanında kullanımını tanıtmak ve Metaverse'nin SWOT analizi ile güçlü, zayıf yönlerini, fırsatlarını ve tehditlerini ortaya koymaktır.

Yöntem: Konu ile ilgili ayrıntılı literatür taraması yapılmış, sağlık hizmetlerinde Metaverse çalışmaları incelenmiş ve SWOT analizi ile sağlık hizmetlerinde metaverse uygulamalarının güçlü ve zayıf yönleri, fırsat ve tehditleri ortaya çıkarılmıştır.

Bulgular: Metaverse'in sağlık hizmetlerinde güçlü yönleri, belirli bir grubu değil, tüm insanları kapsar. Ekonomide önemli bir yere sahiptir, bireysel ve toplumsal sağlığı olumlu yönde etkileyecektir. Hastaların teşhisi, tedavisi ve kontrolü daha kolay olacak, iyileşmeleri hızlanacak ve hastane kaynaklı enfeksiyonlar önlenecektir. Zayıf yönleri ise, internet erişimini gerekli kılmasıdır. Ar-ge çalışmalarındaki yetersizliğin en büyük etkenlerinden biridir. Toplumun düşük okuryazarlık oranı ve teknolojik araçları kullanma konusundaki isteksizlik önemlidir. Fırsatlar ise Metaverse teknolojilerine yatırım yapılması rekabet avantajı sağlar. Sağlık ve tıp eğitimi daha kolay hale gelecek ve hastaya verilen zarar en aza indirilecektir. Riskleri ise, Metaverse uygulamalarının yeniliği beraberinde bazı etik sorunlara yol açabilecektir.

Derleme Makale (Review Article)

Geliş / Received: 24.06.2024 & **Kabul / Accepted:** 24.02.2025

DOI: <https://doi.org/10.38079/igusabder.1676432>

* Asst. Prof., Istanbul Gelisim University, Faculty of Economics, Administrative and Social Sciences, Logistics Management, Istanbul, Türkiye. E-mail: nerdal@gelisim.edu.tr [ORCID https://orcid.org/0000-0002-2961-3906](https://orcid.org/0000-0002-2961-3906)

** Asst. Prof., Istanbul Gelisim University, Faculty of Economics, Administrative and Social Sciences, Department of Economics and Finance, Istanbul, Türkiye. E-mail: aobek@gelisim.edu.tr [ORCID https://orcid.org/0000-0001-9183-6513](https://orcid.org/0000-0001-9183-6513)

*** Dr., Purchasing Director, Istanbul Gelisim University, Istanbul, Türkiye. E-mail: bgelal@gelisim.edu.tr [ORCID https://orcid.org/0009-0002-5017-663X](https://orcid.org/0009-0002-5017-663X)

Sonuç: Sağlık hizmetleriyle bütünleşmiş dijital evrensel sağlık sistemi, terapötik sağlık hizmetlerinin yüksek maliyetlerini azaltır, halk sağlığını iyileştirir ve yaşam kalitesini artırır.

Anahtar Sözcükler: Sağlık hizmetleri, sağlık yönetimi, yapay zekâ, SWOT, Metaverse.

Introduction

Nowadays, rapid changes and developments in technology and digitalization also affect the healthcare sector. Metaverse, which is among the popular topics of recent days, is developing in a way that will take the provision of health services beyond dreams. In health, Metaverse aims to provide digital health solutions using both AR and VR technologies. Thanks to groundbreaking artificial intelligence in the globalizing world, it is possible to diagnose diseases, perform medical scans, read records, develop drugs, perform robotic surgery, etc. applications have become possible and have been put into practice. Metaverse's developments in the field of healthcare will make positive contributions to both patients and healthcare professionals. Metaverse, a post-reality universe, merges physical reality and digital virtuality in a persistent and constantly multi-user environment. In other words, the Metaverse can be considered a parallel universe where all digital worlds are combined, and everything you can do on the internet is collected in a single space. Virtual environments are created in the Metaverse through the integration of virtual reality (VR) and augmented reality (AR) technologies. Thus, they engage in multisensory interactions with digital objects and people thanks to the Metaverse¹. AR and VR technologies are widely used in the world and investments in these technologies are increasing rapidly. In addition, the use of technology increases success in education and enhances learning processes². Thus, great advances will be made in human and animal health, improvements in health protection, treatment, and care processes will be made and daily activities will be easier.

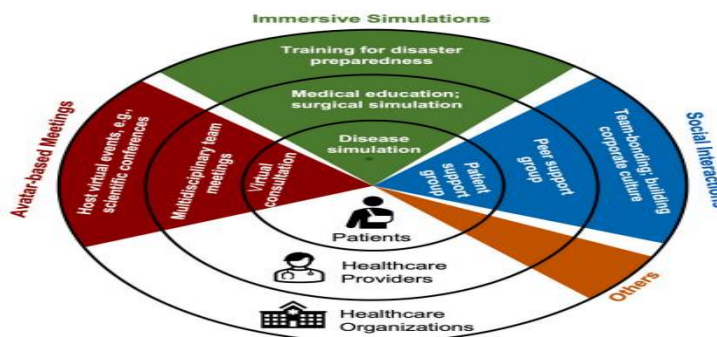
Today, AR (Augmented Reality) and VR (Virtual Reality) technologies are used in almost all sectors. With Metaverse applications in health services, medicine and medical-related education and training, disease and drug research, patient care, rehabilitation services, patient examination, and hospital management are possible³. Businesses that follow these change and development processes quickly will be able to take their place in the market and gain a competitive advantage. Health businesses that fall behind technology are doomed to disappear⁴.

This study includes examining the applications of Metaverse, which is a product of technological developments in the world, in the field of health with Strength, Weakness, Opportunity, and Threat (SWOT) analysis. In the first part of the research, information about Metaverse is given. The emergence of Metaverse and where it is used are mentioned. In the second part, what are the Metaverse applications in health services are explained. In the third part, information about the purpose of the study, method and SWOT analysis is given. In this section, Metaverse applications in health services are evaluated as strengths, weaknesses, opportunities and threats. Discussion and suggestions are made in the conclusion section. Implementation in the Metaverse is necessary for the development of the global health ecosystem.

Metaverse in Health Ecosystems

The healthcare ecosystem consists of patients, physicians, various healthcare professionals, allied healthcare practitioners, government agencies, academic institutions, non-governmental organizations, and companies. The information flow from these actors combines to determine the target. The information collected here is combined⁵. The health ecosystem consists of three components. The first component is the patient, the second component is the healthcare professionals, and the third component is the institutions or organizations. With Metaverse, Avatar-based meetings, immersive simulations, social interactions and other applications can be taken to different dimensions and a healthcare ecosystem can be created. As seen in Figure 1, patients can participate in virtual consultations in the healthcare ecosystem with Avatar-based meetings. Online consultants are inferior in communication and interaction to Metaverse. VR and AR-based virtual diagnosis and treatment tools are becoming more tangible through avatars that reflect behavior⁶.

Figure 1. The interoperable healthcare ecosystem in the metaverse⁶.



It is the facilitation of human-computer MDT, which aims at consultation based on human-computer communication and interaction when applied to the Metaverse regarding the clinical management of a particular patient, involving groups of experts with various specialties. Here, comprehensive diagnosis and treatment plans that combine doctors' expertise, computerized data, and artificial intelligence-derived knowledge and guidance provide great benefit to the patient.

Metaverse Applications in Healthcare

Metaverse (virtual world) includes many technologies such as blockchain technology, cloud, and artificial intelligence. All virtual world applications realized with virtual and augmented reality and defined as extended reality are located in the Metaverse⁷. Table 1. Usage areas of Metaverse are seen) wledge and guidance provide great benefit to the patient. In the field of Metaverse Health, radiology, pain management, plastic surgery, healthy living, psychology, and health (medical) education are used^{8,9}.

Table 1. Key applications of metaverse in the healthcare industry ³

The Healthcare Industry	Key Applications
Metaverse applications in radiology	X-ray and computed tomography, which have an important place in diagnosis and treatment, are necessary for planning the treatment of patients. In this process, Metaverse technology began to be used in the field of radiology. The use of Metaverse in the radiological segment is expected to contribute more to visual abilities. Radiologists will be able to see dynamic images in more detail thanks to the Metaverse. Disease, injury, fracture, mass, etc. Can be better diagnosed. Well-diagnosed images allow diseases to be treated more easily. In addition, medical images in 3D format can be evaluated by other healthcare professionals and collaboration will occur between different stakeholders ³ .
Metaverse Applications in Pain Management	Metaverse Applications in Pain Management: In hospitalized patients, those with chronic pain, burns, etc. Metaverse applications can be used to relieve pain complaints and manage pain in patients with diabetes. Shortly, VR will be seen as the most promising and powerful noninvasive tool to treat and manage pain. With VR, pain can be mentally removed and it prevents it from sending signals to the brain ³ . This is a good example of drug-free pain relief techniques. VR Pain management procedures can help reduce fear and anxiety, especially among children and the elderly. In addition, side effects of medications are prevented ¹⁰ VR; In case of natural disasters, accidents, and infectious diseases, healthcare providers can provide pain management by creating an educational environment. Glasses, gloves, headphones, etc. can be worn on the body and work with VR technology infrastructure. Games that can be played with devices can also provide pain-reducing effects because they distract attention ¹¹ .
Metaverse Applications in Plastic Surgery	Beauty and aesthetic trends change every day. In the coming years, digital images, Metaverse clinics, virtual aesthetics, agelessness, and genderless face concepts will enter our lives. Instead of the uniform concept of 'ideal beauty', personally designed applications will come to the fore ¹² . Everyone will focus on touches that will proudly reveal their uniqueness. As the world becomes more global, borders disappear; people are more embracing their ethnic roots and the characteristics that make them different. This brings with it a multinational understanding of aesthetics. This trend will continue further in the future ¹³ .
Metaverse Apps for Fitness and Healthy Living	The world of good living, which is in the mind and center of the consumer, is preparing to offer new technologies that can better improve people's health. Many companies are launching new products that can improve people's health and lives. Additionally, “unprecedented new synergies” are beginning to emerge between the technology, wellness, and health industries to create the wellness Metaverse. Health sectors, including fitness, beauty, healthy eating, mental health, wellness tourism, wellness real estate, and spas, aim to impact people with new technologies and virtual worlds that provide a much more immersive experience and revolutionize the way health is delivered to global consumers. In terms of fitness and wellness, the Metaverse can be used to provide personalized and more effective workouts under the guidance of virtual trainers ¹⁴ .
Metaverse in Surgical Applications	Nowadays, AR and VR technologies are used in various surgeries. Augmented reality combines information from multiple imaging sources, working more harmoniously with the surgical workflows of surgical personnel and the sterile field of the operating room ¹⁵ . Thanks to robotic surgery via Metaverse, direct surgical intervention will be possible in case of an emergency, regardless of location and time ¹⁶ . The removal of cancerous cells and tumor tissues or the most complex spinal system surgical interventions can be performed with robot

	support ¹⁷ . When surgeons use augmented reality glasses, they will be able to perform surgeries more accurately and easily at the right angle ¹⁸ .
Metaverse Applications in Health Education	Literature shows that regardless of department, VR-assisted training is much more effective than traditional training. It minimizes the difficulty of application, especially in applied training, and can easily provide experiences that are difficult to experience. Students receiving health education receive practical internship training in hospitals. However, these trainings may also have incomplete aspects. Medical experiences gained through the computer-assisted, tactile feedback VR simulator training system through VR glasses can be more useful than traditional training. Students can create the medical events they want to experience in the Metaverse universe and gain experience with these medical events. Apart from this, the use of AR technologies in education is also very common. For example, the HoloAnatomy application, used by Microsoft and Cleveland Clinic to visualize the human body easily and effectively, offers an up-to-date perspective on the biology of the human organism. Thanks to this application, which will be a revolution in medical education, medical students will be able to work on a 3D human body hologram instead of 2D pictures. Another example in the field of health is VR-based pharmacy training. In this application produced thanks to VR glasses technology, you can receive training through simulation in a 3D pharmacy environment, pharmacy. They can gain experience in management and patient communication ¹⁵ .
Metaverse Applications in Psychiatry	Metaverse Applications in Psychiatry: Metaverse can be especially beneficial in psychiatric therapies. Environments can be personalized according to patients. Similarly, VR is already used by psychologists and psychiatrists in avoidance therapy by creating safe environments in which patients can interact with situations that cause their anxiety, where every aspect of the interaction can be closely monitored and controlled ¹⁷ . It is valid for the treatment of "Social Phobia" in psychiatry. Virtual Reality Exposure Therapy is a psychotherapy method in which individuals are confronted with the stimuli they fear and worry about in three-dimensional virtual environments. Virtual reality exposure therapy is used to treat phobias, anxiety disorders, addictions, and post-traumatic stress disorder ¹⁵

Table 1 shows the Basic Applications of Metaverse in the Health Sector. In the future, advances in information technology will add more applications to the health system.

Studies on Metaverse in The Field of Health

Metaverse has the power to impact digital twins, blockchain and digital hospitals. These three technologies can create new treatment methods, reduce treatment costs and significantly improve patient outcomes. Digital twins are digital copies of human physiology constructed digitally with data at both individual and societal levels. Since these are simulations, they can offer solutions without endangering individual and public health. Blockchain ensures that data is stored and transferred securely. Digital Hospitals' infrastructures extend beyond their physical infrastructure. Intelligent information systems, virtual reality (VR), augmented reality (AR), sensors, facility control systems and medical device control systems are present in a digital hospital. The technology team assists in the implementation and management of health services¹⁵. The number of studies conducted has increased with the spread of Metaverse applications in healthcare services.

Table 2. Studies on Metaverse in Healthcare^{6,19-31}.

Author	Year	Subject	Journal
Perez et.al ¹⁹ .	2022	Establishing Standard Operating Procedures in a Precision Medicine Laboratory	Journal of Molecular Diagnostics
Saxena & Malviya ²⁰ .	2023	Printable Drug Delivery Systems	Current Pharmaceutical Design
Jung et.al ²¹ .	2023	Metaverse for Service Industries:	Computers in Human Behavior
Wider et.al ²² .	2023	Metaverse Chronicles: A Bibliometric Analysis	International Journal of Human–Computer Interaction,
Moztarzadeh et al ²³	2023	Metaverse and Healthcare: Machine Learning	Bioengineering,
Gandi et al ²⁴ .	2023	What can the Metaverse do for Urology	Urologia Journal.
Randazzo et.al ²⁵ .	2023	Metaverse in the Field of Urology	World Journal of Urology
Nawaz et.al ²⁶ .	2023	Supporting Vaccine Confidence in Metadata	Digital Health
Li et.al ⁶ .	2024	The Next Generation of Healthcare Ecosystem in the Metaverse	Biomedical Journal
Xiao et.al ²⁷ .	2024	Metaverse's relationship to ethical issues	Humanities & Social Sciences Communications
Skalidis et al ²⁸ .	2024	Metaverse-Based Cardiac Magnetic Resonance Imaging Simulation	Future Cardiology
Erginet et al ²⁹	2024	Nurses' Knowledge, Attitudes and Awareness about the Metaverse	BMC Nursing
Della Corte et.al ³⁰ .	2024	Pediatric Urology Metaverse Surgeries	Surgeries
Habbal et.al ³¹ .	2024	Artificial Intelligence Trust, Risk and Security Management	Expert Systems with Applications

As seen in Table 2, a lot of research has been conducted on Metaverse applications in healthcare in recent years. The table above was created in line with the literature.

Material and Methods

Purpose of The Study

The health sector is among the most developing sectors. What distinguishes health services from other services is that they are different, important, and versatile. In healthcare delivery, with the advancement of technology, the structure of the service has changed and digital transformation has occurred. Institutions that could not keep up with this transformation had to withdraw from the fierce competition environment. This study evaluates the reflections of Metaverse, an indispensable element of the future, in the health sector, and reveals the strengths, weaknesses, opportunities, and threats of Metaverse.

Method of the Study

The study, was carried out by examining scientific studies in various databases and publications published on social media between 01.01.2025 and 01.03. 2025. A search was made with the keywords Metaverse, virtual universe, digital health, digital technology, virtual reality, and augmented reality, published in Google Academy, Web of Sciences, EBSCO, ULAKBİM, Science Direct, Scopus, and SOBIAD databases. Using the secondary data obtained from these studies, Metaverse SWOT in health was evaluated.

SWOT

One of the most important topics of strategic management is SWOT analysis. It is used to evaluate the internal and external environment of the business. It began to be widely used in business management, especially in the 1970s. SWOT analysis is also an important tool for strategic planning. It is also used as a planning tool³²⁻³⁴. SWOT word; it consists of the initial letters of four English words: advantages (strengths), disadvantages (Weaknesses), opportunities (Opportunities), and threats (threats)³⁴. SWOT Analysis; it is accepted as an analysis method applied to identify the strengths or weaknesses of an institution, sector, investment, country, or region arising from the characteristics of the institution, sector, investment, country, or region, and to identify opportunities and threats arising from expected or unexpected future situations. Internal elements for the analysis to be successful: Strengths, weaknesses, and external elements; It is important to identify opportunities and threats well³⁵.

Figure 2. Research model



Figure 2 shows the SWOT analysis and research model of metaverse health applications. The research model was prepared in line with the literature.

Results

Metaverse's use in the health sector is shown in Table 3 by SWOT analysis.

Table 3. SWOT analysis of metaverse applications in healthcare

STRENGTHS OF METAVERSE HEALTH APPS	WEAKNESSES OF METAVERSE HEALTH APPS
• Metaverse is a multi-user collaboration system that includes children, elderly, and disabled people, regardless of race, gender, religion, and age. Not a specific group, but anyone can be found in the virtual World³⁶. • Entrepreneurship within the metaverse consists of social interaction through digital avatars³⁷. Statistical reports show that businesses globally are investing billions of dollars in the metaverse³⁸. • In the metaverse, users are less limited by time and space and can exist in multiple places through avatars. Since geographical borders will disappear, it will be possible to easily reach a doctor and get an examination from anywhere in the world. Additionally, thanks to the necessary equipment, surgical operations can be performed in health institutions in the region³⁹. • With distance learning, many applications will be realized, health and medical education will be easier, applications will be made on model errors made in live animals will be reduced, and learners' skills such as self-directed learning and cooperative learning will increase⁴⁰. • The health sector is a sector that requires teamwork. Metaverse Communication will accelerate interaction and teamwork processes and increase the quality of communication and interaction⁴¹. • XR technologies, including virtual, augmented, and mixed realities, increase the efficiency and quality of health education. Using these technologies allows medical professionals to practice in a safe space without fear of some type of loss or negative consequences and can provide highly interactive learning at a lower cost⁴². • Human cadavers and physical models can only represent a limited range of disease pathologies and are used in medical schools as a solution to issues such as inadequate measurement of the true range of individual variation. Thanks to this solution, multiple pathologies and subtle anatomical variations can be easily added to virtual cadaver representations with Metaverse technologies⁴³. • By creating a dynamic real-time digital replica of the human body, new techniques, tools or therapies can be applied to the digital twin, minimizing risk to the patient⁴⁴. • In clinical trials, principal investigators are not available at all times and in all settings to monitor the research or guide the team. Clinical research will be easier thanks to the metaverse⁴⁵. • AR (augmented reality) and VR (virtual reality) technologies will facilitate hospital management¹⁰. • Metaverse enables real data analytics to benefit decision-making and policy-making. By opening existing digital health applications to the Metaverse universe, large data pools can be obtained and health needs can be determined more accurately and rationally⁴⁶. • Integration of artificial intelligence technology into surgical operations may lead to disability or death It contributes to the	• Adequate internet access is required for the Metaverse. Poor internet access slows down or prevents metaverse apps from happening⁵⁰. • Inadequacies in digital transformation in developing countries and insufficient accessibility to the public Insufficient R&D on the Metaverse⁵¹. • Health education students are not ready for digital transformation and there is no local infrastructure. • Low health literacy of the society⁵¹. • Cyber security breaches⁵¹. • Perception disorders between the virtual world and the real World⁵². • Metaverse may reduce privacy because it reveals people's behavior and threatens privacy and security⁵³. • Too much use of digital media can lead to psychological disorders, mental disorders, and aggression ⁵⁴.

prevention of human-related medical errors that may result in provides savings⁴⁷. • One of the most important opportunities that Metaverse will offer to healthcare services is the ability to allow individuals to access healthcare services through the virtual universe, ensuring identity confidentiality. In this way, there will be no stigmatization since the identity of the patients is unknown⁴⁸. • There are attempts to provide physical therapy services by developing interactive games that develop hand and wrist joints using game sensors that detect movement. It is expected that these initiatives will be furthered with the integration of gaming and healthcare as a field within the Metaverse⁴⁹.	
OPPORTUNITIES OF METAVERSE HEALTH APPS	THREATS OF METAVERSE HEALTH APPS
• Metaverse provides significant opportunities for the creation of new business areas⁵⁰. • It provides significant opportunities for healthcare sector investors⁵¹. • It reduces health care and treatment costs¹¹. • Metaverse will provide significant convenience in hospital and healthcare institution management, medical education, patient diagnosis, treatment, and follow-up⁵¹. • Metaverse evaluates alternative treatment methods, presents different scenarios, and helps find the most appropriate treatment⁵⁵. • Metaverse's large data collection feature facilitates the creation of a global health organization. The increase in Metaverse applications in health leads to the advancement of technology and wearable technologies to come to the fore²³. • The government may provide various incentives for investment in health technologies⁵⁶. • It prevents hospital infections, reduces human errors, and reduces the workload of employees⁵⁷. • Surgical robots will learn to perform surgery on humans and perform difficult procedures on sensitive areas, cancerous tumors, and complex spine surgeries. This will be possible much more easily with robotic support ¹³. • Diseases that do not require physical control opportunity to see a doctor without going to a health institution. will be able to provide. This will provide time and cost advantages⁵⁸. • Through Metaverse, healthcare professionals will be able to easily empathize with the elderly, and treat and rehabilitate them⁵⁷. • Thanks to the Metaverse, infectious diseases can be prevented and treated without infecting others⁵⁸. • Prevents violence against healthcare workers⁵⁸.	Since Metaverse is a new application, there are some ethical issues⁵¹. • There are inequalities in access to health services. While people with sufficient digital technology receive adequate service, those with inadequate access to digital technology cannot receive adequate service⁵¹. • Excessive use of Metaverse can create addiction, and people who use it excessively become distant from real life, and psychological and physiological disorders may occur ¹⁷. • There may be stigma because people can easily access data¹⁸.

In Table 3 we see the SWOT analysis of Metaverse applications in healthcare. The strengths of metaverse applications in the healthcare system should be increased, weaknesses should be strengthened, opportunities should be evaluated and threats should be prevented.

Discussion

A wide field of study has emerged with the use of the metaverse in various sectors. Studies on the Metaverse in healthcare are increasing day by day and will continue to increase in the future. For example, Letafati and Otoum, (2023) investigated the privacy and security of e-health services in the metadata warehouse⁵⁹. Li et al., (2024) examined the next generation healthcare ecosystem in the Metaverse⁶. Ahuja et al., (2023). Digital metaverse: Researched its applications in artificial intelligence, medical education and integrative healthcare⁶⁰. Nguyen and Voznak, (2024). Conducted a bibliometric analysis of technology in digital health⁶¹. Sikandir et al., (2023) examined the interaction of metaverse, artificial intelligence and blockchain in healthcare⁶². Kulkarni et al., (2024) investigated the use of hybrid disease prediction, digital twin and metadata technologies⁶³. Hulsen (2024) examined the applications of metadata in medicine and healthcare⁶⁴. Thomason (2021) states that the Metaverse will offer significant opportunities and that healthcare professionals from all over the world will share their experiences in a virtual environment⁴⁶. Johan, (2022) examined the effects of the Metaverse on the law and business world⁶⁵. Jiang and Xu (2022) evaluated the education system with a SWOT analysis⁶⁶. Akpınar (2023) examined gender investments in Metaverse, one of the digital games, with a SWOT analysis⁶⁷. In addition, Filiz (2022)⁵¹, Chengoden (2023)⁶⁸ and Adigüzel (2024)⁶⁹ examined metaverse applications in healthcare using SWOT analysis. As can be understood from here, Metaverse will make a difference in the provision of healthcare services and will make a positive contribution to the protection, maintenance and development of health. In addition, with its contributions to health education, it will ensure that students receive higher quality education, facilitate internship applications and prevent mistakes caused by inexperience.

Conclusion, Limitations and Recommendations

Metaverse combines digital and augmented reality technologies to create interactive virtual environments. The overall results of the research indicate that Metaverse will make significant positive contributions to the Turkish and global healthcare systems. Metaverse applications in the healthcare sector will significantly contribute to areas such as education and training, preventive healthcare services, diagnosis, treatment, patient experience, and management. The following conclusions were summarized when the research findings were evaluated using a SWOT analysis.

STRENGTHS

Revolution in education: With virtual reality (VR) and augmented reality (AR), medical students and other healthcare professionals can receive hands-on training through realistic simulations and practice without harming the patient.

Remote healthcare services: Patient-doctor conversations can be conducted through avatars via Metaverse, facilitating access, reducing costs and saving time.

Patient experience and comfort: Patients can access certain services without physically visiting the hospital. This prevents hospital-acquired infections.

Data collection and analysis: Patient data collected digitally is analyzed with artificial intelligence to provide better diagnosis and treatment. It also provides personalized treatment tailored to the patient.

WEAKNESSES

High cost: Significant capital is required to acquire the necessary technological infrastructure and devices.

Lack of technological knowledge: Healthcare professionals and patients struggle to use metaverse technologies.

Data security and privacy: Ensuring the security of patient information in virtual environments is more difficult and risky.

Lack of physical examinations: Some diseases may not be adequately examined in a virtual environment.

OPPORTUNITIES

Increased accessibility: Patients living in rural and remote areas will have easier access to healthcare services. Consulting with renowned doctors and obtaining information will become easier.

Global collaborations: Experts in different countries can connect simultaneously for multidisciplinary virtual consultations.

THREATS

Insufficient legal regulations: Legal regulations for healthcare applications in the metaverse environment have not yet been fully established.

Cyberattacks: Because health data carries high value, the risk of cyberattacks in the metaverse environment is high.

Addiction and isolation: Overreliance on digital media, especially in psychological treatments, can have negative effects.

Social acceptance: Using the metaverse can be challenging for elderly individuals or groups unfamiliar with technology.

As can be seen from this, metaverse applications offer numerous advantages for healthcare institutions, patients, and their families.

They can provide the following benefits to healthcare institutions and organizations

Increased Patient Satisfaction: Patient satisfaction increases with virtual consultations, short waiting times, and personalized services. Patient loyalty increases, increasing loyalty.

Strengthening Staff Training: Provides healthcare professionals with hands-on training opportunities using real-time scenarios, reducing error rates. Harm to patients and the institution due to inexperience is reduced.

Operational Efficiency: Patient volume can be better managed through virtual meetings, and resources can be planned more effectively.

Innovation and Brand Value: Institutions that adopt metaverse technologies early on stand out with their innovative image. They gain a competitive advantage and market leadership. Patient trust in the institution increases.

Research and Development: Thanks to virtual data analysis and patient monitoring, scientific research can be conducted more quickly and cost-effectively. Treatment, care, and drug development are facilitated.

This study only includes a SWOT analysis of Metaverse healthcare applications. It is anticipated that future researchers will find it beneficial to examine applications in other sectors. Healthcare institutions that adopt Metaverse applications early will have an advantage over others.

REFERENCES

1. Mystakidis S. Metaverse. *Encyclopedia*. 2022;2(1):486–497.
2. Cayır A. Hemşirelik eğitiminde yapay zekânın önemi ve yapay zekânın kullanım alanları. *Balkan Sağlık Bilimleri Dergisi*. 2025;3(3):187-192. doi: 10.61830/balkansbd.1620267.
3. Yılmaz F, Mete AH, Fidan Türkön B, İnce Ö. Sağlık hizmetlerinin geleceğinde metaverse ekosistemi ve teknolojileri: Uygulamalar, fırsatlar ve zorluklar. *Eurasian Journal of Health Technology Assessment*. 2022;6(1):1-22. doi: 10.52148/ehta.1082705.
4. Söyler S, Averbek GS. Sağlık teknolojileri ve metaverse: Potansiyel uygulama alanları ve mevcut engeller. *International Anatolia Academic Online Journal Health Sciences*. 2022;8(2):38-166.
5. Secundo G, Toma A, Schiuma G, et al. Knowledge transfer in open innovation: A classification framework for healthcare ecosystems. *Business Process Management Journal*. 2019;25(1):144-163.
6. Li Y, Gunasekeran DV, RaviChandran N, et al. The next generation of healthcare ecosystem in the Metaverse. *Biomedical Journal*. 2024;47(3):1-10. doi: 10.1016/j.bj.2023.100679
7. Doğanyigit PB. Sağlık hizmetlerinde yenilik yaklaşımı. *Journal of Health and Management*. 2022;2(1):43-54.
8. Ağaoğlu FO, Ekinci LO, Tosun N. Metaverse ve sağlık hizmetleri üzerine bir değerlendirme. *Erzincan Binali Yıldırım Üniversitesi İktisadi ve İdari Bilimler Fakültesi Dergisi*. 2022;4(1):95-102. doi: 10.46482/ebyuibfdergi.1133902
9. Şimşir İ, Mete B. Sağlık hizmetlerinin geleceği: Dijital sağlık teknolojileri. *Journal of Innovative Healthcare Practices (JOINIHP)*. 2021;2(1):33-39.
10. Trost Z, France C, Anam M, et al. Virtual reality approaches to pain: Toward a state of the science. *Pain*. 2021;162(2):325-331. doi: 10.1097/j.pain.0000000000002060.

11. Duan H, Li J, Fan S, et al. Metaverse for social good: A university campus prototype. *In Proceedings of the 29th ACM International Conference on Multimedia*. 2021;153-161.
12. Ma M, Zheng H. *Virtual Reality And Serious Games In Healthcare*. Chapter, In Sheryl Brahnham, Lakhmi C.Jain (Eds.). doi: 10.1007/978-3-642-17824-5_
13. Elmer NA, Hassell N, Comer CD, et al. Plastic surgery in the metaverse. *Plast Surg (Oakv)*. 2024;32(2):355-356. doi: 10.1177/22925503221109714.
14. Bayer S. *Metaverse ve Sağlık Uygulamaları*. Editörler, Öz S, Akyıldız C, Yılmaz R, Metaverse; 2022.
15. Ergur A, Nuhoglu Ş. Gamma knife, bir ışıktan fazlası: dolayımlanmış müdahalenin cerrahi alanı yeniden yapılandırıcı etkisi. *Sosyoloji Araştırmaları Dergisi*. 2021;24(2):199-226.
16. Demet EN. Endüstri 4.0'ın sağlık dönüşüm programı ve sağlık hizmeti sunumu üzerine etkisi. *Sosyal, Beşeri ve İdari Bilimler Alanında Gelişmeler*. 2024;299-313.
17. Wehde M. Healthcare 4.0. *IEEE Engineering Management Review*. 2019;47(3):24-28.
18. Tortorella GL, Saurin TA, Fogliatto FS, et al. Impacts of healthcare 4.0 digital technologies on the resilience of hospitals. *Technological Forecasting and Social Change*. 2021;166:120666. doi: 10.1016/j.techfore.2021.120666.
19. Perez N, Elemento O, Sboner A, Sigaras A. Building the healthcare metaverse: Leveraging mixed reality guides to augment standard operating procedures (sop) in a precision medicine laboratory, *In Journal of Molecular Diagnostics*. 2022;24(10):85-86.
20. Saxena A, Malviya R. 3D printable drug delivery systems: Next-generation healthcare technology and regulatory aspects, *Current Pharmaceutical Design*. 2023;29(35):2814-2826.
21. Jung T, Cho J, Han ID, et al. Metaverse for service industries: Future applications, opportunities, challenges and research directions. *Computers in Human Behavior*. 2023;108039. doi: 10.1016/j.chb.2023.108039.
22. Wider W, Jiang L, Lin J, et al. Metaverse chronicles: A bibliometric analysis of its evolving landscape. *International Journal of Human-Computer Interaction*. 2023;40(21):1-14.
23. Moztarzadeh O, Jamshidi M, Sargolzaei S, et al. Metaverse and healthcare: Machine learning-enabled digital twins of cancer. *Boengineering*. 2023;10(4):455.
24. Gandi C, Cosenza L, Campetella M, et al. What can the Metaverse do for urology? *Urologia Journal*. 2023;90(3):454-458. doi: 10.1177/03915603231175940.
25. Randazzo G, Reitano G, Carletti F, et al. Urology: A trip into Metaverse. *World J Urology*. 2023;41:2647-2657. doi: 10.1007/s00345-023-04560-3.
26. Nawaz FA, Mekki YM, Tharwani ZH, et al. Toward a meta-vaccine future: Promoting vaccine confidence in the Metaverse. *Digital Health*. 2023;9:20552076231171477.
27. Xiao Y, Ahmad SF, Irshad M, et al. Investigating the mediating role of ethical issues and healthcare between the metaverse and mental health in Pakistan,

- China, and Saudi Arabia, *Humanit Soc Sci Commun.* 2024;1:441. doi: 10.1057/s41599-024-02643-z.
28. Skaldic I, Arangalag D, Kachrimanidis I, et al. Metaverse-based cardiac magnetic resonance imaging simulation application for overcoming claustrophobia: A preliminary feasibility trial. *Future Cardiology.* 2024;20(4):191–195.
29. Ergin E, Yalcinkaya T, Cinar Yücel S. Nurses' knowledge of, attitudes towards and awareness of the metaverse, and their future time perspectives: A cross-sectional study. *BMC Nurs.* 2024;23:414. doi: 10.1186/s12912-024-02048-y.
30. Della Corte M, Clemente E, Checucci E, et al. Pediatric urology metaverse. *Surgeries.* 2023;4(3):325-334. doi: 10.3390/surgeries4030033.
31. Habbal A, Ali MK, Abuzaraida MA. Artificial intelligence trust, risk and security management (ai trism): Frameworks, applications, challenges and future research directions. *Expert Systems with Applications.* 2024;240:122442.
32. Devrim B. Strateji Formülasyonu: SWOT Analizi, Kurumsal Karne, Kalite Fonksiyon Yayılımı, Sun Tzu'nun İşletme Yönetimi Stratejilerinin Bütünleştirilmesi Üzerine Bir Çalışma. [yüksek lisans tezi]. Dokuz Eylül Üniversitesi Sosyal Bilimler Enstitüsü, İzmir, 2023.
33. Uçar D, Doğru Ö. Strategic planning of GIS projects and place of SWOT Analysis, TMMOB Chamber of Surveying and Cadastre Engineers. 10th Turkish Scientific and Technical Scientific Congress, 28 March - April 2005, Ankara.
34. Avcıkurt C, Köroğlu A, Doğdubay M. Alternatif turizmin planlanmasında swot analizinin uygulanması. *Türkiye'nin Alternatif Turizm Potansiyeli ve Güncel Sorunları Konferansı, 3-4 Mayıs 2003, Çankırı.*
35. Polat E, Özdemir SS, Özdemir M. Kırsal turizm potansiyelinin SWOT analizi ile değerlendirilmesi: Balıkesir örneği, *Coğrafyacılar Derneği Uluslararası Kongresi Bildiriler Kitabı*, 2014;4-6.
36. Lee LH, Braud T, Zhou P, at all. All one needs to know about metaverse: A complete survey on technological singularity. *Virtual Ecosystem, and Research Agenda.* 2021;14(8):1-66. doi: 10.48550/arXiv.2110.05352.
37. Insawan H, Alwahidin A, Kira H, Putri AI. Implementation of the eco-metaverse in Indonesia: Sharia economic perspective. Samarah: *Jurnal Hukum Keluarga dan Hukum Islam.* 2025;9(1):107-129. doi: 10.22373/sjhk.v9i1.26262.
38. Alomar JA, Alatawi FM. Evaluating the challenges of metaverse-enabled digital entrepreneurship: Evidence from Saudi Arabia as an emerging economy. *Journal of Entrepreneurship in Emerging Economies.* 2025. doi: 10.1108/JEEE-07-2024-0266.
39. Akour IA, Al-Marroof RS, Alfaisal R, Salloum SA. A conceptual framework for determining metaverse adoption in higher institutions of gulf area: An empirical study using hybridsem-ann approach, *Computers and Education: Artificial Intelligence.* 2022;3.
40. Díaz J, Saldaña C, Ávila C. Virtual world as a resource for hybrid education, *International Journal of Emerging Technologies in Learning (iJET).* 2022;15(15):94-109.

41. Davis A, Murphy JD, Owens D, Khazanchi D, Ziguers I. Avatars, people, and virtual worlds: Foundations for research in metaverses. *Journal of the Association for Information Systems*. 2009;10(2):90. doi: 10.17705/1jais.00183.
42. Logeswaran A, Munsch C, ChongYJ, Ralph N, McCrossnan J. The role of extended reality technology in healthcare education: Towards a learner-centered approach. *Future Healthcare Journal*. 2021;8(1):79-84. doi: 10.7861/fhj.2020-0112.
43. Sheikh AH, Barry DS, Gutierrez H, Cryan JF, O'Keeffe GW. Cadaveric anatomy in the future of medical education: What is the surgeon's view? *Anatomical Sciences Education*. 2016;9(2):203-208. doi: 10.1002/ase.1560.
44. Ahmed H, Devoto L. The potential of a digital twin in surgery. *Surgical Innovation*. 2021;28(4):509-510. doi: 10.1177/15533506209758.
45. Yang D, Zhou J, Song Y, et al. metaverse in medicine. *Clinical eHealth*. 2022;(5):39-43.
46. Thomason J. Met health will the metaverse change health care? *Journal of Metaverse*. 2021;1(1):13-16.
47. Yılmaz A, Ölçer İ. Yapay zekânın cerrahi uygulamalara entegrasyonu. *Beykent Üniversitesi Fen ve Mühendislik Bilimleri Dergisi*. 2021;13(2):21-27.
48. Çam O, Çuhadar D. Ruhsal hastalığa sahip bireylerde damgalama süreci ve içselleştirilmiş damgalama. *Psikiyatri Hemşireliği Dergisi*. 2011;2(3):136-140.
49. Arman N, Tarakci E, Tarakci D, Kasapcopur O. Effects of video games-based task-oriented activity training (Xbox 360 Kinect) on activity performance and participation in patients with juvenile idiopathic arthritis: A randomized clinical trial. *American Journal of Physical Medicine & Rehabilitation*. 2019;98(3):174-181.
50. Hardjanto RW. Digital economy and blockchain technology using the swot analysis model. *Int J Innov Sci Res Technol*. 2022;7(2):2456-2165.
51. Filiz M. Metaverse and a swot analysis of Turkish health system. *Turkish Research Journal of Academic Social Science*. 2022;5(1):61-68.
52. Holsapple C, Wu J. User acceptance of virtual worlds: The hedonic framework. *ACM SIGMIS Database*. 2007;38(2):86-89. doi: 10.1145/1314234.1314250.
53. Acquisti A, Taylor C, Wagman L. The economics of privacy. *Journal of Economic Literature*. 2016;54(2):442-492.
54. Jeong E, Kim D, Lee D. Game addiction from a psychosocial health perspective, Proceedings of the 17th International Conference on Electronic Commerce, ICEC'15. 2015; Association for Computing Machinery.
55. Rizk SH. Ethical and regulatory challenges of emerging health technologies in Applied Ethics in a Digital World, I.Vasiliu-Feltes and J. Thomason, Eds. Hershey, PA: IGI Global. 2021;84-100.
56. Kye B, Han N, Kim E, Park Y, Jo S. Educational applications of metaverse: Possibilities and limitations. *Journal of Educational Evaluation for Health Professions*, 2021;18(32).
57. Yıldırım TÖ. Metaverse ve sağlık hizmetleri. Editör; Kaya H, Şahin KE. *Sağlık & Bilim 2022: Güncel Tıp-IV*, Efe Yayınları.

58. Akalın B. *Sağlık Yöneticilerinde İletişim*. Sağlık profesyonellerinin iletişim becerileri. 2024.
59. Letafati M, Otoum S. On the privacy and security for e-health services in the metaverse: An overview. *Ad Hoc Networks*. 2023;150(2). doi:[10.1016/j.adhoc.2023.103262](https://doi.org/10.1016/j.adhoc.2023.103262).
60. Ahuja AS, Polascik BW, Doddapaneni D, Byrnes ES, Sridhar J. The digital metaverse: Applications in artificial intelligence, medical education, and integrative health. *Integrative Medicine Research*. 2023;12(1). doi: 10.1016/j.imr.2022.100917.
61. Nguyen HS, Voznak M. A bibliometric analysis of technology in digital health: Exploring health metaverse and visualizing emerging healthcare management trends. *IEEE Access*. 2024;12. doi: 10.1109/access.2024.3363165.
62. Sikandir A, Armand ATPT, Athar A, et al. Metaverse in healthcare integrated with explainable ai and blockchain: Enabling immersiveness, ensuring trust, and providing patient data security. *Sensors*. 2023;23(565):1-17. doi: 10.3390/s23020565.
63. Kulkarni C, Quraishi A, Raparathi M, et al. Hybrid disease prediction approach leveraging digital twin and metaverse technologies for health consumer. *BMC Medical Informatics and Decision Making*. 2024;24(1):92. doi: 10.1186/s12911-024-02495-2.
64. Hulsen T. Applications of the metaverse in medicine and healthcare. *Advances in Laboratory Medicine/Avances en Medicina de Laboratorio*. 2024;5(2):159-165.
65. Johan S. Metaverse and its implication in law and business. *Jurnal Hukum Progresif*. 2022;10(2):153-166. doi: 10.14710/jhp.10.2.153-166.
66. Jiang C, Xu J. The application research of education metaverse under the framework of swot analysis. In International Conference on Metaverse. 2022;55-67. Cham, Springer Nature 2022, Switzerland.
67. Akpınar ME. A swot handbook of research on perspectives on society and technology addiction. *IGI Global*. 2023;318-327. doi: 10.4018/978-1-6684-8397-8.ch020.
68. Chengoden R, Victor N, Huynh-The T, et al. Metaverse for healthcare: A survey on potential applications, challenges and future directions. *IEEE Access*. 2023;11:12765-12795. doi: 10.1109/access.2023.3241628.
69. Adigüzel DÜ. The metaverse within the swot framework in consumer experience and decision-making in the metaverse. *IGI Global*. 2024:248-251.

- 1) **Istanbul Gelisim University Journal of Health Sciences** (*abbreviated title: IGUSABDER*) published three times a year, includes articles on specific research, case report and review related to Health Sciences (**Nutrition and Dietetics, Child Development, Physical Therapy and Rehabilitation, Ergotherapy, Gerontology, Nursing, Audiology, Speech and Language Therapy, Orthotics- Prosthetics, Perfusion, Healthcare Management, Social Service, Clinical, Paraclinical, Biological and Basic Sciences.**) Articles related to the field of dentistry are not included in our journal. The articles submitted to be published should be written in English. A full version of your manuscript submitted to IGUSABDER must not have been previously published.
- 2) The articles submitted for publication should be prepared in the format of
 - Times New Roman style, font size 12, A4 paper size, 1.5 line spacing and 2.5 cm margins of all edges.
 - Visual items like figures and tables should be written in the language the article is written and they should be placed appropriately in the text with the necessary explanations.
 - The titles of the tables, figures and graphics should be on the top and left aligned.
 - The abbreviations used in the article should be stated clearly where it is used for the first time and their abbreviations should be indicated between parantheses and specific abbreviations should not be used.
 - The first letters of the main titles should be capital, bold and center aligned.
 - The first letters of the sub titles should be capital, bold and left aligned.
 - Paragraph indentation should not be used.
- 3) The submission process of the article and its appendices should be carried out through DergiPark online article submission system at the address of <http://igusabder.gelisim.edu.tr> or <https://dergipark.org.tr/en/pub/igusabder>. During the submission, the authors should upload the figures of the manuscript to the online manuscript submission system. First of all, if the manuscript is accepted for publication, the copyright transfer agreement form signed by all the authors should be sent to the editorial office. **“Ethical Statement and Copyright Transfer Form”** should be signed by all authors and should be loaded to the system. Studies that requiring ethics committee approval, the **“Ethics Committee Approval Document”** should also be uploaded to the system. If the article is not accepted, the related forms will be invalid. In case the article is not accepted, related form will be invalid.
- 4) According to TUBITAK ULAKBIM DergiPark rules are required, each author should have an ORCID information and should add it to the journal profile. Authors need to enter their ORCID identity into the system while uploading their article. It is possible to obtain the ORCID number free of charge through the <https://orcid.org/signin> website.
- 5) Authors should indicate the institution, date and approval number they have received in the **Ethics Committee Approval** required for the article they wish to publish, at the end of the Discussion section of the Materials and Methods section. Statement of **“Informed Volunteer Consent/Approval Form”** to participants should be included at the end of the discussion section in statements such as conflicts of interest, thanks, supporting organizations and case reports. This information should be written in text language.

6) For all articles, Turkish and English abstracts

- Should be no more than 400 words and they should be written with at least 3 keywords.
- Only the first letter of the first key word should be capital, the other key words should be written with small letters with comas between them.
- Key words in English and Turkish should be selected in accordance with the Turkish Scientific Terms. Accessed from (<http://www.bilinterimleri.com/>).
- The necessary changes recommended for authors who do not have access to the Turkish Scientific Database are made by the Editorial Office.

7) ARTICLE TYPES

7.1. Original Research Articles: Original (full-length) Articles are original and proper scientific papers based on sufficient scientific research, observations and experiments. Articles should consist of title, abstract and keywords in Turkish and title, abstract and keywords in English as well as Introduction, Material & Methods, Results, Discussion, Conclusion and References parts. Also it should not exceed 12 pages except in exceptional circumstances (including text, tables and illustrations). There is no limit for the number of references.

The abstract should include the aim, method, results and the conclusion and it should be written accordingly with the example given below.

Example:

Abstract

Aim: The research has been made descriptively in order to determine the levels of the communication skills and the related variables.

Method: The universe of the research consists of 1116 students at the School of Health Sciences of a private university. In the research the universe has not been selected and the universe consists of 615 students that has accepted to join the research. The information form and communication skills scale has been used to collect the data. The data has been evaluated with the SPSS programme.

Results: According to the research findings, the communication skills scale score average is 156.1 ± 13.5 . When the relationship between the sociodemographic characteristics and the communication skills scale and the sub dimensions score average is analyzed, in women behavioral sub dimension score average is higher at students that have taken a theoretical education about communication ($p < 0.05$). The communication skills scale of the students' whose father's education levels are literate is higher ($p < 0.05$)

Conclusion: As a result of the research it has been determined that the communication skills score average is at medium level and it can be suggested that more lessons about communication skills should be given at all departments of the School of Health Sciences.

Keywords: Health, student, communication.

Örnek:

Öz

Amaç: Araştırma, Sağlık Bilimleri Yüksekokulu öğrencilerinin iletişim becerileri düzeylerini ve ilişkili değişkenleri belirlemek amacıyla tanımlayıcı olarak yapılmıştır.

Yöntem: Araştırmanın evrenini, İstanbul'da bulunan bir özel üniversitenin Sağlık Bilimleri Yüksekokulu'nda öğrenim gören 1116 öğrenci oluşturmuştur. Araştırmada örneklem seçimine gidilmeksizin çalışmaya katılmayı kabul eden 615 öğrenci çalışma kapsamına alınmıştır. Verilerin toplanmasında, Bilgi Formu ve İletişim Becerileri Ölçeği kullanılmıştır. Veriler SPSS programı ile değerlendirilmiştir.

Bulgular: Araştırma bulgularına göre; iletişim becerileri ölçeği puan ortalaması 156,1±13,5 bulunmuştur. Öğrencilerin sosyodemografik özellikleri ile iletişim becerileri ölçeği ve alt boyutlarının puan ortalamaları ilişkisi değerlendirildiğinde; kadınlarda, odyoloji bölümünde okuyanlarda ve iletişim ile ilgili teorik eğitim alanlarda davranışsal alt boyutu puan ortalaması daha yüksek bulunmuştur ($p<0,05$). Baba eğitim düzeyi okuryazar olan öğrencilerin iletişim becerileri ölçeği puan ortalaması daha yüksek bulunmuştur ($p<0,05$).

Sonuç: Araştırma sonucunda iletişim becerileri puan ortalaması orta düzeyde olduğu saptanmış olup, iletişim becerilerinin daha da geliştirilebilmesi için Sağlık Bilimleri Yüksekokulunun tüm bölümlerinde iletişim becerileri ile ilgili derslere daha fazla yer verilmesinin faydalı olacağı düşünülmektedir.

Anahtar Sözcükler: Sağlık, öğrenci, iletişim.

7.2. Case Report: These are the articles that describe rare significant findings encountered in the application, clinic and laboratory of related fields. The reports should include the sections of Introduction, Case History, Conclusion and References and they should not exceed 6 pages. It should be declared that the "Informed Volunteer Consent / Approval Form" was signed at the end of the discussion section.

7.3. Review: These are original articles that the author reviews a current and significant subject through the results that the author obtains from his/her own point of view and research. The reviews should include the sections of Introduction, Conclusion and Suggestions and References and they should not exceed 12 pages.

- 8) Author/Authors' e-mail addresses, institutional information, ORCID information, main text file must be included as footnotes on the first page and added to relevant places in the system during online application. In addition, in research articles -as in the example- ETHICAL STATEMENT note should be included in this part. The language of the information must be the same as the language of the article. Here is an example of how the format of this information is:

(Original Research Article)

Received: & /Accepted:

* Lecturer, Istanbul Gelisim University, Vocational School of Health Sciences, Pathology Laboratory Techniques Program, Istanbul, Türkiye. E-mail:

ORCID <https://orcid.org/.....>

** Prof. Dr., Kırıkkale University, Faculty of Arts and Sciences, Department of Biology, Kırıkkale, Türkiye. E-mail: **ORCID** <https://orcid.org/.....>

ETHICAL STATEMENT: This study was carried out with the approval of the Ethics Committee of University, dated .../.../..... and numbered A signed subject consent form in accordance with the Declaration of Helsinki was obtained from each participant.

- 9) The necessary descriptive information about article (thesis, project, financial supports etc.) should be explained as footnote in article title.

- 10)** If cited in the text, it should be numbered as superscript. Also, References should be listed with numerical order as they appear in the text and the reference number should be indicated inside the parentheses at the cited text place. (For instance..... has been found¹.)

References should be written by using **Journal of American Medical Association** (JAMA Citation Style). This information can be accessed from the links below.
http://guides.med.ucf.edu/ld.php?content_id=5191991
<https://med.fsu.edu/userFiles/file/AmericanMedicalAssociationStyleJAMA.pdf>

REFERENCES

11.1. BOOKS

11.1.1. One Author	Author last name Author's first initials. Title of Book. Edition number. Place of publication: Publisher; year. Duyan V. <i>Sosyal Hizmet: Temelleri, Yaklaşımları, Müdahale Yöntemleri</i>. Ankara: Nar Yayınevi; 2010. Bickley LS. <i>Bate's Guide to Physical Examination and History Taking</i>. Philadelphia: Wolters Kluwer Health/Lippincott Williams & Wilkins; 2013.
11.1.2. More than one author (List all authors if six or less, otherwise list three followed by "et al" or "ve ark")	Author(s) last name Author(s)' first initials separated by commas. Title of Book. Place of publication: Publisher; year. Tayfur M, Barış O, Nazan Baştaş N. <i>Diyetisyenlik Eğitimi ve Meslek Etiği</i>. 2. baskı. Ankara: Hatiboğlu Yayınevi; 2014. Shils M, Shike M, Olson J, Ross AC. <i>Modern Nutrition in Health and Disease</i>. 9th ed. Baltimore: Lippincott Williams & Wilkins, 1998.
11.1.3. Edited book	Author(s) last name Author(s)' first initials, ed(s). Title of Book. Edition number. Place of publication: Publisher; year. Norman IJ, ed. <i>Mental Health Care for Elderly People</i>. New York: Churchill Livingstone; 1996.

11.1.4. Chapter or article from a book	Author(s) last name Author(s)' first initials of article. Title of article. In: Editor's name, ed(s). Title of Book. Edition number. Place of publication: Publisher; Year. Cohen M. Chronic and Acute. In: Sapphire P, ed. <i>The Disenfranchised</i>. Amityville, New York: Baywood Publishing; 2013. Phillips SJ, Whisnant JP. Hypertension and stroke. In: Laragh JH, Brenner BM, eds. <i>Hypertension: Pathophysiology, Diagnosis and Management</i>. 2nd ed. New York: Raven Press; 1995.

11.2. JOURNALS

Author(s) last name Author(s)'s first initials. Article title. Journal Title. Year;volume(issue):Inclusive page numbers.(List all authors if six or less, otherwise list three followed by "et al" or "ve ark") Sevinç S, Yavaş Çelik M. Akıba evliliklerinin çocuk sağığına etkisi ve hemşirelik yaklaşımı. <i>Sağılık ve Toplum</i>. 2016;2:23-28. Nabavi SM, Habtemariam S, Daglia M, et al. Neuroprotective effects of ginkgolide B against ischemic stroke: a review of current literature. <i>Curr Top Med Chem</i>. 2015;15(21):2222-2232

11.3. ELECTRONIC SOURCES

11.3.1. Electronic articles from online journals with DOI available	Author(s) last name Author(s)'s first initials. Title of article. Name of Journal. Year;volume(issue):pages. doi:11.1111. Üstün G, Aluş Tokat M. Gestasyonel diyabet emzirme sonuçları için ne kadar önemli? <i>Perinatoloji Dergisi</i>. 2011;19(3):123-129. doi: 10.2399/prn.11.0193005. Rosenbaum M, Leibel RL. Models of energy homeostasis in response to maintenance of reduced body weight. <i>Obesity</i>. 2016;24(8):1620-1629. doi: 10.1002/oby.21559.
11.3.2. Electronic articles from online journals without DOI available	Author(s). Title of article. Name of Journal. Year;vol(issue):pages. URL. Published date. Updated date. Accessed date. Thomas JL. Helpful or harmful? Potential effects of exercise on select inflammatory conditions. <i>Phys Sportsmed</i>. 2013;41(4):93-100. https://physsportsmed.org/psm.2013.11.2040. Accessed November 22, 2013.
11.3.3. (eBOOK) Book chapter/ article from eBOOK	Author(s) last name Author(s)'s first initials of chapter/article. Title of article. In: Editor's name, ed(s). Title of Book. Edition number. Place of publication: Publisher; year. URL. Accessed date: Chapter or page number or section number. Fields HL, Martin JB. Pain: pathophysiology and management. In: Longo DL, Fauci AS, Hauser SL, Kasper DL, Loscalzo J, Jameson JL, eds. <i>Harrison's Principles of Internal Medicine</i>. 18th ed. New York: McGraw-Hill; 2012. http://www.accessmedicine.com.ezproxy.med.ucf.edu/resourceTOC.aspx?resourceID=4. Accessed November 22, 2013:71-73.
11.3.4. Web pages	Author(s) or responsible body. Title of item cited. Name of website. URL. Published date. Updated date. Accessed date. World Health Organization. Philippines: Assistance and response after Typhoon Haiyan. World Health Organization. http://www.who.int/features/2013/philippinestypoonhaiyan/en/index.html. Published November 2013. Accessed November 22, 2013.

11.4. OTHER SOURCES

11.4.1. Thesis	Author last name Author's first initials. Title of Thesis. [type of thesis]. Name of the place where the thesis was made, Name of the country: Name of the department, Name of the Institute; year. Undeman C. Fully Automatic Segmentation of MRI Brain Images [master's thesis]. Stockholm, Sweden: NADA, Royal Institute of Technology;2001.
11.4.2. Conference paper	Author(s) last name Author(s)' first initials. Title of conference paper. In: Title of conference; Day month, year; Name of the place where the conference was made, Name of the country. Bengtsson S, Solheim BG. Enforcement of data protection, privacy and security in medical informatics. In: Proceedings of the 7th World Congress on Medical Informatics; Sep 6-10, 1992; Geneva, Switzerland. Abstract 209.
11.4.3. Newspaper article	Author(s) last name Author(s)' first initials. Title of newspaper article. Name of the newspaper. Day month, year. Lee G. Hospitalizations tied to ozone pollution: study estimates 50,000 admissions annually. <i>The Washington Post</i>. Jun 21, 2006:A3.

- 12) The Latin expression such as species names of bacterium, virus, parasite and fungus and anatomical terms must be written in italic character keeping their original forms.
- 13) The editorial board has the right to perform necessary revision and reduction in the article submitted for publication and to express recommendations to the authors. The articles sent to authors for correction should be sent back to the editorial office within the time specified. Articles which are pre-estimated and deemed suitable for evaluation are sent to at least two referees specialized in the related field and the article can be published after the reports and evaluations come from experts on consultative committee are evaluated and approved.
- 14) All responsibilities from published articles merely belong to the authors.
- 15) Once the article has been uploaded to the system, it is mandatory that the plagiarism checker (iThenticate, TURNITIN, URKUND) for the article be uploaded to the relevant section of the "Submit Article" module on the web page of our journal. Except for bibliography and abstract, "exclusion" should not be applied in the similarity report.
- 16) There is no copyright fee for the authors.
- 17) Published journal is sent to the authors for free.
- 18) All persons submitting articles to the journal are deemed to have accepted these rules.