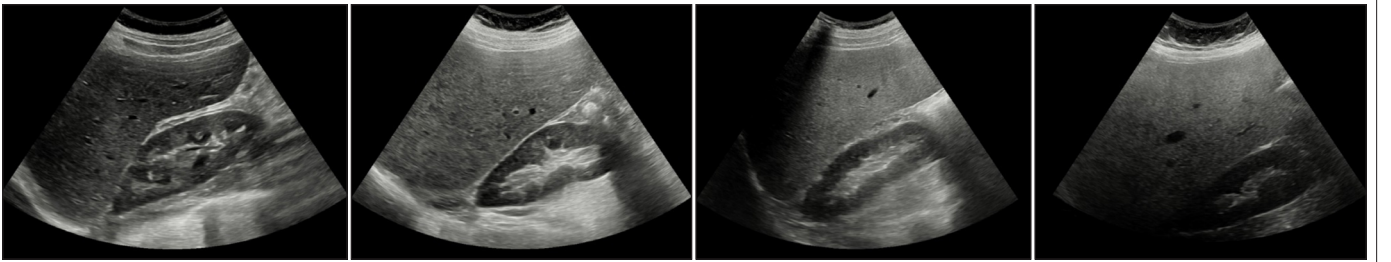


Türkiye Diyabet ve Obezite Dergisi

Turkish Journal of Diabetes and Obesity

Zonguldak Bülent Ecevit Üniversitesi Obezite ve Diyabet Uygulama ve Araştırma Merkezi Yayın Organıdır



Ultrasonographic findings of NAFLD

- Association of Insulin Resistance and Ectopic Fat Accumulation with HOMA Indices: A Single-Centre Observational Study
- The Effects of Summer on Body Composition, Perceived Stress Level and Body Awareness of Young Women and Men: A University Example
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European Association for the Study of Obesity

EASO Collaborating Centres for Obesity Management (COMs)

**Centre: Zonguldak Bülent Ecevit University
Obesity and Diabetes Application and Research Center**

Contact: Professor Taner Bayraktaroglu

We would like to take this opportunity to thank you for submitting a renewal application for your centre.

As you are aware, under the EASO COM scheme, obesity management centres are accredited against a set of carefully developed criteria and in accordance with accepted European and academic guidelines, with centres assessed by the EASO Obesity Management Task Force (OMTF). The OMTF has reviewed the renewal application of your centre and we are delighted to inform you that it has been accredited for a further three-year period from **1st July 2022 to 30th June 2025**.

Your centre will continue to be recognised by EASO as a leading obesity management centre in Europe throughout that period. The EASO COM network brings together accredited centres from across Europe and, as a member of this network, you (and your centre) will have the opportunity to contribute to a number of important EASO projects. One of the main goals of the COM network is to develop consensus guidelines on a number of management issues, with consensus achieved via the exchange of expertise during specially convened 'COM Summit Meetings'.

We look forward to continuing or work with you to develop the EASO COM network and its important actions in the coming years.

With kind regards
Yours sincerely

Professor Jason Halford
President, EASO

Professor Luca Busetto
Dr Dror Dicker
Co-Chairs, EASO OMTF

Mr Euan Woodward
Executive Director, EASO

On behalf of the EASO OMTF and Executive Committee.



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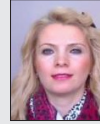
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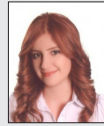
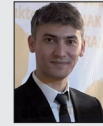
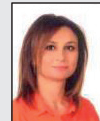
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Turkish Journal of Diabetes and Obesity (Turk J Diab Obes)

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Öz

İki yüz elli sözcükten fazla olmayan Türkçe öz yazılmalıdır. Öz kısmı amaç, gereç ve yöntemler, bulgular ve sonuç bölümlerini içermelidir. Kısaltmalar ve kaynaklar kullanılmamalıdır. Özün sonunda yer alacak anahtar sözcükler, üç ile yedi sözcük arasında, Index Medicus Tıbbi Başlıklar (MeSH) listesine uygun olarak alfabetik sırada verilmelidir. Bir başka sayfaya, Türkçe öz ve anahtar sözcüklerin birebir tercümesi olacak biçimde İngilizce öz (abstract) yazılmalıdır.

Olgu sunumlarında ise; amaç, olgu (lar), sonuç (lar) bölümlerini içeren yapılandırılmış öz bulunmalıdır.

Metin Sayfaları

Makalenin ana metni giriş, gereç ve yöntemler, bulgular ve tartışma başlıkları altında verilmelidir. Bütün ölçümler metrik sistemde verilmelidir. Simgeler ve kısaltmalar uluslararası standartlarda olmalıdır. Kısaltmalar metinde ilk görüldüğünde açıklanmalı ve genel kabul görmüş olanlarla sınırlandırılmalıdır. İstatistiksel analiz için kullanılan testler metinde ve tablolarda belirtilmelidir. Yazarlar, metnin sonunda teşekkür başlığı altında, çalışmanın gerçekleşmesi için katkıda bulunan kişi, kurum ve kuruluşlar varsa bildirebilirler. Makalenin sonunda çıkar çatışması, yazar katkı beyanı, finansal destek ve etik kurul onay başlıkları doldurulmalıdır.

Tablo, Şekil ve Resimler

Tablolar ana metin içinde kaynaklardan sonra gelmeli, her tablo ayrı bir sayfada olacak şekilde ve çift aralıklı olarak yazılmalıdır. Makale içindeki geçiş sırasına göre numaralandırılmalı ve kısa başlık içermelidir. Metin içerisinde de yerleri belirtilmelidir. Tablo başlığı tablonun üstünde, tablo açıklamaları ve kısaltmalar altta yer almalıdır.

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rında glikojen ve oksidatif stres parametreleri üzerine etkisi. Med J West Black Sea. 2022;6(2):177-185.

Kitaplar

Bölümün yazarlarının ad(lar)ı, kitabın adı, kaçınıcı baskı olduğu, yayımlandığı yer, yayınevi, yıl.

Larsen PR, Kronenberg HM, Melmed S, Polonsky KS. Williams Textbook of Endocrinology, 10th Edition, Philadelphia, Elsevier Science, 2003.

Kitap bölümü

İlgili bölüm yazar ad(lar)ı, ilgili bölüm adı, editör(ler), kitabın adı, yayımlandığı yer, yayınevi, yıl, ilk ve son sayfa numarası.

Marsh PD, Nyvad B. The oral microflora and biofilms on teeth. In: Fejerskov O, Kidd E, editors. Dental caries the disease and its clinical management. 2nd ed. Blackwell Munksgaard; 2004. 29-48.

Çevrimiçi makaleler

Aboud S. Quality improvement initiative in nursing homes: the ANA acts in an advisory role. Am J Nurs [Internet yayını]. 2002;102(6) (Erişim Tarihi: 12.08.2002 <http://www.nursing-world.org/AJN/2002/june/Wawatch.htm>).

Tez örneği

Sağlam C. Cerrahi menopoz modeli oluşturulan genç dişi sıçanlarda glp-1 agonistinin depresyon benzeri davranışlara etkisi (Yüksek Lisans Tezi), Zonguldak, Zonguldak Bülent Ecevit Üniversitesi, 2022, 1-106, (ErişimLinki ve Tarihi:)

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“Turkish Journal of Diabetes and Obesity” is a scientific publication of Zonguldak Bülent Ecevit University Faculty of Medicine and Diabetes Research and Application Center. The journal started publication in 2017. It is a peer-reviewed journal that has been included in TR and the Turkish Citation Index since 2019. It is published three times a year, in April, August and December. The publishing language of the journal is Turkish and English.

The aim of the journal is to report and share qualified research studies conducted in relevant fields in Türkiye and abroad by presenting them to the national and international scientific community, and to contribute to scientific to academic and social communication by creating a continuous education platform. In accordance with these aims, the journal publishes original research in the field of obesity and diabetes mellitus, including case reports, review articles, short communications, letters to the editor, biography articles and conference proceedings written in article format. Papers or preliminary studies presented in congresses, symposiums, or online can be published in the journal, provided that this situation is stated. Manuscripts sent to this journal are accepted on the condition that they have not been published anywhere before and have not been sent to another journal for publication.

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Book

Name(s) of the authors of the chapter, title of the book, edition, place of publication, publisher, year.

Larsen PR, Kronenberg HM, Melmed S, Polonsky KS. *Williams Textbook of Endocrinology*, 10th Edition, Philadelphia, Elsevier Science, 2003.

Book Chapter

Author name(s) for the chapter, chapter title, editor(s), title of the book, place of publication, publisher, year, first and last page numbers.

Klein S, Romijn JA. Obesity. In: Larsen PR, Kronenberg HM, Melmed S, Polonsky KS. *Williams Textbook of Endocrinology*, 10th Edition, Philadelphia, Elsevier Science, 2003, p.1642-1706.

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Aboud S. Quality improvement initiative in nursing homes: the ANA acts in an advisory role. *Am J Nurs* [Internet publication]. 2002;102(6). (Accessed Date: 12.08.2002 <http://www.nursingworld.org/AJN/2002/june/Wawatch.htm>)

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Sağlam C. Effect of glp-1 agonist on depression-like behaviors in young female rats created as a surgical menopause model. (Master’s Thesis), Zonguldak, Zonguldak Bülent Ecevit University, 2022, 1-106 (Access Link and Date:).

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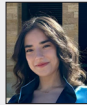
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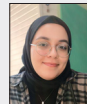
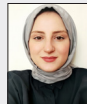
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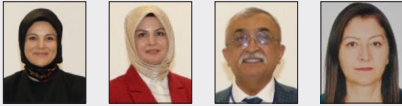
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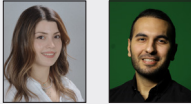
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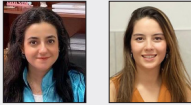
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Editörden

Değerli Okuyucular,

Zonguldak Bülent Ecevit Üniversitesi, Obezite ve Diyabet Uygulama ve Araştırma Merkezi tarafından yayımlanan “Türkiye Diyabet ve Obezite Dergisi” 2024 yılı Ağustos sayısını (Cilt 8, Sayı 2) fiziki ve elektronik ortamda sizlere sunmaktayız.

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Dergimizin bu sayısında obezite ve diabetes mellitus alanında literatüre katkıda bulunan çalışmalarını içeren makaleleri bulacaksınız:

- İnsülin Direnci ve Ektopik Yağ Birikiminin HOMA İndeksleri ile İlişkisi: Tek Merkezli Bir Gözlem Çalışması
- Genç Bireylerin Vücut Kompozisyonu, Algılanan Stres Düzeyi ve Vücut Farkındalığında Yaz Mevsiminin Etkisi: Bir Üniversite Örneği
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Türkiye Diyabet ve Obezite Dergimizin bu sayısının yayınlanmasında; desteklerini esirgemeyen Rektörümüz Prof. Dr. İsmail Hakkı ÖZÖLÇER'e, yazarlara, yazıları titizlikle değerlendiren hakemlerimize, Danışma Kurulumuza, Dil Redaksiyon Kurulumuza, Alan Editörlerine, Biyoistatistik Kuruluna, Yayın Kurulumuza ve yayınevimize teşekkür ederiz.



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Ağustos 2024



Prof. Dr. Taner Bayraktaroğlu
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Editorial

Dear Readers,

Zonguldak Bülent Ecevit University, Obesity and Diabetes Application and Research Center, presents the August 2024 issue of "Turkish Journal of Diabetes and Obesity" (Volume 8, Issue 2) to you in physical and electronic formats.

Our journal continues to publish with the same quality with the publishing ethics principles updated by TUBITAK ULAKBİM TR Index, increasing number of publications and citations. Increasing citations to the publications in our journal by our authors, researchers and scientists further increase the quality of our journal and its place in the scientific world.

We are sharing an innovation in publishing with you in this issue of our journal. With the decision we have made, graphical summaries of the articles will also be published together.

Journals are increasingly requesting the submission of a "graphical" or "visual abstract" alongside the body of the article. A graphical abstract should allow readers to quickly gain an understanding of the main take-home message of the paper and is intended to encourage browsing, promote interdisciplinary scholarship, and help readers identify more quickly which papers are most relevant to their research interests. This is a single, concise, pictorial and visual summary of the main findings of the article. It could either be the concluding figure from the article or better still a figure that is specially designed for the purpose, which captures the content of the article for readers at a single glance (Writing rules / Graphical Abstract, <https://dergipark.org.tr/en/pub/tudod/page/16811>).

In this issue of our journal, you will find articles containing research and review that will contribute to the literature:

- Association of Insulin Resistance and Ectopic Fat Accumulation with HOMA Indices: A Single-Centre Observational Study
- The Effects of Summer on Body Composition, Perceived Stress Level and Body Awareness of Young Women and Men: A University Example
- Investigation of The Effect of Smoking on Eating Behaviors and Body Mass Index in Adults: A Cross-Sectional Study
- Screening Patients with Type 2 Diabetes at High Risk of Obstructive Sleep Apnea: A Single Tertiary Center Experience
- Evaluation of the Effectiveness of Healthy Nutrition and Obesity Awareness Education for Middle School Students Using Drama-Based Learning Activities
- Investigation of the Relationship Between Health Anxiety and Cyberchondria in Obese Cases
- Effects of SGLT2 Inhibitors on Hematologic Parameters in Patients with Type 2 Diabetes Mellitus: A Retrospective Study
- Evaluation of Work-Related Factors Affecting the Frequency of Overweight and Obesity Among Healthcare Workers in Intensive Care Units in a Training and Research Hospital
- Determining The Relationship Between Diet Inflammatory Index Score, Depression and Chronotype In Individuals with Metabolic Syndrome: An Example of a Training and Research Hospital
- Evaluation of Happiness Levels According to Disease Awareness and Acceptance in Patients with Type 2 Diabetes Mellitus
- "Both My Body and My Spirit are Incomplete": Care Needs and Difficulties Experienced by Patients with Amputation

In the our journal of the Turkish Diabetes and Obesity ; We would like to thank to our Rector Prof. Dr. İsmail Hakkı ÖZÖLÇER for his support, to the authors, to our referees for carefully evaluating the articles, to our Advisory Board, to our Language Editorial Board, to our Editors and Deputy editors, to technical supporters, to our Biostatistics Editors, to our Editorial Board and our publishing house.

İnci Turan, Dr.Ac.Lec.

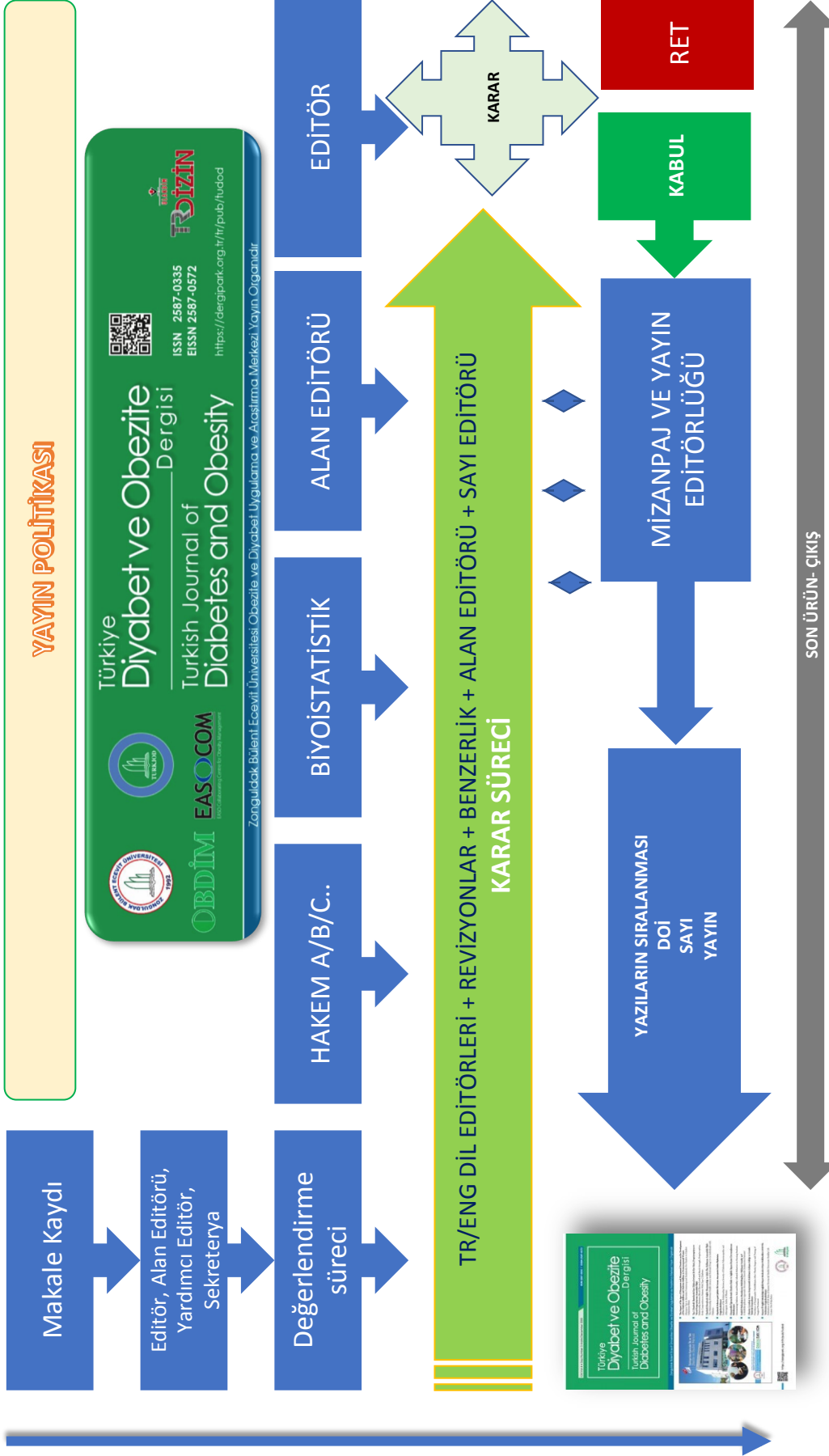
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August 2024

Taner Bayraktaroğlu, Prof., MD

Editor in Chief

August 2024



Association of Insulin Resistance and Ectopic Fat Accumulation with HOMA Indices: A Single-Centre Observational Study

Sevde Nur EMİR¹  , Servet EMİR² 

¹University of Health Sciences, Umraniye Training and Research Hospital, Department of Radiology, Istanbul, Türkiye

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Cite this article as: Emir SN and Emir S. Association of insulin resistance and ectopic fat accumulation with HOMA indices: A single-centre observational study. Turk J Diab Obes 2024;2: 97-106.

GRAPHICAL ABSTRACT

Aim-Methods	Results	Conclusion
<p>Investigate the association between NAFLD and NAFPD detected by US and HOMA indices</p> <p>Participants: Obese patients without diabetes</p> <p>Assessment Tools: Abdominal ultrasound, fasting plasma glucose, C-peptide levels, BMI</p>	<p>NAFLD: Weak positive correlation with HOMA-B Moderate positive correlation with HOMA-IR Strong negative correlation with HOMA-S</p> <p>NAFPD: No significant effect on HOMA scores.</p>	<p>NAFLD is significantly associated with insulin resistance, highlighting the metabolic burden of ectopic fat in obese patients.</p> <p>NAFPD shows no significant correlation with insulin resistance or beta-cell function, suggesting different metabolic impacts.</p>
Turkish Journal of Diabetes and Obesity	Sevde Nur Emir, Servet Emir	Emir SN and Emir S. Association of insulin resistance ... Turk J Diab Obes 2024;2: 97-106.

ABSTRACT

Aim: The aim of this study was to investigate the relationship between non-alcoholic fatty liver disease (NAFLD), non-alcoholic fatty pancreas disease (NAFPD) and HOMA indices in obese patients without a diagnosis of diabetes mellitus, using ultrasound (US) as a common non-invasive diagnostic tool during routine examinations.

Material and Methods: In this single-centre, retrospective study, the records of patients who applied to the obesity outpatient clinic in 2023 were reviewed. Digital records were scanned and patients with abdominal ultrasound reports indicating age, gender, body mass index (BMI), fasting plasma glucose, C-peptide level and degree of pancreatic and hepatic steatosis were included in the study. Patients with known chronic disease or diabetes mellitus and patients with specific drug use were excluded from the study. HOMA indices were calculated using fasting plasma glucose and C-peptide levels. Descriptive statistics were calculated. Spearman's rho coefficient assessed correlations between NAFLD, NAFPD, and HOMA indices and the Kruskal-Wallis and Mann-Whitney U tests evaluated the effect of NAFLD and NAFPD on HOMA indices. ROC analysis predicted NAFLD presence using HOMA-IR and HOMA-S values, showing high model accuracy. Statistical analyses were performed with IBM SPSS v28.0, with significance set at $p < 0.05$.

Results: A total of 62 patients were included. Body mass index was 39.1; 91% had NAFLD and 82% had NAFPD. There was a significant positive correlation between BMI and NAFLD and NAFPD. In our study, NAFLD showed a weak positive correlation with beta-cell function (HOMA-B) (Spearman's $\rho = 0.277$, $p = 0.029$), a moderate positive correlation with insulin resistance (HOMA-IR) (Spearman's $\rho = 0.555$, $p < 0.00001$), and a strong negative correlation with insulin sensitivity (HOMA-S) (Spearman's $\rho = -0.555$, $p < 0.001$). No significant effect of NAFPD on HOMA scores was observed.

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Conclusion: The findings underline the association between NAFLD and insulin resistance and highlight the metabolic burden of ectopic fat deposition in obese patients. In contrast, there was no significant correlation between NAFLD and either insulin resistance or beta-cell function, suggesting that the metabolic impact of pancreatic steatosis might be different. These findings may help to guide clinical strategies for detecting and treating metabolic disorders in obesity.

Keywords: Non-alcoholic fatty liver disease, Non-alcoholic fatty pancreas disease, Insulin resistance, Obesity, HOMA index, Ultrasound imaging

İnsülin Direnci ve Ektopik Yağ Birikiminin HOMA İndeksleri ile İlişkisi: Tek Merkezli Bir Gözlem Çalışması

GRAFİKSEL ÖZET

Amaç-Yöntem	Bulgular	Sonuç
<p>Ultrasonografi (US) ile tespit edilen NAFLD ve NAFLD'nin HOMA indeksleri ile ilişkisinin araştırılması</p> <p>Katılımcılar: Diyabeti olmayan obez hastalar</p> <p>Değerlendirme Araçları: Abdominal ultrasonografi, açlık plazma glukozu, C-peptid seviyeleri, VKİ (Vücut Kitle İndeksi)</p>	<p>NAFLD: HOMA-B ile zayıf pozitif korelasyon HOMA-IR ile orta düzeyde pozitif korelasyon HOMA-S ile güçlü negatif korelasyon</p> <p>NAFLD: HOMA skorları üzerinde anlamlı bir etkisi yok</p>	<p>NAFLD: İnsülin direnci ile anlamlı bir şekilde ilişkilidir, bu da obez hastalardaki ektopik yağın metabolik yükünü vurgulamaktadır.</p> <p>NAFLD: İnsülin direnci veya beta hücre fonksiyonu ile anlamlı bir korelasyon göstermez, bu da farklı metabolik etkiler olduğunu düşündürmektedir.</p>
Türkiye Diyabet ve Obezite Dergisi	Sevde Nur Emir, Servet Emir	Emir SN ve Emir S. İnsülin direnci ve ektopik yağ ... Turk J Diab Obes 2024;2: 97-106.

ÖZ

Amaç: Bu çalışmanın amacı, diyabetes mellitus tanısı olmayan obez hastalarda, rutin muayeneler sırasında yaygın bir non-invaziv tanı aracı olan ultrason (US) kullanılarak, non alkolik yağlı karaciğer hastalığı (NAFLD), non alkolik yağlı pankreas hastalığı (NAFLD) ve HOMA indeksleri arasındaki ilişkiyi araştırmaktır.

Gereç ve Yöntemler: Bu tek merkezli, retrospektif çalışmada, 2023 yılında obezite polikliniğine başvuran hastaların kayıtları gözden geçirilmiştir. Dijital kayıtlar taranmış ve yaş, cinsiyet, vücut kütle indeksi (VKİ), açlık plazma glukozu, açlık plazma glikozu, C-peptid seviyesi ve pankreatik ve hepatik steatoz derecesini belirten abdominal ultrason raporlarına sahip hastalar çalışmaya dahil edilmiştir. Bilinen kronik hastalığı veya diyabetes mellitusu olan ve belirli ilaçları kullanan hastalar çalışma dışı bırakılmıştır. HOMA indeksleri, açlık plazma glukozu ve C-peptid seviyeleri kullanılarak hesaplanmıştır. Tanımlayıcı istatistikler hesaplandı. NAFLD, NAFLD ve HOMA indeksleri arasındaki korelasyonlar Spearman'ın rho katsayısı ile değerlendirildi ve Kruskal-Wallis ve Mann-Whitney U testleri, NAFLD ve NAFLD'nin HOMA indeksleri üzerindeki etkisini değerlendirdi. ROC analizi, HOMA-IR ve HOMA-S değerlerini kullanarak NAFLD varlığını öngördü ve modelin yüksek doğruluğa sahip olduğunu gösterdi. İstatistiksel analizler IBM SPSS v28.0 ile gerçekleştirildi ve anlamlılık düzeyi $p < 0,05$ olarak kabul edildi.

Bulgular: Toplam 62 hasta dahil edildi. Vücut kütle indeksi 39,1; %91'inde NAFLD ve %82'sinde NAFLD vardı. VKİ ile NAFLD ve NAFLD arasında anlamlı pozitif bir korelasyon vardı. Çalışmamızda, NAFLD ile beta hücre fonksiyonu (HOMA-B) arasında zayıf bir pozitif korelasyon (Spearman's rho = 0,277, $p = 0,029$), insülin direnci (HOMA-IR) arasında orta derecede pozitif bir korelasyon (Spearman's rho = 0,555, $p < 0,00001$) ve insülin duyarlılığı (HOMA-S) arasında güçlü bir negatif korelasyon (Spearman's rho = -0,555, $p < 0,001$) gözlemlendi. NAFLD'nin HOMA skorları üzerinde anlamlı bir etkisi gözlemlenmedi.

Sonuç: Bulgular, NAFLD ile insülin direnci arasındaki ilişkiyi vurgulamakta ve obez hastalarda ektopik yağ birikiminin metabolik yükünü ön plana çıkarmaktadır. Buna karşın, NAFLD ile insülin direnci veya beta hücre fonksiyonu arasında anlamlı bir korelasyon bulunmamıştır, bu da pankreatik steatozun metabolik etkisinin farklı olabileceğini öne sürmektedir. Bu bulgular, obezitede metabolik bozuklukların tespiti ve tedavisi için klinik stratejileri yönlendirmede yardımcı olabilir.

Anahtar Sözcükler: Non alkolik yağlı karaciğer hastalığı, Non alkolik yağlı pankreas hastalığı, İnsülin direnci, Obezite, HOMA indeksi, Ultrason görüntüleme

INTRODUCTION

Obesity, with changing lifestyle, has become one of the leading factors increasing the risk of cardiovascular disease, metabolic syndrome and type 2 diabetes mellitus (T2DM) (1). These results are associated with hypertrophy and hyperplasia of adipocytes and the accumulation of ectopic adipose tissue in non adipose organs such as liver, pancreas, heart and muscle tissue due to increased energy (2,3).

The best known organ localisation of fatty tissue accumulation is the liver, formerly known as non-alcoholic fatty liver disease, now known as metabolic associated fatty liver disease (MAFLD). Recently, fat accumulation in pancreatic cells has also been described and is known by various terms such as non-alcoholic fatty pancreas disease (NAFPD), fatty pancreas, pancreatic steatosis, pancreatic lipomatosis, fatty replacement of pancreas, and fatty infiltration of pancreas (4,5).

In the literature, there are many studies indicating that NAFLD and NAFPD are associated with insulin resistance, T2DM, hyperlipidemia, metabolic syndrome and obesity (6-8).

The diagnosis of NAFLD and NAFPD can be evaluated by non-invasive imaging techniques such as abdominal ultrasound (US), computed tomography (CT) and magnetic resonance imaging (MRI). Although MRI is the best imaging method, abdominal US is the first and most preferred method because it is easily accessible and inexpensive (9,10).

NAFPD is often detected using ultrasound in epidemiological studies and is characterized by increased echogenicity of the pancreatic parenchyma compared to the kidneys (11,12). The prevalence of NAFPD has been found to be 16-35% in adults and its frequency is progressively increasing (13). In addition, 67% of NAFLD patients are also associated with NAFPD (14).

Pancreatic beta cell dysfunction and decreased insulin sensitivity predispose to the development of T2DM. Insulin resistance (IR) is another important pathophysiological factor in the development and progression of T2DM (15).

Known methods for the assessment of insulin resistance include dynamic tests (hyperinsulinemic euglycemic clamp, known as the reference technique), simple indices that do not require external administration of insulin or glucose (e.g. HOMA-IR, a homeostasis model assessment) and biochemical markers (e.g. insulin-like growth factor binding protein-1). In particular, simple indices such as HOMA-IR are often used to estimate IR (16-18).

The Homeostasis Model Assessment (HOMA) calculates pancreatic beta cell dysfunction ($\% \beta$) as a percentage of a

reference population with normal body insulin sensitivity ($\%S$). HOMA- $\%B$ is used to estimate beta cell function in most studies (19,20).

HOMA-IR is an index calculated from fasting plasma insulin and glucose values. As stated in diabetes guidelines, evaluation with HOMA-IR can be performed in patients in the early stages of DM (21,22).

The objective of this study was to investigate the potential association between NAFLD and NAFPD, which are commonly detected by ultrasonography in non-diabetic obese patients and HOMA indices.

MATERIAL and METHODS

The Health Sciences University Umraniye Training and Research Hospital Clinical Research Ethics Committee approved the study protocol. Informed consent was not required due to the retrospective design and nature of the study.

The records of patients admitted to our hospital's obesity outpatient clinic in 2023 with follow-up by a single team were retrospectively reviewed.

Patients were included in the study based on age, BMI, fasting plasma glucose and fasting plasma C-peptide levels, and those with evidence of fatty liver and pancreas on abdominal ultrasound. Patients with known chronic liver or pancreatic disease, patients with any other chronic disease, patients with DM, metformin, pioglitazone, statin and fenofibrate users and patients with a BMI below 27 were excluded from the study. After being evaluated based on these criterias, the number of patients included in the study was determined as 62.

Abdominal ultrasonography examinations of all patients in the study were performed by a single radiologist using high resolution ultrasonography. Patients were evaluated with the standart approach after 8-12 hours of fasting.

Assessment of Hepatic and Pancreatic Steatosis

Fatty liver was assessed on a qualitative scale ranging from normal to severe (grades 0-3). Grade 1 (mild) is defined by a slight increase in parenchymal echogenicity, with normal visualization of intrahepatic vascular structures and the diaphragm. Grade 2 (moderate) reflects a moderate increase in parenchymal echogenicity, accompanied by partial visualization of the vascular structures and diaphragm. Grade 3 (severe) is characterized by a marked increase in echogenicity, with indistinct or poorly defined borders of the vascular structures, diaphragm, and posterior lobe (10,23).

Pancreatic steatosis is usually diagnosed by comparing the echogenicity of the pancreas with that of the kidneys. The

condition is qualitatively graded on a scale from normal to severe (grades 0-3). In grade 0, the pancreatic echogenicity is similar to that of the kidneys. Grade 1 indicates that the pancreatic echogenicity is slightly higher than that of the kidneys. Grade 2 is defined by a significant increase in pancreatic echogenicity relative to the kidneys, though it remains lower than the echogenicity of retroperitoneal fat. In grade 3, the pancreatic echogenicity matches or exceeds that of retroperitoneal fat (24,25).

Assessment of HOMA indexes

HOMA is used to assess insulin resistance and beta cell function (26).

Levy et al. (2004) introduced an updated version of the HOMA model, known as HOMA2, which accounts for variations in hepatic and peripheral glucose resistance, adjustments in the insulin secretion curve at elevated plasma glucose levels, and the impact of circulating proinsulin (18,19,27).

In this model, C-peptide concentration is utilized to evaluate beta cell function (HOMA2-%B), while specific insulin levels are used to determine insulin sensitivity (HOMA2-%S). Insulin clearance, however, varies significantly between individuals as it is dependent on liver function. C-peptide, which is secreted in equal amounts with insulin, is cleared by the kidneys. Hence, it is regarded as a more reliable marker for assessing beta cell response (28).

This model gives HOMA2-%B and HOMA2-%S values of 100% and HOMA2-IR = 1 in normal adult individuals (IR index simply represents the reciprocal of %S) (18).

In 2004, the HOMA2 Calculator was published to provide researchers with fast and easy access to the HOMA2 model. In our study, we calculated HOMA2 values by using this web based calculator (29).

Statistical Analyses

The power analysis of the study was conducted using the G*Power 3.1 software package. During the analysis, Cohen's d value was used for the calculation of effect size. Spearman's rho coefficient was used to evaluate the correlations between NAFLD, NAFLD, and HOMA indices. According to the power analysis results, with a sample size of 62, an 80% power and a 5% error rate were achieved. This indicates that our study has sufficient power to assess the results of the specified statistical tests.

In this study, various tests were employed during the statistical analyses. To evaluate the effect of NAFLD and NAFLD on HOMA indices, Kruskal-Wallis and Mann-Whitney U tests were used. ROC analysis was conducted to predict the

presence of NAFLD using HOMA-IR and HOMA-S values. The AUC values in the ROC analysis indicated that the model had a high level of accuracy. IBM SPSS v28.0 (IBM SPSS Inc., Chicago, IL, USA) was used for statistical analyses. The level of significance was set at $p < 0.05$.

RESULTS

In our study, there were 62 patients, 48 females and 14 males. The mean age was 37.9 (SD:11.5). The mean body mass index of the patients was 39.2 (SD:6.1). NAFLD was present in 91% and NAFLD in 82% of the patients. The demographic data and metabolic characteristics in the study subjects are shown in Table 1.

Firstly, there was no significant association between age and NAFLD ($p=0.298$), whereas there was a significant and moderately positive association between age and NAFLD ($p=0.005$).

There is a moderate positive correlation between BMI and NAFLD (Spearman's rho = 0.428, $p=0.469$) and a moderate positive correlation between BMI and NAFLD (Spearman's rho = 0.481, $p=0.146$). These results suggest that the risk of NAFLD and NAFLD may increase with increasing BMI values (Table 2).

Table 1: The demographic data and metabolic characteristics in the study subjects.

Characteristics*	Findings (n=62)	
Age (year)	39.5±11.5	37.9 (19-69)
BMI (kg/m ²)	38.2±6.1	39.2 (28.2-55.2)
Fasting Glucose (mg/dL)	93.0±15.8	95.9 (86-174)
Fasting C-peptide (ng/mL)	3.2±1.6	3.6 (1.1-7.2)
HOMA-B	169.1±61.6	171.4 (44.9-343.4)
HOMA-S	42.3±22.8	45.6 (21.4-124.3)
HOMA-IR	2.4±1.2	2.7 (1.57-6.1)

Age (year), BMI (kg/m²), Fasting Glucose (mg/dL), Fasting C-peptide (ng/mL), HOMA-B, HOMA-S, HOMA-IR values are presented as "mean±Standard Deviation, median (minimum – maximum)"

Table 2: Moderate positive correlations were found between BMI, HOMA scores, NAFLD and NAFLD.

Correlations	NAFLD	p	NAFLD	p
	Correlation coefficient		Correlation coefficient	
BMI	0.428	0.469	0.481	0.146
HOMA-B	0.277	0.029	-0.164	0.202
HOMA-S	-0.555	<0.00001	-0.041	0.753
HOMA-IR	0.555	<0.00001	0.042	0.747

Spearman's rho was used for correlation coefficients.

Relationships Between NAFLD and HOMA Scores

In our study, a weak positive correlation was found between NAFLD and HOMA-B (Spearman's $\rho = 0.277$, $p=0.029$) and a moderate positive correlation was found between HOMA-IR (Spearman's $\rho = 0.555$, $p<0.00001$). A strong negative correlation was found between NAFLD and HOMA-S (Spearman's $\rho = -0.555$, $p<0.001$) (Table 2).

The negative correlation with HOMA-S indicates that NAFLD reduces insulin sensitivity, while the positive correlations with HOMA-B and HOMA-IR indicate increased insulin resistance and pancreatic beta-cell burden.

Relationships Between NAFLD and HOMA Scores

In our study, the relationship between NAFLD and HOMA-B ($p=0.202$), HOMA-IR ($p=0.747$), and HOMA-S ($p=0.753$) scores was not statistically significant (Table 2).

When the presence and absence of NAFLD was binary coded (present = 1, 2, 3 and absent = 0), the accuracy of the model was calculated to be 84.62%. This shows that the model is a strong indicator for predicting the presence of NAFLD based on the HOMA-S score.

In our study, post-hoc analyses performed to evaluate differences between NAFLD groups using Mann-Whitney U tests for HOMA-S ($p=0.753$) and HOMA-IR ($p=0.747$) scores did not show statistically significant differences.

Conversely, the analyses performed to assess differences between the NAFLD groups showed statistically significant results between Grade 1 and Grade 3 groups for both HOMA-S and HOMA-IR scores, with a $p=0.001$.

The area under the curve (AUC) value was calculated as 0.79 in ROC curve analysis to predict the presence of NAFLD using HOMA-S scores in logistic regression analysis (Figure 3).

The AUC value was calculated as 0.71 in ROC curve analysis to predict the presence of NAFLD using HOMA-IR scores in logistic regression analysis. The optimum HOMA-IR cut-off value for differentiating patients with and without NAFLD was determined as 2.76 (Figure 4).

DISCUSSION

Insulin resistance refers to a condition where the biological response of tissues to insulin is diminished. Although this impairment can occur in all tissues with insulin receptors, the most clinically relevant tissues are the liver, skeletal muscles, and adipose tissue. Reduced insulin sensitivity and insulin resistance hinder glucose uptake into cells, prompting increased insulin production by pancreatic beta cells, leading to hyperinsulinemia. The metabolic effects of insulin resistance include hyperglycemia, hypertension, dyslipidemia, and elevated inflammatory markers. As insulin

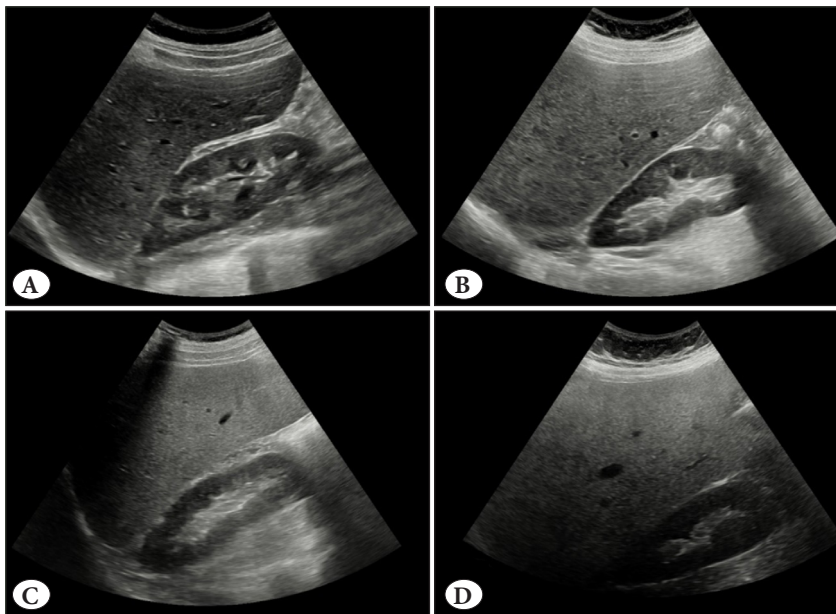


Figure 1: Ultrasonographic findings of NAFLD.

Grade 0 (Normal liver): the liver and the kidney have the same echogenicity.

Grade 1 (Mild fatty liver): slight increase in the liver echogenicity, with echogenic discrepancy between the liver and the kidney.

Grade 2 (Moderate fatty liver): increased liver echogenicity, with echogenic discrepancy between the liver and the kidney.

Grade 3 (Severe fatty liver): marked increase in the hepatic echogenicity, with echogenic discrepancy between the liver and the kidney, and poor visualization of the diaphragm.

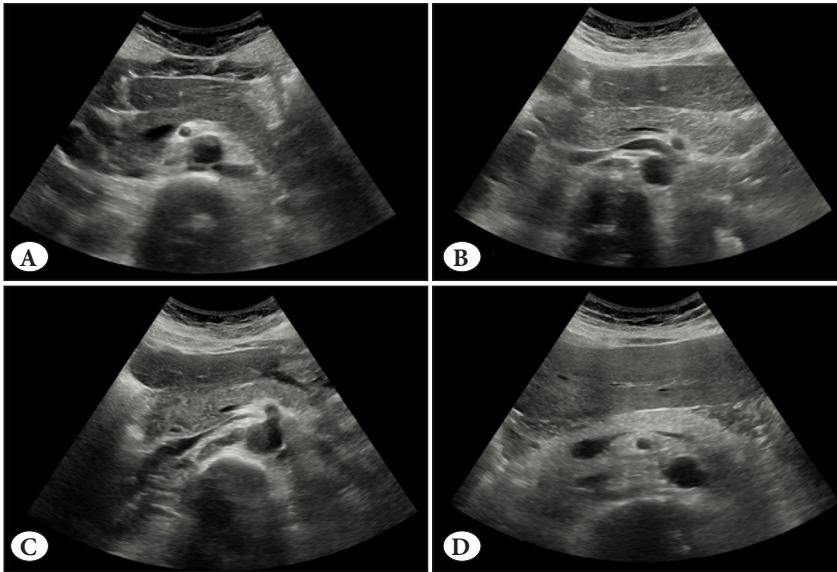


Figure 2: Ultrasonographic findings of NAFPD

Grade 0 (Non-fatty pancreas): normal pancreas parenchyma.

Grade 1 (Mild fatty pancreas): pancreas echogenicity is increased and is slightly higher than the kidney however.

Grade 2 (Moderate fatty pancreas): substantial increase in pancreas echogenicity than renal echogenicity but the retroperitoneal fat echogenicity is more than pancreatic echogen).

Grade 3 (Severe fatty pancreas): the pancreas echogenicity is \geq retroperitoneal fat echogenicity.

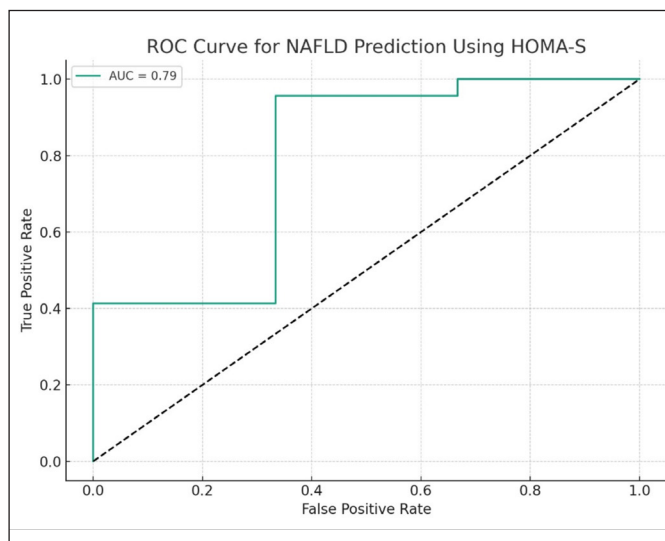


Figure 3: ROC curve showing the performance of predicting the presence of NAFLD using HOMA-S scores. The AUC of the model is 0.79, indicating a high level of accuracy in predicting NAFLD.

resistance continues, it contributes to the development of metabolic syndrome and its components, such as NAFLD and T2DM (30,31).

Insulin increases glycogen synthesis and lipogenesis in the liver. When insulin resistance increases, these processes are impaired, which can lead to fat accumulation in the liver

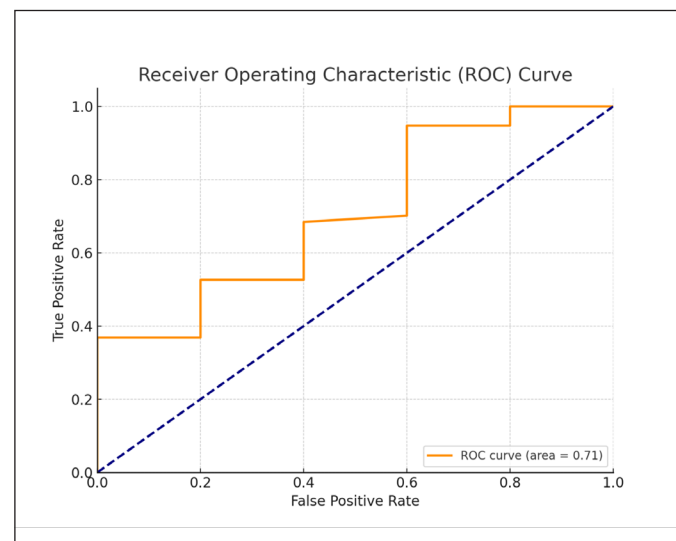


Figure 4: The ROC curve below demonstrates the performance of HOMA-IR values in distinguishing between patients with and without NAFLD. The AUC of the model is 0.71, indicating a high level of accuracy in predicting NAFLD.

and the development of NAFLD. In addition, hyperinsulinemia caused by insulin resistance can increase adiposity by stimulating fatty acid synthesis in the liver (32).

HOMA-IR is a widely used index in the assessment of insulin resistance and is known to play an important role especially in individuals with NAFLD. In many studies, HO-

MA-IR values have been found to have a high diagnostic value in differentiating NAFLD patients from healthy individuals (33-37).

In our study, we found that HOMA-S score decreased and HOMA-IR score increased with increasing fatty liver disease. In other words, insulin sensitivity decreased and insulin resistance increased with increasing fatty liver disease. We did not find any other study directly comparing HOMA-S score with NAFLD in the literature. These results suggest that NAFLD is closely associated with metabolic syndrome and insulin resistance.

In a study, they evaluated the applicability of the HOMA-IR index for the diagnosis of NAFLD and reported that the cut-off values of HOMA-IR values between patients with NAFLD and patients without NAFLD were 1.65 in men and 1.90 in women (38).

In another population-based study between patients with NAFLD and healthy controls, the optimal cut off values were 1.79 (39). Salgado et al, performed measurements between patients with NAFLD and a healthy control group and stated the cut-off value as HOMA-IR index ≥ 2 or 2.5 (33).

Gutierrez-Buey et al, found 4,5 as the best cut off value between NAFLD and non-NAFLD patient groups in patients with type 2 DM (40).

Isokuortti et al, compared individuals with NAFLD selected from the general population and healthy control subjects without NAFLD and found a cut-off value of 1.9 (41).

In our study, we determined the cut-off value as 2.76. Unlike the studies conducted with the general population, our patient group was a group with a BMI above 26. This may explain the high HOMA-IR cut-off value.

The clinical consequences of pancreatic steatosis are still poorly understood (42).

Considering the similar embryological origins of the liver and pancreas, it can be understood that steatosis in the pancreas, much like in the liver, describes a spectrum ranging from fat accumulation to pancreatitis and subsequent fibrosis (43).

Pancreatic steatosis is closely associated with increased BMI, insulin resistance, and metabolic issues. Individuals with a fatty pancreas have a higher risk of developing diabetes compared to those without. Wang et al. have shown that fatty infiltration of the pancreas can lead to a loss of beta cell mass and function, ultimately resulting in the development of diabetes (14).

Due to the anatomical and embryological similarity of the liver and pancreas, many studies have investigated the pathophysiology and clinical effects of adiposity with US, CT and MR. As in other organs, NAFLD shows a significant and reproducible association with obesity (4,7,44).

While obesity is strongly linked to pancreatic steatosis, the precise mechanisms behind this association are not well understood. Unlike liver tissue, where fat accumulates intracellularly, in pancreatic tissue, fat deposits intercellularly through adipocyte infiltration in the intralobular regions of both acinar and islet cells (7,44).

NAFLD is connected with various common clinical conditions, such as metabolic syndrome, type 2 diabetes mellitus (T2DM), cardiovascular risk, and both acute and chronic pancreatitis, pancreatic fibrosis, and pancreatic cancer. Although the exact causal links between NAFLD and these conditions are not yet fully clarified, their frequent association with obesity implies the potential for shared etiological pathways. Over the past decade, increasing evidence has supported the link between NAFLD and metabolic syndrome. Consequently, NAFLD has been recognized as one of the conditions associated with metabolic syndrome, alongside NAFLD, T2DM, and cardiovascular and cerebrovascular diseases (11,44-46).

The nature of the relationship between pancreatic adiposity and general obesity—whether it is causal or merely correlational—remains unresolved and is a focus of ongoing research. Current studies involving T2DM patients do not establish a definitive link between pancreatic fat and diabetes. One theory suggests that impaired glucose metabolism may result from lipotoxicity due to triglyceride accumulation in beta cells, which leads to cell apoptosis and subsequent fat replacement. Another theory proposes that adipocytes in the pancreas might negatively affect beta cells through paracrine signaling. Nonetheless, existing evidence suggests that both NAFLD and T2DM are associated with obesity and may not have a direct causal relationship with each other (44,47).

In our study, we found no significant statistical correlation between pancreatic steatosis and HOMA indices. Although adiposity and HOMA indices are associated with metabolic syndrome and DM, it suggests that there are other accompanying factors related to beta cell dysfunction, insulin sensitivity and resistance.

In one of the largest studies to date, Ou et al. examined 7464 people with US and found that pancreatic steatosis was more common in people with T2DM (12).

In some studies, no relationship was found between pancreatic adiposity and T2DM and beta cell function (48-50).

In a study, pancreatic adiposity was visually evaluated on CT and it was observed that mild and moderate pancreatic adiposity correlated with BMI and T2DM, whereas severe adiposity did not correlate. This suggests that other factors are also effective in the advanced stage of pancreatic adiposity and its relation with the development of DM (51).

Our study has some limitations. Firstly, the small number of patients in our study may limit the applicability of the results to the general population. Our study was designed as a single-centre-retrospective study. Finally, the patients included in the study were restricted to those with certain laboratory parameters and ultrasound scans, so selection bias may occur. Therefore, the results obtained may vary in regions with different demographic and socio-economic characteristics. Multicentre studies with a larger number of patients will allow a more detailed examination of this issue.

In conclusion, in obese but non-diabetic individuals, pancreatic steatosis appears to be associated with increased insulin levels. However, the relationship between pancreatic steatosis and insulin sensitivity is still poorly understood. Our study was conducted in a single centre with a limited group of patients and cannot be applied to the whole population. However, the results of the analyses give us an idea about the relationship between NAFLD and NAFPD and HOMA indices. In our study, no statistically significant association was found between NAFPD and HOMA scores. This indicates that NAFPD may not be directly associated with insulin resistance and beta cell function (measured by HOMA scores). These findings suggest that the assessment of NAFPD, compared with NAFLD, may indicate different mechanisms of insulin resistance and pancreatic beta cell function. Further research and multicentre studies are needed to extrapolate the findings to the general Turkish population.

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Author's Contributions

Conceptualization, methodology, investigation, resources data curation, writing - original draft, visualization: **Sevde Nur Emir**, Conceptualization, methodology, resources software, validation, formal analysis, writing - review & editing: **Servet Emir**.

Conflict of Interest

The authors declare that there are no conflicts of interest regarding the publication of this paper.

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Ethical Approve and Informed Consent

The study protocol received approval from the Clinical Research Ethics Committee at the Health Sciences University Umraniye Training and Research Hospital. Due to the retrospective nature of the study, the requirement for informed consent was waived.

Peer Review Process

Extremely and externally peer-reviewed.

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The Effects of Summer on Body Composition, Perceived Stress Level and Body Awareness of Young Women and Men: A University Example

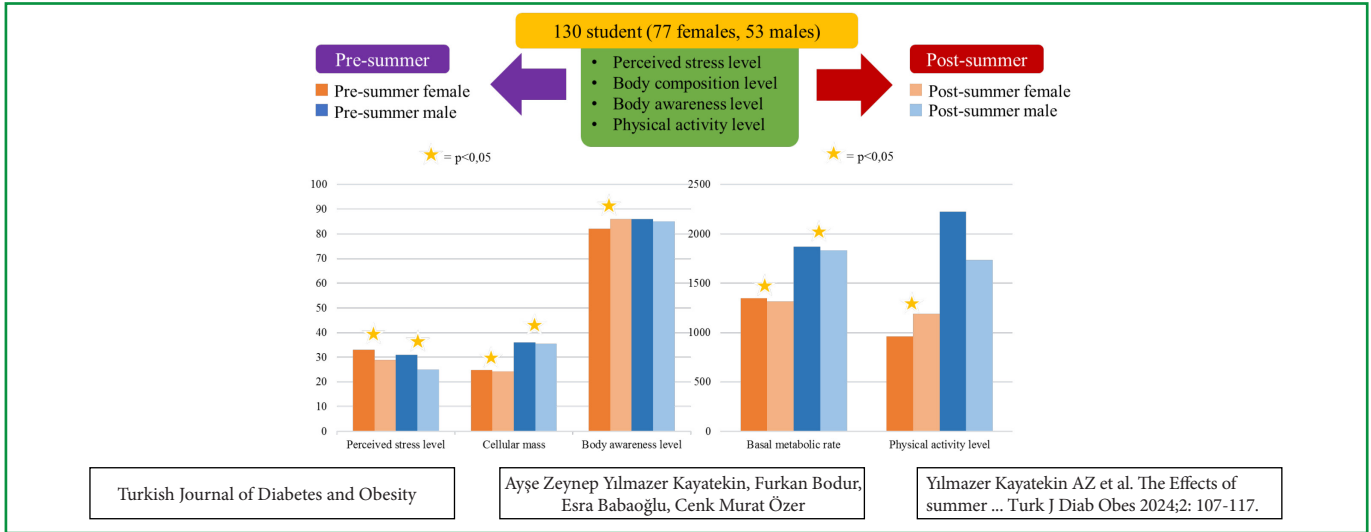
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GRAPHICAL ABSTRACT



ABSTRACT

Aim: To investigate the effect of summer on body composition, perceived stress and body awareness in young male and female university students.

Material and Methods: A total of 130 students (77 females, 53 males) aged between 18 and 26 years without any health complaints participated in the study. Body composition, stress level, body awareness and physical activity level of the participants were evaluated before the summer season in May-June and after the summer season in September-October. Bioelectrical impedance analysis, perceived stress scale, body awareness questionnaire and international physical activity scale were used for these assessments, respectively. To analyse the data in the study, the Wilcoxon test, the Mann-Whitney U test and the Spearman correlation test were used.

Results: Statistical analysis revealed a statistically significant decrease in perceived stress (<0.001; <0.001), basal metabolic rate (<0.001; 0.005) and cellular mass analyses (<0.001; 0.004) in women and men, respectively, when the values before and after the summer season were compared. Body awareness level (0.031) and physical activity level (0.034) were also statistically significantly increased in women.

Conclusion: The results showed that body composition parameters, perceived stress, body awareness and physical activity levels may change after the summer season, especially in women.

Keywords: Body awareness, Body composition, Perceived stress, Physical activity level, Seasonal change

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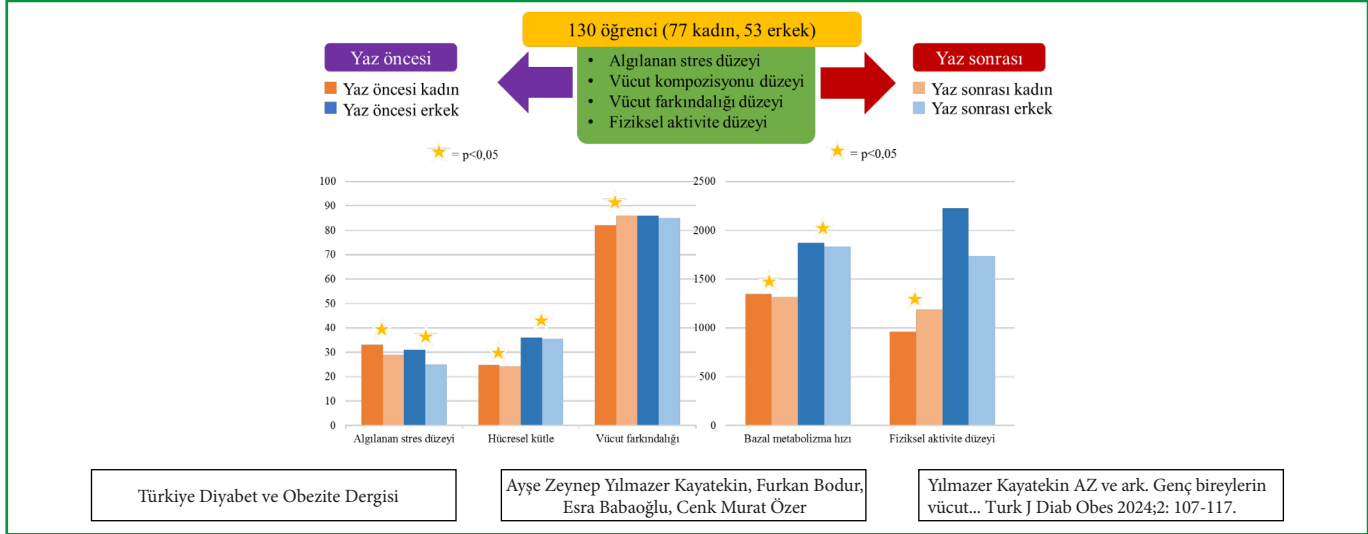
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Genç Bireylerin Vücut Kompozisyonu, Algılanan Stres Düzeyi ve Vücut Farkındalığında Yaz Mevsiminin Etkisi: Bir Üniversite Örneği

GRAFİKSEL ÖZET



ÖZ

Amaç: Genç kadın ve erkek üniversite öğrencilerinde yaz mevsiminin vücut kompozisyonu, algılanan stres ve vücut farkındalığı üzerindeki etkisinin araştırılması amaçlandı.

Gereç ve Yöntemler: Çalışmaya herhangi bir sistemik hastalığı veya sağlık şikâyeti olmayan 77 kadın 53 erkek olmak üzere toplam 130 genç öğrenci (18-26 yaş) katıldı. Katılımcıların yaz mevsimi öncesi Mayıs-Haziran aylarında ve yaz mevsimi sonrası Eylül-Ekim aylarında vücut kompozisyonu, stres düzeyi, vücut farkındalığı ve fiziksel aktivite düzeyi değerlendirildi. Bu değerlendirmeler için sırasıyla biyoelektriksel impedans analizi, algılanan stres ölçeği, vücut farkındalık anketi ve uluslararası fiziksel aktivite ölçeği kullanıldı. Çalışmadaki verilerin analizi için Wilcoxon testi, Mann-Whitney U testi ve Spearman korelasyon testi kullanıldı.

Bulgular: İstatistiksel analiz sonucunda yaz mevsimi öncesi ve sonrası değerler karşılaştırıldığında, kadın ve erkeklerde sırasıyla, algılanan stres (<0,001; <0,001), bazal metabolizma hızı (<0,001; 0,005) ve hücresel kütleli analizlerde (<0,001; 0,004) istatistiksel olarak anlamlı bir azalma saptandı. Kadınlarda vücut farkındalık düzeyi (0,031) ve fiziksel aktivite düzeyinin de (0,034) istatistiksel olarak anlamlı derecede arttığı görüldü.

Sonuç: Sonuç olarak yaz mevsimi sonrası kişilerin vücut kompozisyonu parametrelerinin, algılanan stres, vücut farkındalığı ve fiziksel aktivite düzeyinin özellikle kadınlarda daha fazla değişebileceği bulundu.

Anahtar Sözcükler: Algılanan stres, Fiziksel aktivite düzeyi, Mevsim değişimi, Vücut kompozisyonu, Vücut farkındalığı

INTRODUCTION

Body composition, which is an important aspect of health related to nutritional status, refers to the combination of muscle, bone, fat cells, other organic substances and extracellular fluids that come together at a specific rate and collectively form the mass of an organism (1). Body composition classifies the body into meaningful units such as muscle, bone and adipose tissue ratio. This way, it basically provides significant benefits in the clinical follow-up of obesity, osteoporosis and metabolic diseases (2,3). Body composition is usually measured in humans in response to the

need to identify the deficiency or excess of a component that is thought or known to be associated with a disease (4).

It has been widely shown that chronic exposure to stressors or stress hormones can lead to a number of metabolic imbalances. For example, exposure to social stressors may cause changes in body weight, body composition and weight distribution (5). Although there is no consensus on how stress affects body weight and body composition, it is a known fact that stress is a risk factor for many diseases including obesity and diabetes, which is a chronic disease (5). In addition, excessive secretion of cortisol, which is one of the

most important hormones activated by stress, can change the metabolic functioning of the body and lead to problems such as local weight gain, fatigue, tension and deterioration in skin-fat balance (6,7).

Body awareness is defined as the ability to define and experience the internal sensations, general physiological, emotional and psychological state of the body. Body awareness also includes paying attention to bodily information in daily life, noticing bodily changes/emotions and reactions to the environment (8). The main purpose of evaluating body awareness is to define body awareness with emotional components, to find out disorders in body functions, to evaluate the effectiveness of the treatment applied and to measure the change between different evaluation parameters. Traditionally, body awareness has been used to define anxiety and panic disorders and it has been stated that the dysfunctions in body awareness may be associated with many adverse health conditions such as anorexia, chronic pain and addiction (9,10).

With seasonal changes, many conditions such as social life, eating habits, appetite, sleep duration and energy level of individuals change. These changes are known to affect physical activity level, mental state and body composition in individuals (11). The holiday, which comes at the end of the busy academic calendar, coincides with the summer season in Türkiye with longer days and higher temperatures. The fact that students have more free time in the summer, away from the academic environment, increases their social interaction, participation in physical activities, and provides the opportunity to learn new skills or develop themselves in areas of interest. Thus, lifestyle changes associated with the summer season may also bring about psychophysiological changes, providing relaxation and stress reduction in young people and supporting their mental, physical and emotional health (11). Therefore, in order to develop more effective prevention strategies in the development of obesity and psychosocial disorders, it is necessary to better understand how seasonal changes, physical and psychosocial conditions affect body composition. Although body composition, perceived stress and body awareness are associated with many adverse health conditions such as obesity, metabolic dysregulation and mental health problems, it has been determined that there are limited number of studies evaluating these parameters together in the literature. Therefore, this study investigated how summer-related lifestyle changes affect body composition, perceived stress and body awareness in university students in a specific center. The study also investigated the impact of psychophysiological changes in perceived stress and body awareness on changes in body composition. Men and women often have different body structures and experience stress in different ways. Further-

more, gender differences were also taken into account, as hormonal differences between men and women can affect body composition, metabolism and stress responses.

MATERIAL and METHOD

This research was carried out at the Laboratory of the Department of Anatomy, Zonguldak Bülent Ecevit University Faculty of Medicine from May 1st to October 31st, 2022. A total of 130 volunteer students (77 female, 53 male), aged between 18-26 years, studying at Zonguldak Bülent Ecevit University Faculty of Medicine participated in the study. Prior to the study, the research was fully reviewed and approved (date 2022 and number 2022/11) by the Institutional Review Board (IRB) of Zonguldak Bülent Ecevit University Non-Interventional Clinical Research Ethics Committee. The students, who were selected on a voluntary basis, were informed about the purpose and procedures of the study and signed an informed consent form before participating in the study. The inclusion criteria were not having a diagnosed systemic or psychiatric disease, being in good health, having spent the summer vacation in Türkiye and not having worked during the summer months.

The G Power Version 3.1.9.2 software was utilised to determine the minimum number of participants needed prior to conducting the study. During the calculation of the required sample size, effect size of 0.50, test power of 80%, and 95% confidence level were taken into account. The power analysis revealed a sample size of at least 35 students was essential, separately for female and male students.

Data Collection

A Socio-demographic Information Form prepared by the researchers, Perceived Stress Scale (PSS), Body Awareness Questionnaire (BAQ) and International Physical Activity Questionnaire-Short Form (IPAQ-SF) were administered to the participants. The necessary usage permissions for the scales used in the study were obtained from the researchers who developed the Turkish version of the scale. After these forms were filled in, Tanita BC 418 (Tokyo, Japan, 2015), which was working with bioelectrical impedance analysis (BIA) method, was used to evaluate body composition. These evaluations were made twice, before summer in May-June as the first measurement and after summer in September-October as the second measurement. Participants whose second measurements of body awareness and stress values were higher than the first measurement were considered to have “increased stress” and “increased body awareness”. Participants who participated in the first measurement but could not participate in the second one were excluded from the study and the study was completed with individuals who completed both measurements.

In the sociodemographic information form, the participants' age, gender, smoking and alcohol use, where they spent their summer holidays, and whether they worked in any job during the summer were questioned and recorded.

The PSS, a stress measurement tool, was originally developed by Cohen et al. in 1983 (12) and was subsequently adapted into Turkish by Eskin et al. in 2013, where its validity and reliability were analysed (13). The tool comprises 8 items and is presented in a five-point Likert scale (ranging from 0 - never to 4 - very often). The total scale score ranges from 0 to 32, with higher scores indicating higher perceived stress levels (13).

The BAQ, which aims to determine the normal or abnormal sensitivity level of body composition, was developed by Stephanie A. Shields et al. in 1989 (14). In 2017, Karaca adapted the BAQ into Turkish and conducted a validity and reliability study (15). BAQ is an 18-item Likert type questionnaire consisting of four sub-groups as prediction of body reactions, sleep-awake cycle, changes in the body process and prediction of disease onset. Participants are asked to score each item between 1 and 7. Total score is calculated next and higher score means higher body awareness level (15).

Physical activity level of participants was evaluated with IPAQ-SF. The validity and reliability study of the questionnaire was conducted by Sağlam et al. in 2010 (16). The questionnaire has 7 questions and provides information about the time spent by the individual in the last 7 days for activities such as sitting, walking and moderate and intense activities. Of these activities, the ones that last for 10 minutes and longer are taken into account and metabolic equivalent (MET) method is used to determine the physical activity levels of participants. A 1-week time period is usually sufficient to reflect the diversity and regularity of physical activities in daily routines. International standardisation, coverage of different types of physical activity and living spaces, easy applicability, and frequent use in the fields of public health and epidemiology are the reasons for the preference of IPAQ-SF (16,17).

Body composition of the participants was evaluated with Tanita BC 418 (Tokyo, Japan, 2015) device working with BIA method. Before the measurement, participants were told that they should not have consumed alcohol in the last week, that they should come to the measurement at least 2 hours after eating and that female participants should have their measurements performed outside the menstrual phase of the menstrual cycle. During the measurement, participants got on the device with minimum number of light clothes and without metal objects. The students who got on

the weighing device were asked to hold the probes of the device and look across in an upright position.

After the measurement was completed, the device reported the participants' cellular analysis weight, body mass index (BMI), basal metabolic rate (BMR); body fat ratio (BFR), lean mass ratio (LMR), arm, leg and torso fat ratio (AFR; LFR; TFR), fluid ratio (FR), muscle ratio (MR), bone ratio (BR), mineral ratio (MiR), protein ratio (PR), internal adiposity (IA), obesity rate (OR) and soft muscular tissue rate (SMTR), skeletal muscle ratio (SMR), extracellular fluid ratio (ECFR) and cell mass (CM). It should be noted that Tanita estimates BMR from fat-free mass values rather than measuring it directly (18).

Statistical Analysis

Statistical analysis of the study was performed by using IBM SPSS 20.0 (Statistical Package for Social Science) program. Conformity of continuous variables to normal distribution was evaluated with Shapiro Wilk test. While the descriptive data of the continuous variables in the study were expressed as mean, standard deviation, median, minimum and maximum values, categorical variables were expressed as frequency and percentage. Wilcoxon test was used for the relationship between before and after in dependent variables, while Mann Whitney U test was used for the comparison of continuous variables between groups. Since the data were not normally distributed, correlation analysis was performed using Spearman correlation test. In addition, Cronbach's alpha coefficients were calculated for PSS and BAQ used in the study. As a result of the statistical analysis conducted, the values below 0.05 were considered to be statistically significant.

RESULTS

Our study was conducted between May 1, 2022 and October 31, 2022 with 130 individuals, 77 female and 53 male, who were attending Zonguldak Bülent Ecevit University. The mean age of the participants was 19.58 ± 1.32 years, the rates of smoking and alcohol use were 13.1% (17 individuals) and 26.9% (35 individuals), respectively, and it was determined that all students spent the summer in Türkiye and did not work in any job. Table 1 shows the results of body composition, perceived stress and body awareness of the participants before and after the summer. According to the Mann Whitney U test results, the change in some parameters related to body composition and the change in perceived stress after summer compared to before summer were statistically significant ($p < 0.05$). The change in body awareness after summer compared to before summer was statistically significant only in women ($p < 0.05$).

Changes in body composition parameters according to the increase or decrease of stress levels in female and male participants are shown in Table 2. No statistically significant difference was found in male participants between groups with increased stress level and decreased stress level in terms of body composition parameters ($p > 0.05$). In females, statistically significant difference was found between increased stress level and decreased stress level in terms of changes in weight, body mass index and obesity level ($p < 0.05$).

Table 3 shows the changes in body composition parameters in female and male participants in terms of increased and decreased body awareness. In male individuals, statistically significant difference was found in terms of all body composition parameters except for metabolism age change between groups with increased body awareness and groups

with decreased body awareness ($p < 0.05$). In female individuals, statistically significant difference was found between group with increased body awareness and group with decreased body awareness only in terms of weight, body mass index, metabolic age and change in obesity level ($p < 0.05$).

Table 4 shows the correlation between the changes in perceived stress and body awareness and the changes in other parameters in female and male participants.

Cronbach's alpha coefficients were calculated to determine the reliability of the scales used in this study. PSS showed a Cronbach's alpha of 0.85 before the summer season and 0.88 after the summer season. BAQ showed a Cronbach's alpha of 0.86 before the summer season and 0.89 after the summer season. These values indicate good internal consistency for both scales at both measurement points.

Table 1: Comparison of pre-summer and post-summer perceived stress, body awareness, physical activity level and body composition values of the participants.

Parameters	Female (n=77)			Male (n=53)		
	Pre-summer	Post-summer	p	Pre-summer	Post-summer	p
Perceived stress	33.00 (22-42)	29.00 (15-45)	<0.001	31.00 (8-51)	25.00 (3-47)	<0.001
Body awareness	82.00 (52-120)	86.00 (42-117)	0.031	86.00 (30-126)	85.00 (53-120)	0.548
Metabolic equivalent	963 (90-4830)	1188 (330-3906)	0.034	2223 (198-4866)	1737 (231-5266)	0.694
Weight	56.5 (41.2-94.7)	55.8 (40.2-91.3)	<0.001	72.5 (47.4-112.5)	72.9 (49.3-109.4)	0.092
Body mass index	20.90 (15.7-32.3)	20.90 (15.3-32)	<0.001	23.20 (17.6-35.9)	22.80 (17.9-33.3)	0.115
Body fat ratio	25.60 (15.6-41.8)	25.60 (14.6-42.8)	0.814	16.70 (1.8-30.0)	16.30 (6.6-30.3)	0.457
Metabolic age	19.00 (15-30)	19.00 (14-30)	0.821	19.00 (14-31)	19.00 (14-30)	0.560
Basal metabolic rate	1348 (1110-1821)	1317 (1096-1720)	<0.001	1870 (1339-2514)	1834 (1382-2422)	0.005
Obesity level	-2.64 (-27.0-50.4)	-3.78 (-28.8-48.8)	<0.001	11.75 (-15.1-73.1)	9.68 (-13.8-60.3)	0.097
Fluid rate	54.49 (42.6-61.9)	54.49 (41.8-62.4)	0.766	60.98 (51.2-71.9)	61.25 (51.1-68.6)	0.389
Lean mass ratio	74.38 (58.2-84.5)	74.38 (57.2-85.3)	0.805	83.27 (70.0-98.3)	83.75 (69.8-93.5)	0.439
Mineral ratio	4.84 (3.03-6.17)	4.94 (2.97-6.23)	0.814	5.65 (3.64-7.17)	5.65 (3.63-6.83)	0.356
Protein ratio	15.06 (11.9-17.8)	14.95 (11.5-18.0)	0.933	16.98 (13.9-19.8)	17.17 (14.0-19.7)	0.636
Internal adiposity	1.00 (1-6)	1.00 (1-6)	0.166	2.00 (1-11)	2.00 (1-10)	0.452
Muscle ratio	70.74 (55.1-80.1)	70.56 (54.3-81.1)	0.873	79.54 (66.9-92.4)	80.18 (66.6-89.2)	0.418
Bone ratio	3.70 (3.09-6.18)	3.70 (2.91-4.26)	0.921	3.72 (3.11-5.90)	3.70 (2.88-4.25)	0.040
Soft muscular tissue ratio	40.20 (32.3-53.5)	39.44 (31.8-50.1)	<0.001	58.49 (41.3-75.8)	57.29 (42.7-73.1)	0.005
Skeletal muscle ratio	24.51 (19.7-32.7)	23.83 (19.2-30.6)	<0.001	35.49 (25.2-46.3)	34.86 (26.1-44.6)	0.004
Extracellular fat ratio	13.41 (10.8-17.8)	13.09 (10.5-16.7)	<0.001	19.42 (13.8-25.4)	19.08 (14.3-24.4)	0.003
Intracellular fat ratio	18.29 (14.7-24.4)	17.78 (14.4-22.8)	<0.001	26.48 (18.8-34.6)	26.02 (19.5-33.3)	0.004
Cellular mass	27.73 (22.2-36.9)	27.04 (21.8-34.4)	<0.001	40.48 (28.7-52.7)	39.76 (29.7-50.7)	0.008
Leg fat ratio	30.00 (20.6-41.5)	29.50 (22.3-43.3)	0.052	14.40 (2.7-32.2)	14.95 (5.1-32.3)	0.033
Arm fat ratio	28.50 (17.9-46.7)	27.20 (15.5-45.7)	0.023	19.45 (7.3-32.8)	18.10 (7.9-32.8)	0.353
Torso fat ratio	23.00 (8.8-41.1)	23.20 (7.3-42.0)	0.503	17.90 (3.0-31.1)	16.60 (6.5-32.2)	0.818

(min.; minimum, max.; maximum, p;0.05, * Wilcoxon test)

Table 2: Analysis of changes in body composition according to changes in stress levels in male and female participants.

Body composition change	Female (n=77)			Male (n=53)		
	Increased SL (n=23) Median (Min-Max)	Decreased SL (n=54) Median (Min-Max)	P	Increased SL (n=14) Median (Min-Max)	Decreased SL (n=39) Median (Min-Max)	P
Weight	-0.4 (-5.5-4.4)	-1.3 (-6.2-3.5)	0.013	-0.5 (-8.3-4.3)	-0.5 (-10.8-10.2)	0.455
Body mass index	-0.1 (-2.0-1.6)	-0.5 (-2.2-1.3)	0.020	<0.001 (-2.6-1.4)	-0.2 (-3.4-3.1)	0.492
Body fat ratio	0.6 (-5.8-4.1)	-0.05 (-5.3-7.4)	0.195	0.1 (-1.3-3.8)	0.3 (-9.2-5.3)	0.607
Metabolic age	<0.001 (-5.0-3.0)	<0.001 (-5.0-5.0)	0.070	<0.001 (-1.0-3.0)	<0.001 (-6.0-3.0)	0.575
Basal metabolic rate	-8.0 (-56-56)	-24.0 (-119-36)	0.058	-6.0 (-192-102)	-24.0 (-124-169)	0.519
Obesity level	-0.67 (-9.29-7.34)	-2.21 (-9.95-6.4)	0.014	-0.70 (-12.77-6.85)	-0.82 (-16.3-15.0)	0.474
Fluid ratio	-0.33 (-3.01-4.37)	0.15 (-5.25-7.18)	0.204	-0.17 (-2.83-0.96)	-0.14 (-3.88-6.63)	0.506
Lean mass ratio	-0.51 (-4.04-5.93)	0.15 (-7.35-5.28)	0.201	-0.18 (-3.72-1.37)	-0.31 (-5.43-9.09)	0.579
Mineral ratio	-0.03 (-0.29-0.44)	0.01 (-0.39-0.39)	0.152	-0.10 (-0.19-0.07)	-0.20 (-0.39-0.47)	0.545
Protein ratio	-0.13 (-0.74-1.48)	<0.001 (-1.7-1.0)	0.178	-0.01 (-0.69-0.34)	-0.07 (-1.2-1.99)	0.716
Internal adiposing	<0.001 (-1.0-1.0)	<0.001 (-1.0-1.0)	0.370	<0.001 (-1.0-1.0)	<0.001 (-4.0-2.0)	0.679
Muscle ratio	-0.57 (-4.17-5.60)	0.13 (-7.13-5.03)	0.158	0.06 (-3.55-1.46)	-0.35 (-4.12-8.70)	0.628
Bone ratio	-0.01 (-2.06-0.41)	-0.01 (-2.26-0.43)	0.443	-0.08 (-0.24-0.23)	-0.05 (-1.90-0.38)	0.920
Soft muscle tissue ratio	-0.28 (-1.99-1.66)	-0.75 (-3.98-1.42)	0.159	-0.14 (-5.47-3.50)	-0.83 (-3.71-4.63)	0.593
Skeletal muscle ratio	-0.17 (-1.18-1.02)	-0.45 (-2.38-0.85)	0.162	-0.08 (-3.34-2.10)	-0.51 (-2.26-2.82)	0.579
Extracellular fat ratio	-0.12 (-0.66-0.54)	-0.24 (-1.33-0.51)	0.238	-0.05 (-1.91-1.14)	-0.28 (-1.21-1.49)	0.650
Intracellular fat ratio	-0.13 (-0.89-0.76)	-0.34 (-1.78-0.64)	0.164	-0.06 (-2.49-1.56)	-0.38 (-1.69-2.11)	0.565
Cellular mass	-0.19 (-1.49-1.26)	-0.50 (-2.68-0.84)	0.180	-0.01 (-3.69-2.36)	-0.55 (-2.49-3.41)	0.607

(min.; minimum, max.; maximum, p;0.05, * Mann-Whitney U test)

Table 3: Analysis of changes in body composition according to changes in body awareness in male and female participants.

Body composition change	Female (n=77)			Male (n=53)		
	Increased BA (n=31) Median (Min-Max)	Decreased BA (n=46) Median (Min-Max)	P	Increased BA (n=30) Median (Min-Max)	Decreased BA (n=23) Median (Min-Max)	P
Weight	-1.40 (-6.20-3.50)	-0.50 (-5.50-4.40)	0.009	-1.55 (-10.80-2.30)	1.30 (-8.30-10.20)	< 0.001
Body mass index	-0.50 (-2.20-1.30)	-0.20 (-2.00-1.60)	0.011	-0.55 (-3.40-0.70)	0.40 (-2.60-3.10)	< 0.001
Body fat ratio	-0.25 (-5.70-5.60)	0.60 (-5.80-7.40)	0.201	0.15 (-9.20-4.40)	1.10 (-1.30-5.30)	0.023
Metabolic age	<0.001 (-5.0-5.0)	<0.001 (-5.0-3.0)	0.022	<0.001 (-6.0-3.0)	<0.001 (-3.0-3.0)	0.855
Basal metabolic rate	-27.00 (-119-33)	-8.00 (-80-56)	0.061	-53.00 (-124-53)	-5.00 (-192-169)	0.001
Obesity level	-2.36 (-9.95-6.35)	-0.98 (-9.3-7.3)	0.010	-2.50 (-16.25-3.41)	2.02 (-12.8-15.0)	< 0.001
Fluid ratio	0.23 (-4.14-7.18)	-0.98 (-9.29-7.34)	0.218	-0.14 (-3.22-6.63)	2.02 (-12.8-15.0)	0.022
Lean mass ratio	0.28 (-5.60-5.72)	-0.51 (-7.35-5.93)	0.213	-0.15 (-4.36-9.09)	-1.10 (-5.43-1.37)	0.020
Mineral ratio	0.02 (-0.29-0.39)	-0.03 (-0.39-0.44)	0.172	-0.005 (-0.23-0.47)	-0.06 (-0.39-0.07)	0.018
Protein ratio	0.03 (-1.17-1.48)	-0.12 (-1.73-1.13)	0.140	0.07 (-0.93-1.99)	-0.22 (-1.16-0.34)	0.015
Internal adiposing	<0.001 (-1.0-1.0)	<0.001 (-1.0-1.0)	0.082	<0.001 (-4.0-1.0)	<0.001 (-1.0-2.0)	0.050
Muscle ratio	0.24 (-5.34-5.20)	-0.44 (-7.13-5.60)	0.294	0.24 (-4.12-8.70)	-1.06 (-3.99-1.89)	0.024
Bone ratio	-0.05 (-2.06-0.40)	0.07 (-2.26-0.43)	0.129	0.01 (-0.56-0.38)	-0.09 (-1.90-0.20)	0.027
Soft muscle tissue ratio	-0.83 (-3.98-1.33)	-0.37 (-3.60-1.66)	0.136	-1.54 (-3.71-1.85)	-0.09 (-5.47-4.63)	0.003
Skeletal muscle ratio	-0.50 (-2.38-0.80)	-0.22 (-2.15-1.02)	0.149	-0.94 (-2.26-1.13)	-0.06 (-3.34-2.82)	0.003
Extracellular fat ratio	-0.24 (-1.33-0.49)	-0.24 (-1.33-0.49)	0.192	-0.55 (-1.21-0.55)	-0.55 (-1.21-0.55)	0.003
Intracellular fat ratio	-0.38 (-1.78-0.59)	-0.17 (-1.60-0.76)	0.152	0.68 (-1.69-0.85)	-0.05 (-2.49-2.11)	0.003
Cellular mass	-0.59 (-2.68-0.79)	-0.25 (-2.60-1.26)	0.294	-1.04 (-2.49-1.25)	0.05 (-3.69-3.41)	0.001

(min.; minimum, max.; maximum, p;0.05, * Mann-Whitney U test)

Table 4: Analysis of the correlation between the changes in perceived stress and body awareness and the changes in other parameters in female and male participants.

		Female			Males		
		BA	MET	PS	BA	MET	PS
Weight	rho	-0.307	-0.316	0.298	-0.576	-0.219	0.119
	p*	0.007	0.005	0.004	<0.001	0.115	0.398
Body mass index	rho	-0.304	-0.320	0.286	-0.593	-0.202	0.113
	p*	0.007	0.005	0.009	<0.001	0.147	0.421
Obesity level	rho	-0.303	-0.319	0.295	-0.584	-0.209	0.115
	p*	0.007	0.005	0.009	<0.001	0.134	0.414
Basal metabolic rate	rho	-0.254	-0.013	0.228	-0.431	0.064	0.118
	p*	0.026	0.908	0.046	0.001	0.648	0.401
Fat ratio	rho	-0.118	-0.337	0.133	-0.400	-0.328	-0.005
	p*	0.308	0.003	0.248	0.003	0.017	0.974
Fluid ratio	rho	0.107	0.333	-0.127	0.401	0.336	-0.008
	p*	0.354	0.003	0.272	0.003	0.014	0.956
Lean mass ratio	rho	0.108	0.338	-0.127	0.400	0.341	-<0.001
	p*	0.351	0.003	0.272	0.003	0.012	0.89
Body awareness	rho	-	0.220	-0.323	-	0.002	-0.279
	p*	-	0.050	0.004	-	0.988	0.043
Perceived stress	rho	-0.323	-0.266	-	-0.279	0.093	-
	p*	0.004	0.020	-	0.043	0.506	-

(rho: correlation coefficient, p; 0.05, *Spearman correlation test)

DISCUSSION

In our study, we investigated the effects of seasonal changes on body awareness, body composition and perceived stress. Body awareness, which one of the important parameters for being healthy and maintaining this state of health, has been one of the outstanding issues in scientific studies conducted in the field of health in recent years. Studies conducted have reported that body awareness interacts with cognition, joint position sense, depression and health-related quality of life, and evaluating and developing body awareness may be useful in problems such as appetite problems, emotional problems, depression and sleep disorders (9,10,19). In line with this information, our study evaluated pre-summer and post-summer perceived stress, physical activity level and body composition parameters that may be related to these in healthy university students. University students were selected for this study because this age group (18-26) are young adults whose lifestyles and physical activities are sensitive to seasonal changes. The fact that they move away from the academic environment and spend more free time during the summer season may have significant effects on their stress levels and body awareness. Furthermore, individuals in this age group are generally in good health, making the body

composition changes that the study should focus on more specific and generalizable.

Some changes are seen in the nature and all living beings with the change of seasons. It is a known fact that these changes are mostly physiological and psychological in humans (20). In a study they conducted on 27 pregnant women between the ages of 18 and 49 and women who had children between the ages of 2 and 6 in the United States of America (USA) Yakima Valley, Smith MN et al. reported that in summer and autumn, the amount of cortisol, which is an indicator of stress, and stress anxiety scores were significantly different between seasons (21). In another similar study conducted in Sweden by Persson et al., cortisol concentrations were analysed in 17 women and 7 men who were between the ages of 32 and 61, who had a mean BMI of 24.5 ± 2.3 , who were actively working, who were living with their families except for 2, and 21 of whom were non-smokers, and they found seasonal changes in cortisol concentrations. The lowest concentrations were reported in summer months of July and August (22). In the literature, biochemical markers such as cortisol, cortisol awakening response, dexamethasone suppression test, and salivary α -amylase are measured or scales such as Perceived Stress Scale, Depression Anxiety

Stress Scale are used to evaluate stress in humans (23,24). In our study, Perceived Stress Scale was used to evaluate stress since it is easy to apply and evaluate and preferred in literature. In our study which included 130 students between the ages of 18 and 26 and a mean BMI of 22.48 ± 3.51 , 77 of the students were female and 53 were male, 13.1% were smokers, 26.9% were social drinkers. According to the results of the Perceived Stress Scale, although cortisol levels were not measured, differences were found between pre-summer and post-summer as in the previously mentioned studies (Table 1). In addition, although variations such as age range, the angle of receiving sun, the duration of exposure to sun, occupation, BMI, living with the family, living alone in another city, consuming alcohol-cigarette, being aware of the current responsibilities which may all affect the level of stress have been reported in these studies, it has also been stated that seasonal changes may be related with stress. In our study, the significant decrease in the level of stress may be due to the fact that students are on holiday with the start of summer and their exam anxiety is over and they are back to their family and friend environment.

In a study Ersoy N. conducted on 31 individuals older than 65 years of age, it was found that 11 were retired men and 70% were housewife, 87.1% of the participants had at least one chronic illness, there was an increase in the state of exercising regularly in summer months, while there was no significant increase in MET value. It was also found in this study that a decrease was found in body weight and body fat ratios in transition to summer and autumn from spring, although not statistically significant (20). In a study conducted in USA by Ma Y. et al. on 593 participants (316 men and 277 women) between the ages of 20 and 70 to find out seasonal changes in food intake, physical activity and body weight, it was found that 84.1% were non-smokers, 63.6% were overweight or obese and a great majority were at least high school graduates and it was found that physical activity level was high in spring and summer months and body weight was the lowest in summer (25). In our study, while it was found that women had higher physical activity level after summer, no significant change was found in men. Although nutritional state was not evaluated, no significant change was found in pre-summer and post-summer body fat ratio in women and men, similar to the literature. Body weight was found to decrease significantly after summer only in women (Table 1). It can be thought that the reason for this result can be the increase in physical activity level with the increase in body awareness after summer. The result that there were no significant changes in body awareness and physical activity level in men supports this hypothesis.

In a study by Christaki et al. of 121 (43 boys, 78 girls) children and adolescents aged 5-15 years, stress levels were found to be statistically significantly higher in overweight children than in normal weight children (26). Scott et al. reported that women and men who were overweight or at the upper limit of normal weight were more likely to gain weight in response to stress than those who were underweight. It is thought that the high levels of insulin observed in overweight individuals are responsible for greater weight gain in response to stress (27). In our study, weight, BMI and OD decreased in women whose stress level decreased and increased, but this decrease was greater in women whose stress level decreased than in women whose stress level increased. In male participants, there was no significant difference in body composition change between the increasing and decreasing stress groups (Table 2). Our results suggest that there may be gender differences in the effect of stress on weight change and adiposity.

The reliability of the PSS and BAQ in this study was found to be consistent with the values reported in the original validation studies. The original PSS reported a Cronbach's alpha of 0.84 (12), which is similar to the values obtained in our study (0.85 and 0.88). Similarly, the original BAQ had a Cronbach's alpha of 0.87 (14), which closely matched our findings of 0.86 and 0.89. These comparisons suggest that the scales retain reliability when applied in the context of our study.

In studies in the literature, it has been stated that impulsive eating behaviour increases under stress (24,28,29). In a study conducted by Lundahl et al., it was found that women had higher impulsive eating, self-perception of body shape and dieting rates than men (30). In our study, it was found that women with increased stress had lower rates of losing weight when compared with women who had decreased stress. This may be related to the impulsive eating behaviour of women under stress and therefore we suggest this parameter to be included and evaluated in future studies.

Body awareness is defined as a bridge connecting the body and mind, making sure that tissues work in harmony without being damaged. The higher body awareness we have, it will be easier for us to protect our physical health and to have shorter illness process with early awareness (31,32). It mediates a holistic health such as our physical health, mental health, physical activity and mental perception (33). Individuals' being healthy in the society provides a social gain and contributes to creating healthy societies (34). Body awareness has begun to be used in clinical areas since it provides assessment and data about the treatment in cases such as chronic pain, obesity and post-traumatic stress

disorder (8,35). Today, how body awareness changes with the increase in obesity has become a matter of interest and there is no consensus on the issue in literature. In a study conducted by Kalkışım et al. on healthy 189 women and 100 men with a mean age of 19.34 ± 1.48 , while no significant correlation was found between body mass index and body awareness, significant correlation was found between body weight and body awareness (35). In a similar study conducted by Vatansever et al. on healthy 37 women and 27 men with a mean age of 22.68 ± 6.75 , no significant correlation was found between body awareness level and body mass index (36). However, in another study, Erden and Emirzeoğlu found a significant correlation between BMI and body weight and body awareness level in 36 basketball players with a mean age of 14.5 ± 2.14 (37). In our study, unlike other studies, the correlation between body composition and body awareness was evaluated separately in women and men, and while other studies made a single measurement and evaluated correlations, our study made two different measurements and analysed the changes. In our study, when the correlation between the changes in these parameters was examined, it was found that in individuals who had increased body awareness, weight, BMI and obesity rate mostly decreased (Table 3). According to literature, it can be seen that body awareness affects BMI and body weight, especially in individuals who do sports professionally and in individuals receiving education in the field of health. We think that this result may be due to the fact that medical faculty students, who constitute our study group, have higher level of education and both medical faculty students and professional athletes know their bodies well. In their study, Cheah et al. also found a positive correlation between level of education and body awareness (38). Koltyn et al.'s study result that exercise level affects body awareness positively also supports our inferences (39).

Another topic which is not studied much in literature is the relationship between body awareness and perceived level of stress. In a study they conducted, Gyllensten et al. researched the relationship between psychological well-being and body awareness level in 45 women and 30 men with a mean age of 36.5 ± 8.3 . As a result of the study, they found a negative and moderate correlation between anxiety sub-parameter of Psychological Well-being Index (PWBI) and body awareness (40). Similarly, negative weak correlation was found between body awareness and perceived level of stress in both men and women in our study (Table 4). In line with these results, it was found that individuals' psychological state affected body awareness and body awareness decreased with the increase in stress and anxiety level.

The data obtained in this study are specific to healthy university students aged 18-26 years. The results can be generalised to individuals in this age group, but generalisation to different age groups or individuals with different health status may not be appropriate. In addition, the fact that the participants spent their summer holidays in Türkiye and did not work may affect the results of the study. Therefore, it may vary whether similar results can be obtained on individuals living in different geographical regions or working during summer holidays. For the generalisability of the results, it is recommended to conduct additional studies with a wider scope and including different demographic groups.

Although this study examined the immediate effects of seasonal change from a general perspective, longer-term studies may offer a more holistic view. Summer effects can be considered from many angles and more specificity on changes in lifestyles during the summer months may be desirable. Furthermore, future research could be conducted in a larger population for a more comprehensive result. It should consider widening the range of variables investigated, such as sleep patterns, dietary habits, cortisol levels and mental health status, as well as including wider age groups and various sociodemographic characteristics of participants, such as wealth level.

The results of the study were evaluated from the perspective of physicians and physiotherapists and the results were interpreted specific to the research center. It was found that physical activity levels of women increased after the summer season, while there was no significant change in men. It was determined that the stress level decreased in general in both genders after the summer season. It was determined that the weight, BMI and obesity levels of women with decreased stress levels were lower than those of women with increased stress levels, and there was no significant difference between the groups with increased and decreased stress levels in terms of body composition parameters. These results showed that stress may affect men and women differently in terms of weight gain, BMI, OD and body awareness in a university sample. It was also found that body awareness increased significantly in women after the summer, whereas it did not cause a significant change in men. However, body awareness was found to affect men more than women in terms of body composition parameters. These results may suggest that strategies to increase body awareness and reduce perceived stress may be effective in the process of obesity and psychosocial illness. We think that giving sufficient importance to body awareness, which is effective in various diseases, will also contribute to the field of preventive medicine.

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Ethical Approval

The study was carried out in accordance with the ethical principles and the Helsinki Declaration. The study protocol was approved by the Ethics Committee of Zonguldak Bülent Ecevit University (date 2022 and number 2022/11).

Peer Review Process

Externally and extremely peer-reviewed.

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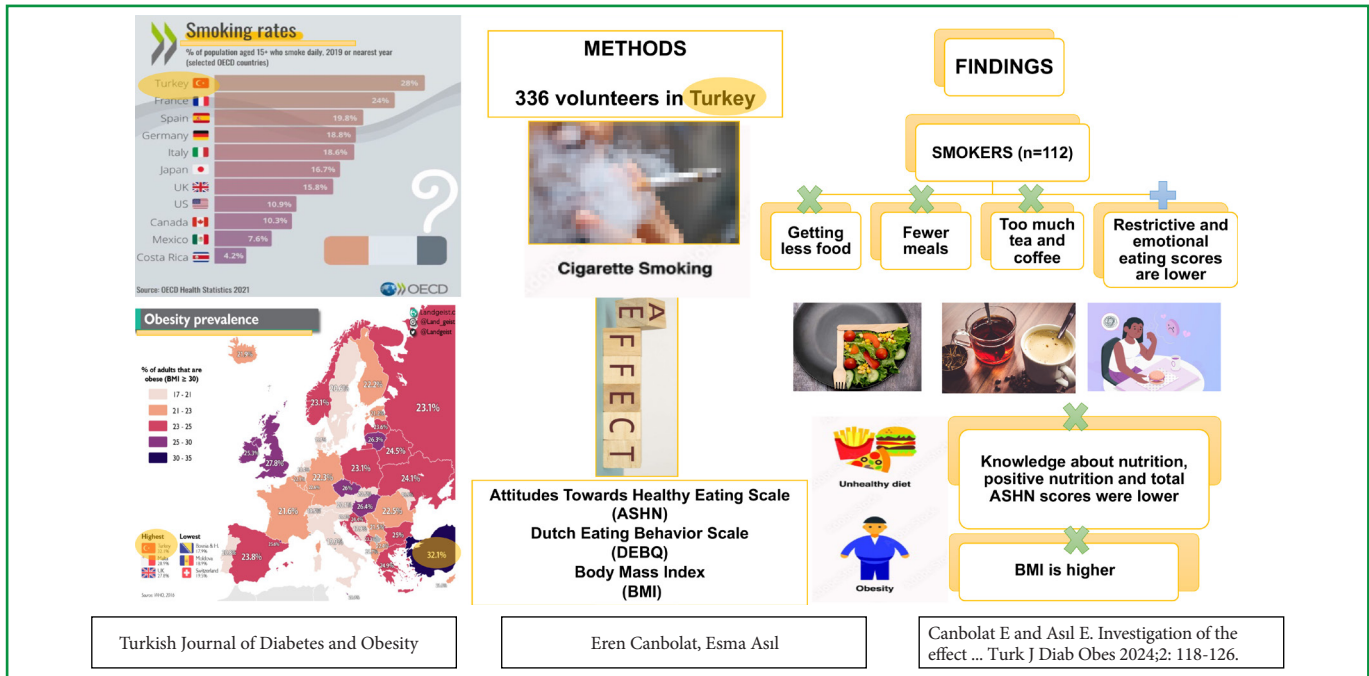
Investigation of The Effect of Smoking on Eating Behaviors and Body Mass Index in Adults: A Cross-Sectional Study

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GRAPHICAL ABSTRACT



ABSTRACT

Aim: This study was conducted to evaluate the effect of smoking on eating behaviors and body mass index in Turkey, which is one of the countries where smoking is common in the world and has the highest number of obesity cases in Europe.

Material and Methods: This study was carried out with the participation of 336 adult individuals. Body mass index (BMI) was calculated using the body weight and height declared by the participants, and the eating behaviors of the participants were determined by the Attitude Scale for Healthy Nutrition (ASHN) and their eating behavior was determined by the Dutch Eating Behavior Scale (DEBQ).

Results: It was determined that 33.3% of the individuals participating in the study used to smoke. It was concluded that smokers thought that they took less food with diet, they had fewer meals during the day, they consumed more tea/coffee, and their restrictive and emotional eating scores were lower ($p<0.05$). In addition, knowledge about nutrition, positive nutrition and total ASHN scores of smokers were found to be lower ($p<0.05$). Finally, it was observed that the BMI values of smokers were higher ($p<0.05$). IBM SPSS 24.0 statistical package program was used for statistical evaluation of the data. Independent Samples T, Chi-Square Independence Test and

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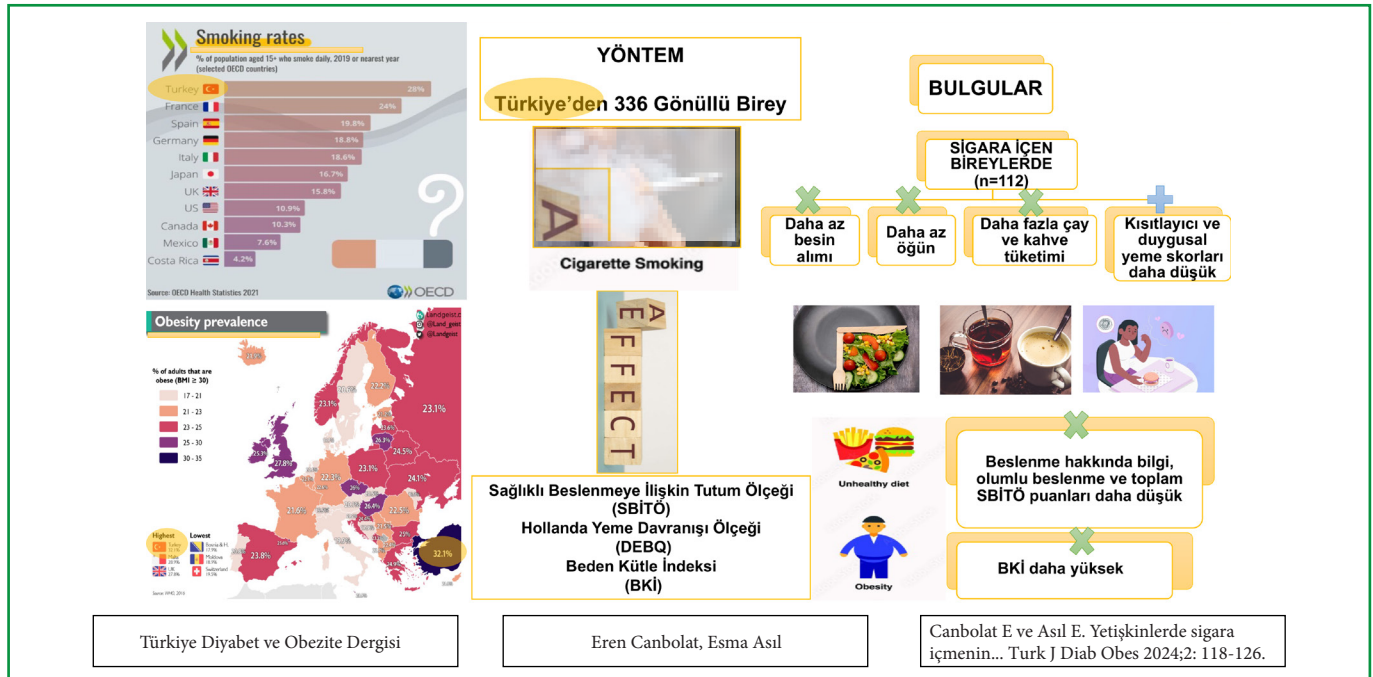
Partial Correlation Analysis were used to analyze the relationship between the study data. $p < 0.05$ values were considered statistically significant.

Conclusion: The data obtained at the end of the study were found to be compatible with the data in the literature that its use reduces appetite and that individuals who smoke maintain an unhealthier diet. At this point, in terms of public health, the relationship between smoking and unhealthy diet should be addressed, public awareness should be raised by nutritionists and the effects of smoking on nutrition and obesity should be evaluated with more comprehensive studies.

Keywords: Smoking, Body weight, Eating behavior, Health, Obesity

Yetişkinlerde Sigara İçmenin Yeme Davranışları ve Beden Kütle İndeksine Etkisinin Araştırılması: Kesitsel Bir Araştırma

GRAFİKSEL ÖZET



ÖZ

Amaç: Bu çalışma dünyada sigara kullanımının yaygın olarak görüldüğü ülkelerden biri olup aynı zamanda Avrupada en çok obezite vakasının görüldüğü Türkiye'de sigara kullanımının yeme davranışlarına ve beden kütle indeksine etkisini değerlendirmek amacıyla yapılmıştır.

Gereç ve Yöntemler: Bu çalışma 336 yetişkin bireyin katılımıyla gerçekleştirilmiştir. Katılımcıların beyan ettiği vücut ağırlığı ve boy uzunluğu kullanılarak Beden Kütle İndeksi (BKİ) hesaplanmış, katılımcıların yeme davranışları Sağlıklı Beslenme Tutum Ölçeği (SBİTÖ) ile, yeme davranışları ise Hollanda Yeme Davranışı Ölçeği ile belirlenmiştir (DEBQ). Verilerin istatistiksel analizi IBM SPSS İstatistik 24.0 yazılım paketi kullanılarak gerçekleştirilmiştir. Independent Samples T, Ki-Kare Bağımsızlık Testi ve Kısmi Korelasyon Analizi ile çalışma verileri arasındaki ilişki incelenmiştir. Verilerin anlamlılık durumu $p < 0,05$ değerine göre tanımlanmıştır.

Bulgular: Araştırmaya katılan bireylerin %33,3'ünün sigara kullandığı tespit edilmiştir. Sigara içenlerin diyetle daha az yiyecek aldıklarını, gün içinde daha az yemek yediklerini, daha çok çay/kahve tükettiklerini, kısıtlayıcı ve duygusal yeme puanlarının daha düşük olduğunu düşündükleri belirlenmiştir ($p < 0,05$). Ayrıca sigara içenlerin beslenme bilgisi, pozitif beslenme ve toplam SBİTÖ skorlarının daha düşük olduğu tespit edilmiştir ($p < 0,05$). Son olarak sigara içenlerin BKİ değerlerinin daha yüksek olduğu saptanmıştır ($p < 0,05$).

Sonuç: Çalışma sonunda elde edilen veriler, sigara kullanımının iştahı azalttığı ve sigara içen bireylerin sağlıksız beslenmeyi sürdürdüğü yönünde literatürdeki verilerle uyumlu bulunmuştur. Bu noktada halk sağlığı açısından sigara kullanımının sağlıksız beslenme ile ilişkisi ele alınmalı, beslenme uzmanları tarafından toplumun bilinçlendirilmesi ve yapılacak daha kapsamlı çalışmalar ile sigara kullanımının beslenme ve obezite üzerine etkilerinin değerlendirilmesi gereklidir.

Anahtar Sözcükler: Sigara kullanımı, Vücut ağırlığı, Yeme davranışı, Sağlık, Obezite

INTRODUCTION

Cigarette is a filtered or unfiltered tobacco product prepared by wrapping tobacco cut on a 70-120 mm long thin paper in the form of an 8 mm thick cylinder. Smoking, which is the main cause of early preventable mortality and morbidity, is one of the biggest public health threats ever encountered, causing the death of more than 8 million people in the World (1, 2). Of these 8 million deaths, nearly 85% (about 7 million) are due to tobacco use, while the remaining 15% (about 1.2 million) are due to non-smokers' exposure to cigarette smoke (3). As reported by the "Global Burden of Disease Study", the countries with the highest number of tobacco users include India, China, Russia, the USA, Indonesia, Vietnam, the Philippines, Bangladesh, and Japan. Among these, China leads the list, accounting for 30% of the 1.14 billion cigarette users worldwide. Turkey ranks tenth among these countries (4), and according to 2019 data, 41% of men, 14% of women and 28% of the entire population smoke in Turkey. In addition, it is stated that the number of people who died due to smoking in the country is about 10 times more than the number of people who died due to traffic accidents (5). Unfortunately, Turkey is the country with the highest smoking-related death rate in the world (26.1% for men and 7.6% for women) (6).

Appetite, known as the desire, to eat, is regulated by various hormones and metabolites secreted by certain cells. The appetite-regulating hormones (peptide YY (PYY), glucagon-like peptide 1 (GLP-1), cholecystokinin (CCK), pancreatic polypeptide (PP), insulin, amylin, and leptin) help reduce food intake and thus suppress appetite. The active form of the hormone ghrelin and hormones such as glucagon are suppressed by food intake and stimulated in case of hunger, thereby increasing the appetite (7, 8). When the effects of smoking on appetite were examined, it was found that smokers had higher ghrelin levels (9), and ghrelin levels were lower in those who quit smoking (10). In this case, while it is expected that smokers will have higher appetite levels, on the contrary, it has been reported that food consumption decreases, energy expenditure increases, and weight loss is observed in these individuals (11). It has also been shown that nicotine exposure suppresses food intake, reduces the number of meals, prolongs the time between meals (12) and increases metabolic rate by activating the sympathetic nervous system (13).

Studies indicate that the risk of type 2 diabetes increases within two years in people who quit smoking, and this is caused by the increase in body weight after smoking cessation (14, 15). Research has also demonstrated that the rate of obesity tends to rise among individuals who quit smok-

ing (16, 17). Conversely, people who have never smoked are at a higher risk of developing obesity compared to those who continue to smoke (17). While the data might suggest that cigarettes could help reduce appetite and prevent obesity, other studies indicate that smokers often have comparable or higher intake levels of energy, total and saturated fats. Additionally, they tend to consume more energy-dense and less healthy foods compared to non-smokers (18, 19).

Finally, the effects of smoking on body weight, appetite and food intake are not clearly stated and are contradictory. Based on all these contradictory data, this study was conducted to evaluate the effect of smoking on eating behaviors and body mass index (BMI) in Turkey, which is one of the countries where smoking is common in the world and at the same time has the highest number of obesity (32.1%) (20) and diabetes (14.7%) (21) cases in Europe.

MATERIALS and METHODS

Participants and Ethics

The cross-sectional study was carried out from December 2021 to March 2022, using an online survey administered to adults aged 18 to 65 years. The survey form was delivered to the participants via e-mail or social media. All individuals living in Turkey who can be reached through snowball sampling from schools, workplaces, social media groups and platforms constitute the population of the study. Snowball sampling is an approach that focuses on finding new information-rich data providers in the network that the researcher initiates with a sample event. In order to determine the sample size required for the study, it was estimated that at least 384 participants would be needed based on a 5% margin of error and 95% confidence level according to standard tables for populations exceeding 1.000.000 people (22, 23). However, after the individuals who gave incomplete answers to the survey questions were excluded, the study was completed with 336 volunteers. "Ankara University Ethics Committee" approved the study protocol (Approval No: 21/228, Date: 27.12.2021).

Study Instrument

General information about the participants, smoking habits, eating behaviors and attitudes towards healthy eating were questioned with an online questionnaire. Cigarette consumption was determined in per/day and BMI was calculated using the body weight and height declared by the participants, and those " $<18.5 \text{ kg/m}^2$ were defined as underweight, $18.5\text{--}24.99 \text{ kg/m}^2$ as normal, between $25.0\text{--}29.99 \text{ kg/m}^2$ as overweight and $\geq 30 \text{ kg/m}^2$ as obese" (24). At this point, the details of how and when the participants will do their body weight and height were stated in the questionnaire.

Eating behaviors of the participants were determined by the Attitudes towards Healthy Eating Scale (ASHN) and their eating behaviors were determined by the Dutch Eating Behavior Scale (DEBQ). "The ASHN is a 21-item scale that includes 4 factors: knowledge about nutrition (items 1-5), feeling towards nutrition (items 6-11), positive nutrition (items 12-16), and malnutrition (items 17-21). The scale was developed by Tekkurşun Demir & Cicioğlu (25) and validity and reliability analyze were performed by these researchers. The Cronbach alpha internal consistency coefficient obtained at the end of the application was 0.90 and calculated as 0.81, 0.79, 0.68 and 0.80 for the sub-dimensions respectively." In this study, the internal consistency of the ASHN scale, measured by Cronbach's alpha, was 0.82. The Cronbach's alpha values for the scale's sub-dimensions were 0.90 for nutrition knowledge, 0.71 for attitudes toward nutrition, 0.72 for positive nutrition, and 0.70 for poor nutrition. The scale items are rated as "Strongly Disagree," "Disagree," "Neutral," "Agree," and "Strongly Agree." "Positive attitude items were scored as 1, 2, 3, 4 and 5, and negative attitude items were scored as 5, 4, 3, 2 and 1. The lowest score that can be obtained from the scale is 21, and the highest score is 105. Evaluation criteria were determined as 21 points very low, 23-42 points low, 43-63 points medium, 64-84 points high and 85-105 points ideally high as having an attitude towards healthy eating (26)."

"Dutch Eating Behavior Scale (DEBQ) Van Strien et al. (27) was developed by. The validity and reliability study in Türkiye was conducted by Bozan et al (28). The cronbach alpha internal consistency coefficient of the whole scale was determined as 0.94. The scale consists of 33 questions and has 3 sub-factors (emotional eating behavior, restrictive eating behavior, extrinsic eating behavior)." While the scale is evaluated with a 5-point Likert scale "(1-never, 2-rarely, 3-sometimes, 4-often, 5-very often)", questions 1-10 of the scale are "restrictive eating behaviors" and questions between 11-23 are "emotional eating behaviors" and questions between 24-33 constitute the sub-dimensions of "extrinsic eating behaviors". The scores that can be obtained from the sub-dimensions of the scale range from 13 to 65 for emotional eating, 10 to 50 for restrictive eating and 10 to 50 for extrinsic eating. Of the scale questions, only the 31st question is reverse coded. The scale yields a total score ranging from 33 to 165. There is no cut-off point in the scoring of the test and the high scores of each sub-dimension indicate the negativity associated with that eating behavior. In this study, the Cronbach's alpha internal consistency coefficient for the DEBQ scale was found to be 0.91. The coefficients for the subscales were 0.91 for emotional eating behavior, 0.96 for restrictive eating behavior, and 0.83 for external eating behavior. The study data were collected using the

Turkish version of the scale, with permission granted by the researchers who developed it.

Statistical Analysis

IBM SPSS 24.0 statistical package program was used in the statistical evaluation of the data obtained from the study. The data with kurtosis and skewness values between $-1.5/+1.5$ were also examined in histogram graphs and accepted as suitable for normal distribution. The Independent Samples T-test was used to compare two distinct groups. The Chi-Square Test was utilized to determine if there was a relationship between two or more qualitative variable groups. Correlation analysis was used to investigate the association between two quantitative variables. In the study, Partial Correlation Analysis was applied in which the variables likely to affect the two variables were taken under control. Correlation coefficients are defined as follows: " $0 < r \leq 0.3$ = weak; $0.3 < r \leq 0.7$ = medium; $0.7 < r \leq 1.0$ = strong relationship." Test results are considered significant with $p < 0.05$.

RESULTS

The findings regarding the sociodemographic and BMI values of the participants are given in Table 1. The majority of the 336 individuals participating in the study were male (75.6%) and university graduates (85.7%). Individuals with

Table 1: Sociodemographic characteristics and BMI of participants.

Variables	Findings (n=336)
Age (years±SD) (Min-Max)	26.0±9.0 (18.0-63.0)
BMI (kg/m ² ±SD) (Min-Max)	22.8±4.0 (15.6-38.4)
Gender*	
Male	82 (24.4)
Female	254 (75.6)
Educational Status*	
Primary education	5 (1.5)
High school	43 (12.8)
University	288 (85.7)
Income *	
Income less than expenses	78 (23.2)
Income equals expense	189 (56.3)
Income more than expenses	69 (20.5)
BMI Classification*	
Weak (<18.5)	43 (12.8)
Normal (18.5-24.99)	211 (62.8)
Overweight (25.0-29.99)	64 (19.0)
Obese (30.0 and above)	18 (5.4)

*Data are shown as n (%). n: number; SD: standard deviation.

an average age of 26.0 ± 9.0 years were predominantly classified as having a moderate income (56.3%) and were generally within the normal BMI range (62.8%). Of the participants, 5.4% were obese and 19.0% were overweight.

When the findings of the participants regarding smoking were analyzed, it was found that 33.3% of the participants smoked even though almost all of them (98.8%) stated that smoking was harmful. It was determined that individuals who smoked 11.9 ± 8.3 cigarettes per/day for an average of 9.7 ± 9.6 years. Smokers generally stated that they smoke whenever they want (49.1%). When the relationship between smoking and dietary habits was analyzed, it was found that smoking did not affect the diet of half of the individuals, while 43.8% of them consumed less food (Table 2).

The relationship between the smoking status of the participants and their eating habits, DEBQ and ASHN scores is shown in Table 3. When the results were examined, it was seen that smokers had fewer meals during the day ($p < 0.05$) and consumed more tea/coffee ($p < 0.001$). When the DEBQ results of the individuals participating in the study were examined according to their cigarette use, it was determined that the restrictive ($p < 0.05$) and emotional eating ($p < 0.001$) scores of the smokers were lower. In addition, DEBQ scores of smokers were lower than non-smokers ($p < 0.05$).

Table 2: Smoking habits of the participants.

Variables	Findings (n=336)
Do you think smoking is harmful to health?*	
Yes	332 (98.8)
No	4 (1.2)
Smoking*	
Yes	112 (33.3)
No	224 (66.7)
Smoking time*	
When I want	55 (49.1)
After dinner	20 (17.9)
Accompanied by tea/coffee during breaks	19 (17.0)
When I'm in a bad mood	18 (16.1)
The effect of smoking on your diet*	
No effect	56 (50.0)
Eat less	49 (43.8)
Eat more	7 (6.2)
Smoking duration (years \pm SD) (Min-Max)	9.7 ± 9.6 (1.0-55.0)
Amount of smoking (per/day \pm SD) (Min-Max)	11.9 ± 8.3 (1.0-35.0)

*Data are shown as n (%). n: number; X: mean; SD: standard deviation.

Table 3: The relationship between eating habits, scale scores and smoking.

Variables	Total (n=336)	Smokers (n=112)	Non-Smokers (n=224)	p
Number of meals*	2.5 ± 0.7	2.4 ± 0.7	2.6 ± 0.6	0.006
Water consumption*(mL)	1421.9 ± 830.0	1424.1 ± 929.0	1420.8 ± 777.9	0.972
Tea/coffee consumption* (mL)	456.6 ± 336.3	578.6 ± 399.2	392.6 ± 281.1	<0.001
DEBQ Score*				
Restrictive Eating	23.5 ± 8.2	22.1 ± 8.8	24.2 ± 7.9	0.030
Emotional Eating	29.7 ± 13.5	26.4 ± 11.8	31.4 ± 14.0	<0.001
Extrinsic Eating	30.5 ± 5.8	30.3 ± 5.8	30.6 ± 5.8	0.617
Total Points	84.1 ± 19.5	79.6 ± 18.0	86.4 ± 19.9	0.003
ASHN Score*				
Information about nutrition	21.5 ± 3.0	20.9 ± 3.1	21.7 ± 2.7	0.013
Feeling towards food	16.4 ± 4.4	16.5 ± 4.4	16.4 ± 4.4	0.807
Positive nutrition	17.6 ± 4.0	16.9 ± 4.2	17.9 ± 3.8	0.024
Malnutrition	18.5 ± 3.8	17.8 ± 3.9	18.8 ± 3.7	0.065
Total Points	73.9 ± 10.3	72.1 ± 9.9	74.9 ± 10.5	0.009
ASHN Classification**, n (%)				
Intermediate	57 (17.0)	21 (18.8)	36 (16.1)	0.176
High	50 (68.1)	80 (71.4)	149 (66.5)	
Ideal	336 (14.9)	11 (9.2)	39 (17.4)	

* Independent Samples T test was used. And data are shown as mean \pm standart deviation. ** The Chi-square test was applied, with bold values indicating statistical significance at $p < 0.05$

When the ASHN responses of the participants were examined, it was seen that the knowledge about nutrition and positive nutrition scores of smokers were lower ($p < 0.05$), but no difference was found between feelings about nutrition and malnutrition scores ($p > 0.05$). Additionally, while smokers were found to have lower ASHN scores ($p < 0.05$), there was no significant difference in nutritional knowledge levels between smokers and non-smokers ($p > 0.05$). When the data of all participants were analyzed, it was understood that 17.0% of them had intermediate, 68.1% had high and 14.9% had ideal level attitudes towards healthy nutrition (Table 3).

Table 4 examines the relationship between the smoking status of the participants and their BMI. When the results were examined, the BMI values of the individuals who smoked were found to be significantly higher ($p < 0.05$). When analyzed according to BMI groups, it is seen that overweight

(43.8%) and obese (66.7%) smoking group are significantly higher than normal individuals (28.9%) and obese individuals (66.7%) are significantly higher than underweight individuals (25.6%) ($p < 0.05$). In the non-smoker group, overweight (56.3%) and obese individuals (33.3%) were compared to normal individuals (71.1%); again, it was determined that obese individuals (33.3%) were less than underweight individuals (74.4%) ($p < 0.05$). Lastly, partial correlation analysis, controlling for gender, revealed a weak but significant positive relationship between smoking duration (in years) ($r: 0.222$; $p < 0.05$) and the number of cigarettes smoked daily ($r: 0.191$; $p < 0.05$) with the BMI values of smokers (Figure 1).

DISCUSSION

Tobacco use represents a major public health issue globally, leading to illness and death for millions of people each year (3). Cigarette, which is widely used among tobacco products, is shown to be responsible for one in ten deaths in the world (29) and it is stated that the resulting mortality exceeds 8 million people annually (2). Cigarette is a tobacco product that increases the risk of diabetes, respiratory problems, cerebrovascular diseases, cancer, cardiovascular diseases and premature death due to its carcinogenic, mutagenic, inflammatory and toxic effects (5). In addition, smoking has a negative effect on healthy life. The study found that smokers scored lower in spiritual development, health responsibility, nutrition, physical activity, interpersonal relationships, and stress management (30). Among these components, the effect of cigarettes on nutrition has not been sufficiently investigated and is a subject with conflicting results. Based on this, this study was conducted to examine the relationship between smoking, eating habits and obesity.

Table 4: Relationship between smoking and BMI.

Variables	Smokers (n=112)	Non-Smokers (n=224)	<i>p</i>
BMI (kg/m ² ±SD) *	23.7±4.6	22.3±3.5	0.004
BMI Classification **, n(%)			
Underweight (<18.5)	11 (25.6) ^{a,b}	32 (74.4) ^{a,b}	0.002
Normal (18.5-24.99)	61 (28.9) ^b	150 (71.1) ^b	
Overweight (25.0-29.99)	28 (43.8) ^{a,c}	36 (56.3) ^{a,c}	
Obese (30.0 and above)	12 (66.7) ^c	6 (33.3) ^c	

* Independent Samples T test was used.

** The Chi-square test was conducted, and post hoc analysis was performed for significant Chi-square results. Columns with different letters denote differences between groups. Bold values indicate statistical significance with $p < 0.05$.

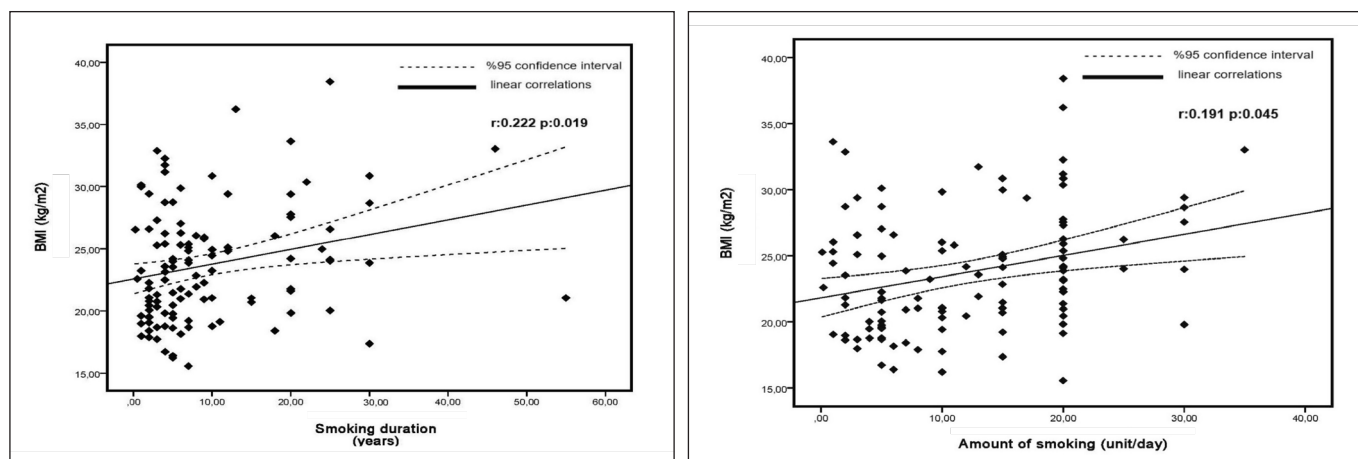


Figure 1: Relationship between smoking (duration and amount) and BMI.

Note: The gender variable was controlled.

In the study, ASHN and DEBQ scales were applied to the participants. While the Cronbach's alpha coefficient of the ASHN scale was 0.90, it was found to be 0.82 in this study, and while the DEBQ scale was 0.94, it was found to be 0.91 in this study. Therefore, it can be stated that the reliability of our study is high. The study was completed with 336 individuals, 82 males (24.4%) and 254 females (75.6%) with a mean age of 26.0 ± 9.0 years. While it was observed that 33.3% of the individuals participating in the study were smokers, it was determined that these individuals thought that they took less food because they smoked ($p < 0.05$) (Table 2) and they had more self-made meals during the day and consumed more tea/coffee ($p < 0.001$) (Table 3). In this case, it can be stated that cigarette use decreases appetite within the scope of the study. When the eating behaviors of the participants were examined, the fact that the restrictive ($p < 0.05$), emotional ($p < 0.001$) and extrinsic ($p > 0.05$) eating scores of the smokers were lower also supports this data (Table 3). When the literature is examined, Raatz et al. stated in their research that nicotine is associated with less energy intake (31). In another study, it was determined that individuals exposed to cigarette smoke get less energy with diet (32). However, there are studies in the literature showing that smokers consume more energy-dense foods and consume more energy, total and saturated fat than non-smokers (18, 19, 33, 34). The contradiction seen in this situation is explained by the fact that some of the approximately 4000 toxic compounds in cigarettes are obesogenic (polycyclic aromatic hydrocarbons) and some have anti-obesogenic effects (chromium, cadmium) (35).

There are data in the literature that smokers maintain an unhealthier diet. For example, in a study, it was found that smokers have lower intakes of folic acid, iron, fiber, polyunsaturated fatty acids, vitamin C, vitamin A, carotene and vitamin E, while their intake of saturated fatty acids is higher (32). In another study, it is seen that smokers consume more white bread, sugar, red meat, butter, whole milk, eggs, and consume less bread made from whole wheat, high-fiber breakfast cereals, vegetables, and fruits (36). In this study, the knowledge about nutrition, positive nutrition and total ASHN scores of smokers were found to be lower ($p < 0.05$) (Table 3) and these data support the literature on this subject. However, no difference was found between the nutritional knowledge levels for the smoking and non-smoking groups ($p > 0.05$) (Table 3). In addition, 87.0% of the participants had a high and ideal level of attitude towards healthy nutrition (Table 3) and the majority (62.8%) had a BMI in the normal range (Table 1), indicating that the selected sample consisted of healthy individuals.

Smoking's impact on body weight is attributed to nicotine's ability to boost metabolic rate, increase energy expenditure, and reduce appetite, leading to weight loss (37). In a study investigating the link between smoking and obesity among adults aged 31 to 69, it was observed that smokers have a lower likelihood of being obese compared to non-smokers (38). In other studies, overweight and obesity were found to be less common in smokers (39-41), while there was no relationship between smoking and BMI (42) or clear results could not be (43) are available in studies. In this study, BMI values of smokers (23.7 ± 4.6 kg/m²) were found to be higher than non-smokers (22.3 ± 3.5 kg/m²) ($p < 0.05$). When analyzed according to BMI groups, it was determined that the overweight and obese were significantly higher than normal and underweight in the smoking group, while the opposite results were found in the non-smoker group ($p < 0.05$) (Table 4). Additionally, partial correlation analysis, with gender controlled for, revealed a weak but significant positive correlation between smoking duration (in years) ($r: 0.222$; $p < 0.05$) and the number of cigarettes smoked daily ($r: 0.191$; $p < 0.05$) with the BMI values of smokers (Figure 1). In this case, the findings of the study differ from the literature, albeit partially. The fact that the participants had lower restrictive ($p < 0.05$), emotional ($p < 0.001$) and extrinsic ($p > 0.05$) eating scores (Table 3); it is generally characterized by lower BMI in the literature (44, 45). And in this case, it can be said that this finding of the study is contradictory. However, although smokers stated that they eat fewer meals and consume food and have lower emotional-restrictive eating scores (Tables 2 and 3), higher BMI values may be associated with maintaining an unhealthy diet. The fact that smokers among the individuals participating in the study had lower knowledge about nutrition ($p < 0.05$) and positive nutrition ($p < 0.05$) scores supports this situation.

This study has a few limitations. First, the participants' BMI and appetite levels were taken according to their own statements. These data can be obtained in the presence of experts. Another limitation is that the Cronbach alpha internal consistency coefficient of ASHN and DEBQ scales is lower than the original studies. This may be explained by the small number of participants. Additionally, the participants' food consumption records were not collected. Because obtaining the data online is a situation that prevents the recording of food consumption. To obtain clearer data in future studies, food consumption records should be obtained in the presence of an expert.

In this study, it was concluded that adult smokers think that they take less food with diet because they smoke, they have

fewer meals during the day, they consume more tea/coffee, and their restrictive and emotional eating scores are lower. These data are compatible with the studies in the literature that smoking reduces appetite. In addition, knowledge about nutrition, positive nutrition and lower total ASHN scores of smokers are also supported by the data in the literature that smokers maintain an unhealthier diet. Finally, in this study, it was observed that the BMI values of smokers were higher. Although the data in the literature on this subject are generally that obesity is less common in smokers, there are also findings indicating that it has no effect. In addition, a few recent studies have found that maternal smoking increases the risk of childhood obesity (46) and that obesity is more common in individuals who smoke electronic cigarettes (47). In conclusion, the effect of smoking on obesity has not yet been clarified and comprehensive experimental studies are needed.

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Authorship Contributions

Study design: **Eren Canbolat, Esma Asil**, Data collection: **Eren Canbolat, Esma Asil**, Data analysis: **Eren Canbolat**, Draft preparation: **Eren Canbolat, Esma Asil**, Critical review for content: **Eren Canbolat, Esma Asil**, Final approval of the version to be published: **Eren Canbolat, Esma Asil**.

Conflict of Interest

The authors reported no conflicts of interest.

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Ethics Approval

The study received approval from the "Ankara University Ethics Committee" on December 27, 2021, under decision number 21/228.

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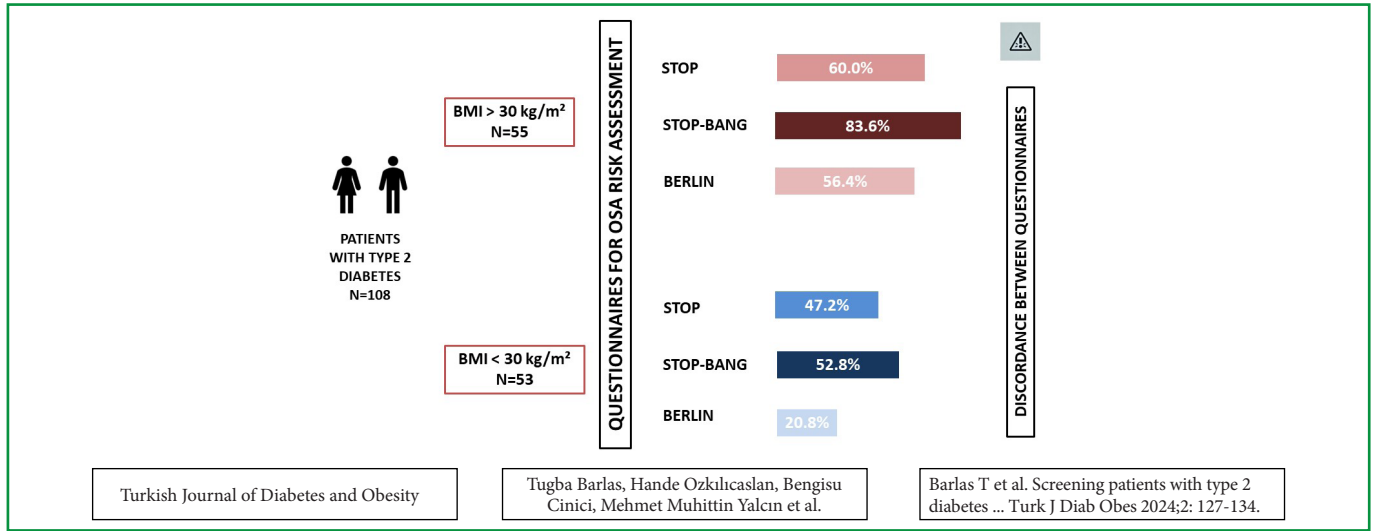
Screening Patients with Type 2 Diabetes at High Risk of Obstructive Sleep Apnea: A Single Tertiary Center Experience

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GRAPHICAL ABSTRACT



ABSTRACT

Aim: Current guidelines suggest screening patients with type 2 diabetes (T2D) for obstructive sleep apnea (OSA). However, there is no consensus regarding the optimal method for OSA risk assessment. We aimed to identify those with diabetes who are at high risk for OSA in a tertiary single center and investigate the concordance among questionnaires utilized in assessing high OSA risk.

Material and Methods: STOP, STOP-BANG, and Berlin questionnaires for the assessment of the risk of OSA and the Epworth Sleepiness Scale (ESS) for an investigation of daytime sleepiness were utilized. McNemar test evaluated the agreement between questionnaires. A multivariate logistic regression analysis identified factors influencing high OSA risk.

Results: We included 108 patients, with a median HbA1c of 7.5%, a BMI of 30.7 kg/m², and waist and neck circumferences measuring 104.3 cm and 38.9 cm, respectively. On ESS, 10.2% of patients had excessive daytime sleepiness. According to Berlin (38.9%), the number of patients at high risk of OSA was found to be lower than that of in STOP (53.7%) and STOP-BANG (68.5%) questionnaires. For patients with a BMI<30 kg/m², insufficient consistency was observed between Berlin with STOP and STOP-BANG, whereas there was a

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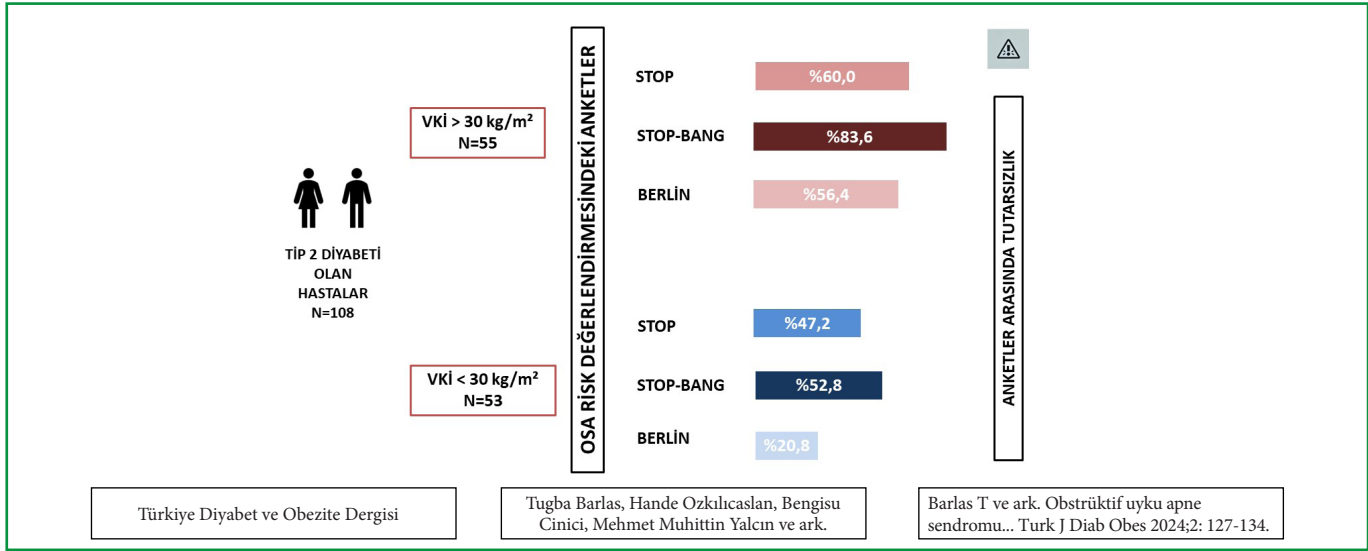
concordance between STOP and STOP-BANG ($p<0.05$, $p=0.453$). In those with $BMI>30\text{ kg/m}^2$, while Berlin and STOP were consistent, no concordance was detected between Berlin and STOP-BANG, as well as between STOP and STOP-BANG ($p=0.824$, $p<0.05$). The insulin therapy was the associated factor with a high OSA risk in multivariate logistic regression analysis ($p=0.041$).

Conclusion: The questionnaires used to predict the risk of OSA in T2D exhibit insufficient compatibility. Insulin therapy contributes to the increased risk of OSA in individuals diagnosed with T2D.

Keywords: Berlin questionnaire, Epworth Sleepiness Scale, STOP-BANG, Obesity, Type 2 diabetes

Obstrüktif Uyku Apne Sendromu İçin Yüksek Riskli Olan Tip 2 Diyabet Hastalarının Belirlenmesi

GRAFİKSEL ÖZET



Öz

Amaç: Mevcut kılavuzlar, tip 2 diyabet (T2D) hastalarının obstrüktif uyku apnesi (OSA) açısından taranmasını önermektedir. Ancak, OSA risk değerlendirmesi için en uygun yöntem konusunda bir fikir birliği yoktur. Üçüncü basamak bir merkezde, OSA riski yüksek olan diyabet hastalarını belirlemeyi ve yüksek OSA riski değerlendirmesinde kullanılan anketler arasındaki uyumu araştırmayı amaçladık.

Gereç ve Yöntemler: OSA riski değerlendirmesi için STOP, STOP-BANG ve Berlin anketleri ve gündüz uykululuğunu araştırmak için Epworth Uykululuk Ölçeği (ESS) kullanıldı. McNemar testi ile anketler arasındaki uyum, çok değişkenli lojistik regresyon analizi ile yüksek OSA riskini etkileyen faktörler belirlendi.

Bulgular: Çalışmaya dahil edilen 108 hastanın ortanca HbA1c değeri %7,5, vücut kütle indeksi (VKİ) değeri $30,7\text{ kg/m}^2$ ve bel ve boyun çevreleri sırasıyla 104,3 cm ve 38,9 cm olarak bulundu. ESS'ye göre hastaların %10,2'sinde aşırı gündüz uykululuğu vardı. Berlin anketine göre (%38,9), yüksek OSA riski taşıyan hasta sayısı, STOP (%53,7) ve STOP-BANG (%68,5) anketlerine göre daha düşük bulundu. $VKI<30\text{ kg/m}^2$ olan hastalarda, Berlin ile STOP ve STOP-BANG arasında yetersiz tutarlılık gözlenirken, STOP ile STOP-BANG arasında yeterli uyum vardı ($p<0,05$, $p=0,453$). $VKI>30\text{ kg/m}^2$ olan hastalarda ise Berlin ile STOP arasında tutarlılık gözlenirken, Berlin ile STOP-BANG ve STOP ile STOP-BANG arasında uyum tespit edilmedi ($p=0,824$, $p<0,05$). Çok değişkenli lojistik regresyon analizinde, insülin tedavisinin yüksek OSA riski ile ilişkili faktör olduğu bulundu ($p=0,041$).

Sonuç: T2D'de OSA riskini tahmin etmek için kullanılan anketler yetersiz uyum sergilemektedir. İnsülin tedavisi, T2D tanısı alan bireylerde artmış OSA riski ile ilişkilidir.

Anahtar Sözcükler: Berlin anketi, Epworth uykululuk ölçeği, STOP-BANG, Obezite, Tip 2 diyabet

INTRODUCTION

Obstructive sleep apnea (OSA) is a chronic disease that is identified by recurring instances of either complete (apnea) or partial (hypopnea) obstruction of the upper respiratory tract (1). OSA can lead to elevated levels of carbon dioxide, intermittent deoxygenation, and disrupted sleep patterns. Consequently, there may be a development of sympathetic neuronal activation, resulting in alterations beta cell function (2). Although population-based studies indicate varying rates of OSA incidence, there are studies reporting remarkable rates changing between 23-46% (1, 3). The frequency of OSA is known to rise with increasing obesity, and it serves as a contributory factor for metabolic, cardiovascular, and neurocognitive disorders (4).

The prevalence of type 2 diabetes (T2D) is globally on rise, similar to OSA. Regarding the International Diabetes Federation (IDF) reports, the worldwide prevalence of T2D in individuals aged 20–79 was approximated to be 12.2% (783.2 million) by 2045 (5). Although obesity and age commonly underlie both OSA and T2D, mounting evidence indicates that the connection between these conditions is not solely reliant on obesity (2). It was demonstrated in animal models that intermittent hypoxia leads to a worsening of insulin resistance. Intermittent hypoxia during OSA episodes may directly affect cellular metabolism and contribute to oxidative stress, impacting insulin signaling pathways (6, 7). Furthermore, the sympathetic nervous system could be stimulated by intermittent hypoxia and arousal, leading to an increase in the secretion of stress hormones like cortisol and adrenaline. Elevated levels of these hormones might contribute to poor glycemic control in T2D (2, 8). Moreover, OSA is related with a chronic inflammatory state, which might impair the function of β -cells in the pancreas (7). However, multiple studies have shown that diabetes impacts the regulation of breathing in the central respiratory system and is therefore believed to contribute to the development of OSA (8). The underlying pathophysiology linking T2D and OSA is still under investigation.

Current guidelines indicate that 24–86% of individuals with T2D have OSA, and these guidelines also suggest screening patients with T2D for OSA especially in recent years (9, 10). It was emphasized that screening should be considered for individuals who exhibit symptoms consistent with OSA, like excessive daytime sleepiness, snoring, and witnessed apnea (11). However, in routine practice, aforementioned symptoms might be subjective and there is no clear consensus regarding the optimal method for OSA risk assessment in T2D patients. Polysomnography is the gold standard diagnostic procedure in the evaluation of OSA. However it is time-consuming and costly (12). Herein, we aimed

to identify the high-risk patient group for OSA in patients with T2D followed in our center and to investigate the concordance of questionnaires that are used for the evaluation of high OSA risk.

MATERIALS and METHODS

Study Design and Patients

This single-center study was conducted at the endocrinology and metabolism outpatient clinic of a tertiary hospital between July 2023 and September 2023. It has a descriptive, cross-sectional design. Patients with T2D were included according to the following criteria: (i) ≥ 18 years of age; (ii) followed at our center for at least 1 year; and (iii) treated with insulin and/or oral antidiabetic (OAD) medications. The exclusion criteria comprised the following: (i) diabetes types other than T2D; (ii) pregnancy; (iii) use of any medication associated with sleep disorders; (iv) known diagnosis of OSA or any condition causing airway obstruction; (v) presence of severe co-morbidities such as pulmonary diseases, renal failure or acute heart failure; (vi) psychiatric disorder and related drug usage; (vii) individuals working night shifts. The study adhered to the principles of the Declaration of Helsinki and received approval from the Ethical Board of Gazi University (decision number: 481, date: 05 June 2023). All participants provided written informed consent.

Data Collection

Diabetes mellitus was diagnosed according to the criteria of the American Diabetes Association (13). Demographic features, diabetes-related information, laboratory results and body mass index (BMI), waist and neck circumferences of the patients were documented retrospectively from hospital records. Nephropathy presence was assessed through 24-hour or spot urinalysis (14). Retinopathy, determined through fundus examination, or neuropathy, assessed by examination with a monofilament within the last year, were recorded (15). The presence of cerebrovascular disease, peripheral artery disease, or coronary heart disease was documented as macrovascular complications of T2D (16, 17).

Questionnaires

The Turkish validated versions of STOP, STOP-BANG, and Berlin questionnaires (BQ) were utilized for the evaluation of the risk of OSA in T2D patients (18, 19). The STOP questionnaire consists of four yes-or-no questions regarding: 1. Snoring; 2. Feeling tired, fatigued, or sleepy during the daytime; 3. Observed apnea; and 4. Blood pressure. Two or more “yes” responses indicate a high OSA risk (20). The STOP-BANG questionnaire expands upon the STOP questionnaire by including four additional questions: 1. BMI; 2.

age; 3. neck circumference; and 4. gender. If a patient answers “yes” to three or more items across both sets of questions, it suggests a high risk of OSA (21). The BQ consists of ten questions in three categories: fatigue, hypertension, and snoring (22). In accordance with the scoring criteria, if two or more categories were positive, it signified that patients were at a high OSA risk, whereas having less than two positive categories suggested that patients were at a low risk of OSA.

The Turkish validated version of Epworth Sleepiness Scale (ESS) was also used for an accurate assessment of daytime sleepiness, which is a common question in all three questionnaires (23). The ESS consists eight questions that inquire about the probability of patients falling asleep in typical situations. Widely utilized in clinical and research settings, an ESS score of 11 or higher is generally regarded as excess daytime sleepiness (24).

Statistical Analysis

The IBM SPSS (Version 23.0) statistical software was utilized for statistical analyses. The Shapiro-Wilk test was applied to assess the normal distribution of continuous data. The data were given as mean \pm standard deviation (SD), median and interquartile range. Continuous variable comparisons utilized Mann–Whitney U and independent sample t tests, while categorical variables were compared using χ^2 (chi-squared) and Fisher’s exact test. Cronbach’s alpha coefficient was used to assess the correlation of scores for each item. McNemar test evaluated the agreement between questionnaires. A multivariate logistic regression analysis identified factors influencing high OSA risk. A significance threshold of $p < 0.05$ was utilized to determine statistical significance.

The sample size was calculated as 108 at 95% power, 0.32 effect size, and a 0.05 error level using the G*Power 3.1.10 program.

RESULTS

One-hundred eight patients were enrolled. Seventy-two (66.7%) patients were female, and the mean age was 60.8 ± 10.1 years. There were 67 (62%) patients with bed partners. While the median diabetes duration was 10 (7–15) years, the median HbA1c value was 7.5% (6.6–8.9). Anthropometric measurements and the diabetes-related features of the patients are shown in Table 1.

Fifty-five (50.9%) patients had a BMI exceeding 30 kg/m^2 , while 53 patients (49.1%) had a BMI below 30 kg/m^2 . The median BQ score of the patients was 1 (1-2), the STOP score was 2 (1-2), the STOP-BANG score was 3 (2-4), and the ESS score was 3 (1-6). Cronbach’s alpha coefficient was

0.84 for the BQ, 0.68 for the STOP, and 0.77 for the STOP-BANG. Figure 1 presents the patients experiencing daytime sleepiness based on the ESS. Patients with T2D are at high risk of OSA, regarding the questionnaires shown in Figure 2. According to the BQ, the number of patients at high risk of OSA was detected to be lower than in STOP and STOP-BANG. For patients with T2D with a BMI below 30 kg/m^2 , although there was concordance between STOP and STOP-BANG ($p=0.453$), sufficient agreement was not observed between BQ and STOP as well as between BQ and STOP-BANG ($p < 0.05$). In those with a BMI exceeding 30 kg/m^2 , while concordance was observed between BQ and STOP ($p=0.824$), no agreement was detected between BQ and STOP-BANG, as well as STOP and STOP-BANG ($p < 0.05$).

Table 1: Anthropometric measurements and the diabetes-related features of the patients.

Characteristics	Patients with T2D (n=108)
BMI ($\text{kg/m}^2 \pm \text{SD}$)	30.7 ± 5.7
Waist circumference, ($\text{cm} \pm \text{SD}$)	104.3 ± 13.0
Neck circumference, ($\text{cm} \pm \text{SD}$)	38.9 ± 3.7
Treatment	
Insulin + OAD, n (%)	43 (39.8)
OAD, n (%)	89 (82.4)
Hypertension, n (%)	62 (57.4)
Microvascular complications	
Neuropathy, n (%)	34 (31.5)
Nephropathy, n (%)	10 (9.3)
Retinopathy, n (%)	16 (14.8)
Macrovascular complications	
Coronary artery disease, n (%)	21 (19.4)
Cerebrovascular disease, n (%)	4 (3.7)
Peripheral artery disease, n (%)	18 (16.7)

T2D: Type 2 diabetes, BMI: Body mass index, OAD: Oral antidiabetics

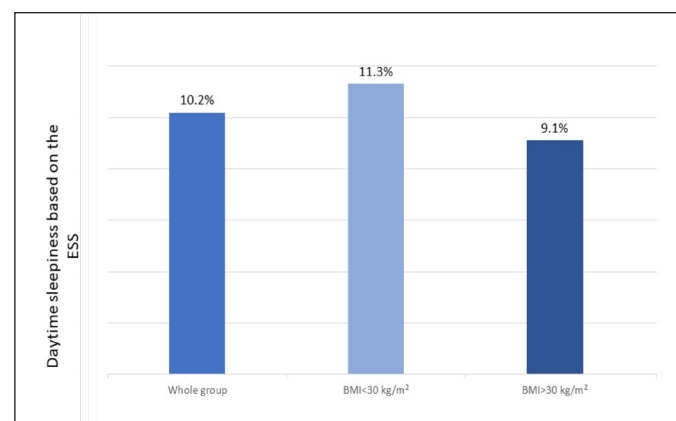


Figure 1: Patients experiencing daytime sleepiness based on the Epworth Sleepiness Scale.

ESS: Epworth Sleepiness Scale, BMI: Body mass index.

Table 2: Characteristic features of T2D patients with a high risk of OSA according to all BQ, STOP, and STOP-BANG questionnaires.

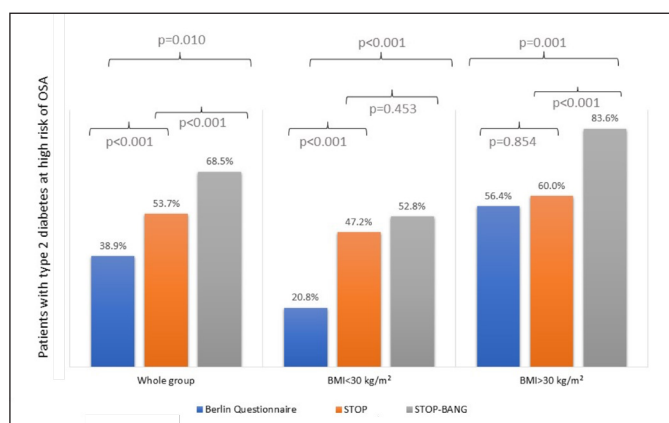
Characteristic features of T2D patients	High risk of OSA (n=32)	Not high risk of OSA (n=76)	p value
Male gender, n (%)	9 (28.1)	27 (35.5)	0.456
Age, years	61.6±9.6	60.4±10.3	0.928
Duration of diabetes, years	11.5 (6.2-19.5)	10.0 (7.0-15.0)	0.287
Hypertension, n (%)	25 (78.1)	37 (48.7)	0.006
HbA1c, n (%)	8.2 (7.3-10.2)	7.1 (6.5-8.6)	0.091
Insulin therapy, n (%)	19 (59.4)	24 (31.6)	0.008
BMI kg/m ²	34 (28-39)	29 (26-32)	0.001
Waist circumference, cm	111 (100-120)	102 (93-110)	0.001
Neck circumference, cm	40.0 (38.0-42.0)	39.0 (36.0-40.7)	0.056
Retinopathy, n (%)	9 (28.1)	7 (9.2)	0.012
Neuropathy, n (%)	14 (43.8)	20 (26.3)	0.075
Nephropathy, n (%)	4 (12.5)	6 (7.9)	0.318
Coronary artery disease, n (%)	10 (31.3)	11 (14.5)	0.044
Cerebrovascular disease, n (%)	0 (0)	4 (5.3)	0.316
Peripheral artery disease, n (%)	8 (25.0)	10 (13.2)	0.132

T2D: Type 2 diabetes, OSA: Obstructive sleep apnea, BQ: Berlin questionnaire, BMI: Body mass index. Statistically significant values are given in bold

Table 3: Univariate and multivariate logistic regression analysis based on high OSA risk of patients with T2D according to the questionnaires.

Parameters High risk of OSA	Univariate logistic regression			Multivariate logistic regression		
	B coef.	%95 CI	p value	B coef.	%95 CI	p value
Hypertension	1.30	1.41-9.50	0.007	0.60	0.61-5.48	0.281
Insulin therapy	1.13	1.31-7.31	0.009	0.98	1.03-6.94	0.041
Waist circumference	-0.06	0.90-0.97	0.002	-0.04	0.91-1.00	0.063
Retinopathy	1.35	1.29-11.52	0.016	0.24	0.35-4.61	0.706
Coronary artery disease	0.98	1.00-7.18	0.049	0.78	0.68-7.01	0.183
BMI > 30 kg/m ²	1.05	1.19-6.87	0.018	0.27	0.42-4.05	0.635

OSA: Obstructive sleep apnea, T2D: Type 2 diabetes, BMI: Body mass index. Statistically significant values are given in bold.

**Figure 2:** Patients with type 2 diabetes at high risk of obstructive sleep apnea according to questionnaires.

OSA: Obstructive sleep apnea. McNemar test evaluated the agreement between questionnaires. $p < 0.05$ was accepted as statistical significant.

When patients with a high risk of OSA were evaluated according to all three questionnaires, the presence of hypertension, insulin therapy, BMI, waist circumference, the presence of retinopathy, and coronary artery disease were detected to be related with a high risk of OSA (Table 2). We observed no gender-related difference regarding a high risk of OSA in our study. Even though the median HbA1c value of high OSA risk group was higher, no statistically significant difference was observed between the two groups. The presence of insulin therapy was the most associated factor with a high OSA risk in logistic regression analysis (Table 3).

DISCUSSION

In our study, the considerable proportion of patients with T2D revealed an elevated risk of OSA. However, it was determined that the questionnaires used to predict the risk of

OSA yielded varying OSA incidences, resulting in inconsistency between them. Although there are conflicting results in studies conducted to investigate the superiority of these questionnaires to each other in patient populations without T2D, it is often reported that the sensitivity of the STOP-BANG questionnaire is slightly higher (25-27). However, there are also studies reporting that these questionnaires are suboptimal for individuals with T2D (28, 29). Westlake et al. emphasized that the sensitivity of the STOP-BANG questionnaire is significantly lower in women compared to men with T2D (28). Based on our findings and existing literature, it is essential to develop more sensitive screening tests to identify patients at high risk for OSA. This approach can help prioritize which patients with T2D should undergo more time-consuming and costly tests like polysomnography.

Depending on the questionnaire utilized, our study indicated that patients with T2D had a high risk of OSA, with prevalence rates varying between 39-68%. In some studies conducted on patients with T2D, the high risk of OSA with BQ was found to be ranging from 42-44% (30, 31). In another screening study utilizing the STOP-BANG questionnaire, the high risk of OSA among individuals with T2D was determined to be 63% (32). In a study involving 58 patients with T2D, where both questionnaires were administered to the same patient group, a high risk of OSA was identified in 74% based on the BQ and 62% using the STOP-BANG questionnaire (33). These differences reveal that the method used in screening for OSA is highly important.

As expected and in accordance with the established literature (34, 35), our study revealed an association between an elevated risk of OSA and elevated BMI, increased waist circumference, hypertension, and coronary artery disease. The prevalence of OSA can reach levels ranging from 40% to 80% in individuals with co-morbidities (36). OSA and T2DM is known to share common pathophysiological mechanisms related to the cardiovascular complications in particular (37). Hence, detecting and treating OSA will be beneficial to prevent this synergistic effect.

Even though the T2D patients at a high risk of OSA exhibited a greater BMI compared to those at low risk, insulin therapy emerged as the most associated factor when considering the collective analysis of risk-increasing factors for OSA. This data strengthen the perspective that factors beyond obesity play a role in the increased risk of OSA in patients with T2D. Consistent with our results, in a population-based study, it was reported that, following adjustments for BMI, individuals with diabetes treated with insulin therapy had a 43% higher OSA risk (38).

Despite a higher neck circumference in the high OSA risk group compared to the low OSA risk group, no statistically significant difference was observed in our study. While some studies in the literature suggest that neck circumference serves as an independent predictor of high-risk OSA (34, 35), there are also studies similar to our findings that did not identify a significant association (30). This might be attributed to factors such as the sample size, as well as potential influences from gender and anatomical variations among the patients.

Our study had some limitations. First of all, the assessment of OSA risk was conducted using questionnaires, and the survey data were not validated through polysomnography, which serves as a definitive diagnostic method. However, it is important to note that the questionnaires used in the study have been validated and extensively utilized in both clinical settings and research studies. In addition, because of the cross-sectional design of the study, cause-and-effect relations among the variables could not be determined.

Our results indicate that the questionnaires used to predict the OSA risk in individuals with T2D exhibit insufficient compatibility. Considering that polysomnography is time-consuming and costly, it is important in clinical practice to correctly select high-risk patients and a more comprehensive screening approach is essential for assessing the risk of OSA in T2D.

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Authors Contributions

All authors contributed to the study conception and design. Material preparation, data collection and analysis were performed by **Tugba Barlas, Hande Ozkिकासlan, Bengisu Cinici, Mehmet Muhittin Yalcin, Mujde Akturk, Fusun Balos Toruner, Ayhan Karakoc and Alev Eroglu Altinova**. The first draft of the manuscript was written by **Tugba Barlas, Alev Eroglu Altinova and all authors** commented on previous versions of the manuscript. All authors read and approved the final manuscript.

Conflict of interest

The authors declare that they have no conflict of interest in relation with the present study.

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Ethics approval

The study was approved by Gazi University Ethical Board.

Availability of data and material

The datasets generated during and/or analysed during the current study are available from the corresponding author on reasonable request.

Peer Review Process

Extremely and externally peer-reviewed.

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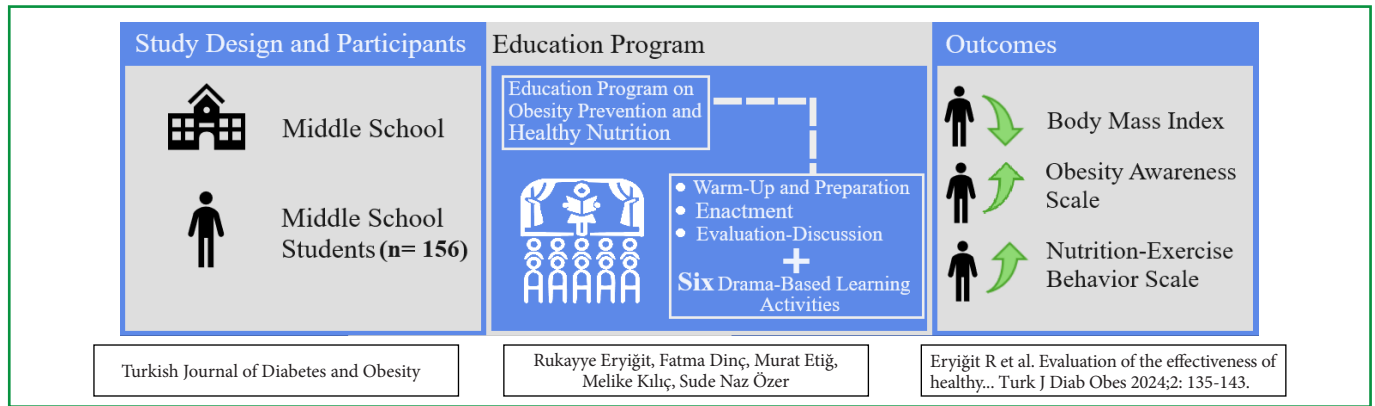
Evaluation of the Effectiveness of Healthy Nutrition and Obesity Awareness Education for Middle School Students Using Drama-Based Learning Activities

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GRAPHICAL ABSTRACT



ABSTRACT

Aim: The prevalence of childhood obesity is rapidly increasing, making it one of the most common nutritional problems globally. In this study, it was aimed to investigate the effectiveness of healthy nutrition and obesity awareness education for middle school students using drama-based learning activities.

Material and Methods: This study was conducted as a one-group pretest-posttest quasi-experimental study. The study was conducted between October 2023 and January 2024 with 156 middle school students selected by simple random sampling method in a public middle school in a province in the Western Black Sea Region. A six-session face-to-face education program on obesity prevention and healthy nutrition was implemented. Data collection tools included a Demographic Information Form, an Obesity Awareness Scale, and a Nutrition-Exercise Behavior Scale. Data collection tools were administered to students before and one month after the education. Descriptive statistics and dependent sample t test were used to evaluate the data.

Results: The mean age of the participating students was 12.33±0.92. Following drama-based learning activities that focused on healthy nutrition-exercise behaviour and obesity awareness education middle school students experienced a decrease in body mass index values. Additionally, a significant increase in obesity awareness and nutrition-exercise behaviour total mean scores was observed after the education ($p<0.001$).

Conclusion: Awareness education on healthy nutrition and obesity, in which students participated interactively and learned by doing and experiencing, was effective in increasing students' obesity awareness and healthy nutrition-exercise behaviours.

Keywords: Child, Creative drama, Health education, Obesity awareness, Nutrition

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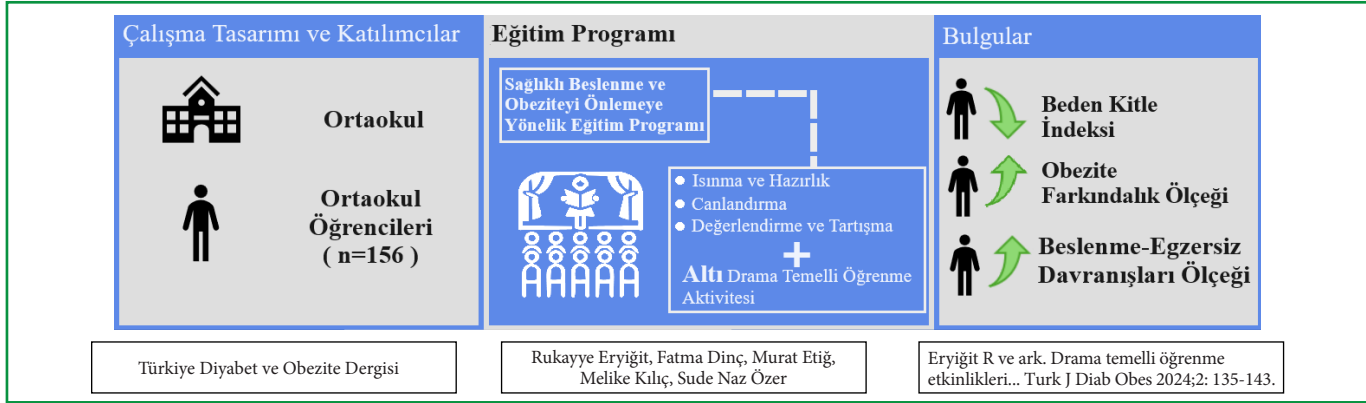
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Drama Temelli Öğrenme Etkinlikleri Kullanılarak Ortaokul Öğrencilerine Yönelik Sağlıklı Beslenme ve Obezite Farkındalığı Eğitiminin Etkinliğinin Değerlendirilmesi

GRAFİKSEL ÖZET



ÖZ

Amaç: Çocukluk çağı obezitesi prevalansı hızla artmakta, dünyada ele alınması gereken en yaygın beslenme sorunlarından birisi hâline gelmiştir. Bu çalışmada drama temelli öğrenme etkinlikleri kullanılarak ortaokul öğrencilerine yönelik sağlıklı beslenme ve obezite farkındalığı eğitiminin etkinliğinin araştırılması amaçlanmıştır.

Gereç ve Yöntemler: Bu çalışma tek gruplu ön test-son test yarı deneysel olarak yapılmıştır. Çalışma Ekim 2023-Ocak 2024 tarihleri arasında Batı Karadeniz Bölgesi'ndeki bir ildeki devlet ortaokulunda basit rastgele örneklem yöntemiyle seçilen 156 ortaokul öğrencisiyle gerçekleştirilmiştir. Obeziteden korunma-sağlıklı beslenmeye yönelik eğitim programı, altı oturum şeklinde yüz yüze uygulanmıştır. Veri toplama araçları olarak Tanıtıcı Bilgi Formu, Obezite Farkındalık Ölçeği ve Beslenme-Egzersiz Davranışları Ölçeği kullanılmıştır. Öğrencilere veri toplama araçları eğitimden önce ve eğitimden bir ay sonra uygulanmıştır. Verileri değerlendirmek için tanımlayıcı istatistikler ve bağımlı örneklem t testi kullanılmıştır.

Bulgular: Çalışmaya katılan öğrencilerin yaş ortalaması $12,33 \pm 0,92$ 'dir. Drama temelli öğrenme etkinlikleri kullanılarak ortaokul öğrencilerine yönelik sağlıklı beslenme-egzersiz davranışı ve obezite farkındalığı eğitimi sonrasında beden kütle indeksi değerleri azalmış, obezite farkındalıkları ve beslenme-egzersiz davranışları toplam puan ortalamalarında ise eğitim sonrasında anlamlı artış görülmüştür ($p < 0,001$).

Sonuç: Öğrencilerin interaktif katılımlı, yaparak-yaşarak öğrenme sağladıkları, sağlıklı beslenme ve obeziteye yönelik farkındalık eğitimi, öğrencilerin obezite farkındalıklarını, sağlıklı beslenme-egzersiz davranışlarını artırmada etkiliydi.

Anahtar Sözcükler: Çocuk, Yaratıcı drama, Sağlık eğitimi, Obezite farkındalığı, Beslenme

INTRODUCTION

According to the World Health Organization (WHO), obesity is defined as a condition characterized by abnormal excessive accumulation of fat that poses a health risk (1). The prevalence of childhood obesity is rapidly increasing, becoming one of the most prevalent nutritional issues globally (2). According to WHO data, worldwide, 340 million adolescents and 39 million children are obese (1, 3). Obesity can lead to chronic diseases such as Type 2 diabetes, cardiovascular disease, hypertension, various types of cancer, and non-communicable mental health issues, affecting body systems and causing long-term detrimental consequences.

Given the potential health consequences of childhood obesity and its likelihood to persist into adulthood, it is crucial for children to gain awareness and develop behaviors toward healthy nutrition and obesity prevention during the time they spend in school.

For school-age children, physical activity, lifestyle choices, and nutrition habits are crucial factors influencing obesity. Children in this age group are influenced by advertising through media communication tools and an obesogenic environment containing visual elements in their food choices. They also tend to lead more sedentary lifestyles with online games and services (3,4). The imbalance between energy in-

take and expenditure from insufficient exercise and sedentary living can lead to excessive weight gain and obesity in school-age children (5). The school environment provides a suitable setting for interventions aimed at preventing obesity and fostering lifestyle changes. Innovative school-based education programs focusing on healthy nutrition during childhood should be adopted to ensure that the lessons learned become lifelong dietary habits in adulthood (6, 7). Previous studies have implemented school-based interventions to influence behaviors related to obesity in school-age children (8-11). Teaching methods that include interactive sessions and opportunities for active peer participation are essential for school-age children to acquire healthy behaviors (6). Nurse-led interventions can serve as encouraging approaches for preventing obesity and promoting healthy nutrition and lifestyles in children (12, 13).

Drama is an activity in which students identify their strengths and weaknesses and associate them with real life situations and play themselves or act according to another character (14). In the historical process of creative drama, the “do, play, believe” practices of a village teacher named Finlay-Johnson in 1911 are examples of the first studies in this field. Creative drama was introduced in the 1960s by Dorothy Heathcote, a British drama teacher and academic who combined play, children and life for the same purpose. Heathcote defined creative drama as a way for children to feel comfortable (15). Dorothy Heathcote discussed drama from different perspectives and stated that its theoretical foundations are compatible with “student-centred” education (16). In 1967, Brien-Way, one of the pioneers of creative drama, showed that creative drama is a technique that supports children’s emotional skills (17).

Creative drama is an educational method based on improvisation that allows exploration, deepening, and creative thinking about ideas and emotions (18). A meta-analysis found that drama-based learning activities (originally called drama-based pedagogy) have a significant positive effect on students’ creative thinking (19). Research indicates that drama-based learning activities are an important component of social learning in students’ education (20). Drama-based learning activities integrate verbal and non-verbal communication and performance in a fictional context. They provide an entertaining opportunity to improve students’ language skills, problem-solving abilities, and motivation. The literature shows that drama-based learning activities are effective in achieving these goals (18, 19).

While studies on creative drama related to obesity in school-age children are limited in the literature, it has been

observed that using creative drama helps these children better understand problems, leading to positive changes in knowledge, attitudes, and behaviors through hands-on activities and play (21, 22). Creative drama, which activates cognitive and emotional learning, enables school-age children to participate in the learning process actively, and the use of experiential and interactive methods can enhance the sustainability of learning (22). Therefore, this study aimed to investigate the effectiveness of healthy nutrition-exercise behavior and obesity awareness education for middle school students using drama-based learning activities. The research hypotheses are as follows, in line with the general objective:

H1: After healthy nutrition-exercise behaviour and obesity awareness education for middle school students using drama-based learning activities, students’ body mass index values will decrease.

H2: After healthy nutrition-exercise behaviour and obesity awareness education for middle school students using drama-based learning activities, students’ healthy nutrition-exercise behaviour scores will increase.

H3: After healthy nutrition-exercise behaviour and obesity awareness education for middle school students using drama-based learning activities, students’ awareness scores for obesity prevention will increase.

MATERIALS and METHODS

Study Design

This study was designed as a single-group pre-test-post-test quasi-experimental research. The effect of the independent variable (healthy nutrition-exercise behaviour and obesity awareness education for middle school students using drama-based learning activities) on the dependent variables (obesity awareness levels, nutrition-exercise behaviours, body mass index) was examined. Permission was initially obtained from the scale owners via email for the scales used in the study. Ethical approval was obtained from Bartın University Social and Human Ethics Committee. (Decision date: 29.03.2023, Decision no: 07), and institutional permission was obtained from Bartın Provincial Directorate of National Education (Number: E-64441482-605.01-80957138, Date: 07.08.2023, Number of Documents: 2300078680). Before starting data collection and the education program, children and parents were informed about the purpose of the study. It was emphasized that their identity information would be kept confidential, written consent was obtained from parents, and they were informed that they could leave the study at any time.

Study Population and Location

The research was conducted in a state middle school determined by a lottery method in a Western Black Sea Region province. Simple random sampling method was used to determine the classes and branches of middle school students to be included in the study. The study was conducted with 5th, 6th, and 7th-grade students between October 2023 and January 2024. The sample size required for the study was determined as 126 children in G-Power statistical analysis software, taking into account Type I error 0.05, Type II error 0.20, 80% power and obesity prevalence rates in school children in Turkey (between 9% and 27%). This sample was increased by 20% considering the missing data and was determined as 156 middle school students. Inclusion criteria for the research were students attending 5th, 6th, or 7th grade and obtaining written consent from their parents. Exclusion criteria included students who did not want to participate in the research and those with chronic illnesses. All middle school students included in the study received information from the lessons on healthy nutrition and obesity according to their grade levels within the curriculum of the Ministry of National Education.

Education Program

An education program on obesity prevention and healthy nutrition was developed for children (3-6, 9, 13-15, 22). Following a literature review, the education program's content was created based on input from five experts in pediatric nursing, child development, and nutrition and dietetics. To enhance the content validity of the education programme, it underwent a content validity test by five experts. The test questionnaire comprised 16 items that evaluated the programme's structure, effectiveness, content, and applicability.

The items were rated on a 4-point Likert-type scale (1 = not very valid, 4 = very valid). The results indicated that all items received a minimum of three points. The education programme on obesity prevention and healthy nutrition was implemented in six sessions using drama-based learning activities (Table 1). Healthy nutrition and obesity awareness training was given to the middle school students in the study together with nursing undergraduate students (R.E., M.E., M.K., S.N.Ö.) under the supervision of a faculty member of child health and diseases nursing (F.D.). F.D., who is a faculty member among the researchers in the study, has many articles and projects in the field of Child Health and Diseases. The other undergraduate nursing students (R.E., M.E., M.K., S.N.Ö) who are the researchers are final year students who have successfully completed the undergraduate courses "Nutrition" and "Child Health and Diseases Nursing". In addition, the researchers completed 120 hours of Creative Drama Training before the training and received the "Creative Drama Training Certificate". The school where the study was conducted did not have a school health nurse. Materials such as notebooks, colouring pencils, small envelopes, photocopied papers and cardboard were used for students' interactive participation in drama-based learning activities. All education sessions were conducted for 40+40 minutes. The educational sessions, designed according to the creative drama method for middle school students, were implemented with groups of 12-13 students. Each session of the education program consisted of three stages.

1. Warm-up and Preparation

In this stage, the middle school students were introduced, group dynamics were enhanced, and activities were conducted to prepare for the next stage.

Table 1: Education sessions and content.

Topics	Content
Adequate and Balanced Nutrition	<ul style="list-style-type: none"> • Definition of adequate and balanced nutrition • Basic food groups and their characteristics
Overweight and Obesity in School Age and Adolescence I	<ul style="list-style-type: none"> • Definition of obesity and overweight • Health problems caused by obesity • Characteristics of school age and adolescence
Overweight and Obesity in School Age and Adolescence II	<ul style="list-style-type: none"> • Ways to prevent obesity • Types of exercises
Overweight and Obesity in School Age and Adolescence III	<ul style="list-style-type: none"> • Addictive foods and beverages • Consumption of sugar, salt, and fat • Definition of glycemic index
Hunger, appetite, and satiety	<ul style="list-style-type: none"> • Definition of hunger, appetite, and satiety • Relationship between physical hunger, emotional hunger, and eating
Obesity-Sleep and Stress	<ul style="list-style-type: none"> • The impact of stress and sleep deprivation on obesity

2. Enactment

This stage involved the use of frozen images, improvisation, and role-playing techniques. For example, in the frozen image technique, middle school students were gathered in the middle of the class, and based on the number of students, the class was divided into several groups. Each group was assigned a leader, and music was played. Students were asked to think about the problems an imaginary person with obesity might face in their imagination. They were then asked to envision a scene in their minds, and when the music stopped, they were instructed to freeze according to the scene in their minds. The leader would then go to the frozen students, unfreeze one of them, have them play out the imaginary scene in their mind, freeze them again, and pass it on to another student. In the improvisation technique, a group of students who were very happy when eating was selected. They were asked to create a small story among themselves. For instance, they were tasked with imagining a situation, such as a student who got low grades on their exams coming home and feeling happy when they saw their favorite meal. After a brief improvisation, discussions were held about what could happen if they dedicated themselves to eating whenever they felt unhappy. Volunteers from the group were then asked to reenact the first story, but this time, they were encouraged to demonstrate alternative activities instead of eating. This way, both emotional hunger and the risks of emotional hunger for obesity were explained and illustrated.

3. Evaluation-Discussion

In the final stage, emotions were shared, and evaluations and discussions were conducted collectively after the outputs.

Data Collection

Implementing the education program and completing data collection tools were carried out at times that would not affect the middle school students' curricula. Prior to the education program, students were informed about the study, and informed consent was obtained from the guidance teacher and parents. In the first week, height and weight measurements of children were taken, and the Introductory Information Form, Obesity Awareness Scale, and Nutrition-Exercise Behavior Scale were administered. Researchers conducted weight measurements using a scale sensitive to up to 100 grams, with students wearing their school uniforms. A portable stadiometer was used for height measurements. The education program on creative drama was conducted by researchers who had received education in crea-

tive drama. The education programme on obesity prevention and healthy nutrition for middle school students using drama-based learning activities was planned as follows:

1st week: Height and weight measurements of students were taken before the education.

2nd week: Session on adequate and balanced nutrition with creative drama was conducted.

3rd week: Session on overweight and obesity in school age and adolescent I was conducted.

4th week: Session on overweight and obesity in school age and adolescence II was conducted.

5th week: Session on overweight and obesity in school age and adolescence III was conducted.

6th week: Session on hunger, appetite, and satiety was conducted.

7th week: Session on obesity-sleep and stress was conducted.

One month later, the Obesity Awareness Scale and Nutrition-Exercise Behavior Scale were administered. All students who participated in the study completed the education programme.

Data Collection Tools

Introductory Information Form

This form consisted of 5-questions filled out by the children, including the child's age, gender, grade, income status, participation in the course on obesity and healthy nutrition.

Obesity Awareness Scale (OAS)

Developed by Allen in 2011 to determine awareness of obesity, dietary habits, thoughts on physical activity, and the impact of obesity education on individuals (23). The Cronbach's alpha coefficient of the original scale is 0.80. The Turkish adaptation was done by Kafkas and Özen in 2014 (24). The Turkish validity and reliability study of the scale included three subdimensions: obesity awareness, nutrition, and physical activity, consistent with the original scale. The sample of the study consisted of students aged 10-14 years. The scale consists of 23 items, encompassing three sub-dimensions: obesity awareness, nutrition, and physical activity. The scale is in a 4-point Likert structure, and both the scale and sub-dimensions are evaluated as "0-1 low," "1.1-2.0" average, "2.1-3.0" good, and "3.1-4.0" high levels of positive awareness. The overall Cronbach's alpha coefficient for the scale is 0.87. In this study, the scale's Cronbach's alpha coefficient is 0.77.

Nutrition-Exercise Behavior Scale (NEBS)

The scale was developed by Yurt and Yıldız for adolescents aged 12-14 years in order to determine students' behaviours related to nutrition (11). This scale comprises 45 items and four sub-dimensions: meal order (ranging from 6 to 30 points, 6 items), healthy Nutrition-Exercise Behavior (ranging from 14 to 70 points, 14 items), Unhealthy Nutrition-Exercise Behavior (ranging from 14 to 70 points, 14 items), and Psychological-Dependent Eating Behavior (ranging from 11 to 55 points, 11 items). The scale has a 5-point Likert structure, and the Cronbach's alpha coefficient for the scale is 0.85. In this study, the scale's Cronbach's alpha coefficient is 0.75.

Statistical Analysis

The data were transferred to IBM SPSS Statistics 23 for analysis. Descriptive statistics were used to present students' demographic characteristics, including percentages, numbers, means, and standard deviations. The normality of the data was checked using the Kolmogorov-Smirnov test. Due to the normal distribution of the data, the dependent sample t-test was used to examine the difference between before and after drama-based learning activities for middle school students. The results of this study were evaluated at 95% confidence interval and $p < 0.05$ significance level.

RESULTS

The average age of the participating students was 12.33 ± 0.92 . Half of the students (50.0%) were female, and 34.6% were in the 5th grade. In the study, 80.8% of the students had equal income expense. In addition, 3.8% of the students had previously attended a course on obesity and healthy nutrition (Table 2).

Table 3 shows the differences in body mass index, obesity awareness and nutrition-exercise behaviours of the students before and after the education. Following drama-based learning activities that focused on healthy nutrition-exercise behaviour and obesity awareness education middle school students experienced a decrease in body mass index values

($p < 0.001$). The mean posttest score for the students' level of obesity awareness (3.54 ± 0.20) was significantly higher than the mean pretest score (2.99 ± 0.17) ($p < 0.001$) (Figure 1). Similarly, the mean posttest score for the students' nutrition and exercise behaviour (165.10 ± 11.57) was significantly higher than the mean pretest score (153.76 ± 13.07) ($p < 0.001$) (Figure 2).

DISCUSSION

Given the serious global health issue of childhood obesity, this study aimed to investigate the effectiveness of healthy nutrition-exercise behavior and obesity awareness education for middle school students using drama-based learning activities. Following the intervention, a decrease in BMI values and an increase in obesity awareness and healthy eating and exercise behaviors were observed among middle school students. Although there are studies in the literature on obesity and healthy eating that include different methods, the results are similar to the findings of this study (2, 3, 5, 25, 26).

In this study, a decrease in the BMI values of the students was found after the training, which supported H1 of the

Table 2: Demographic of the included students in the study.

Characteristics	Findings (n=156)	
Age, Years \pm SD (Min.-Max)	12.3 \pm 0.9	(11.0-15.0)
Gender, n (%)	Female	78 (50.0)
	Male	78 (50.0)
Grade, n (%)	5 th	54 (34.6)
	6 th	51 (32.7)
	7 th	51 (32.7)
Income Status, n (%)	Higher than expense	14 (9.0)
	Equal to expense	126 (80.8)
	Lower than expense	16 (10.3)
Participation in the course on obesity and healthy nutrition, n (%)	Yes	6 (3.8)
	No	150 (96.2)

Table 3: Differences in body mass index, obesity awareness and nutrition-exercise behavior of students before and after education.

Parameters*	Findings (n=156)		t	p
BMI (Pretest)*	19.82 \pm 3.48	(10.85-33.86)	2.390	<0.001
BMI (Posttest)*	19.66 \pm 3.49	(10.85-33.86)		
Obesity Awareness Scale (Pretest)*	2.99 \pm 0.17	(2.5-3.35)	-24.119	<0.001
Obesity Awareness Scale (Posttest)*	3.54 \pm 0.20	(3.0-3.9)		
Nutrition-exercise behavior scale (Pretest)*	153.76 \pm 13.07	(123-181)	-7.875	<0.001
Nutrition-exercise behavior scale (Posttest)*	165.1 \pm 11.57	(144-196)		

t: Dependent sample t-test. *Data are shown as Mean \pm SD with Minimum-Maximum.

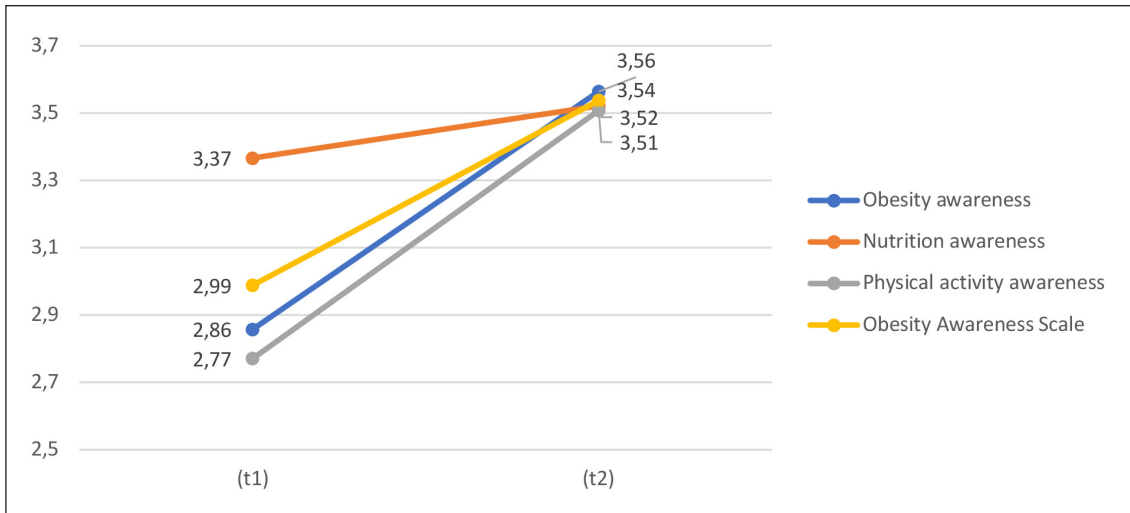


Figure 1: Comparison of students' obesity awareness scale mean scores before and after the education.

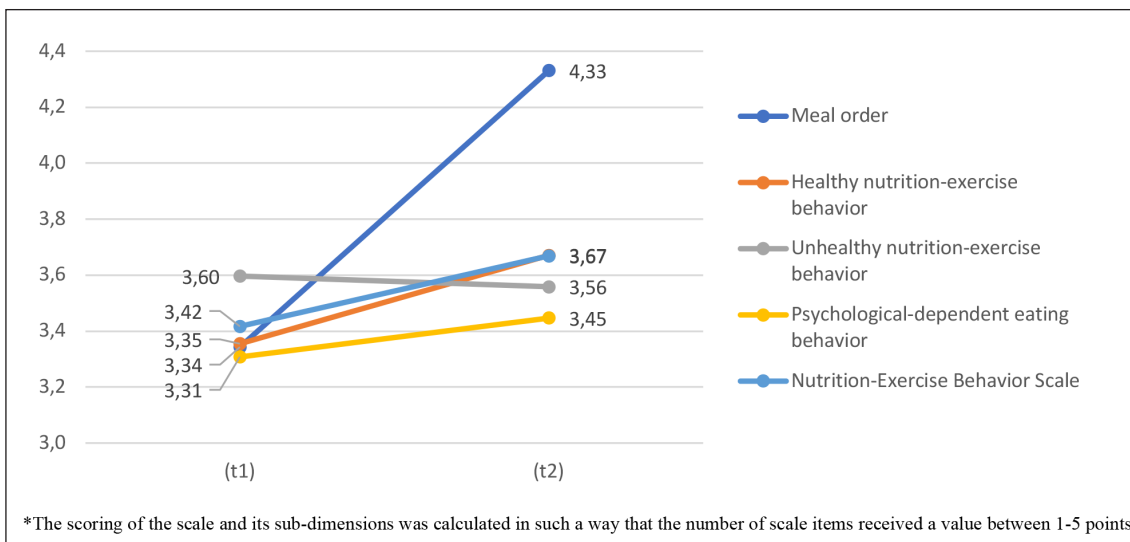


Figure 2: Comparison of students' nutrition-exercise behavior scale mean scores before and after the education.

study. Nowadays, the frequency of physical activity of school-age children is decreasing due to increased use of smartphones, internet and video games. In order to prevent obesity, innovative learning activities are important for students to gain regular exercise and healthy lifestyle behaviour skills (13). In a study conducted in the literature, a decrease in BMI values was observed after education, similar to our findings (25). In this study, there was a decrease in body mass index. However, the small decrease is not surprising and may be due to the short duration of the education and education programmes requiring long-term follow-up may be recommended.

In addition, this study revealed that there was an increase in students' nutrition-exercise behaviours after the education, which supported H2 of the study. Education has a critical

role in the prevention of childhood obesity and the promotion of lifelong healthy nutrition and physical activity for children's health (3). Studies in the literature have similarly found that students' participation in healthy nutrition and physical activities increased after education (21, 27). This study's hands-on and experiential learning environment may have facilitated more effective nutrition-exercise behaviour learning.

In this study, obesity awareness of the students increased after the education, which supported H3 of the study. Drama-based learning activities can increase interest in the subject among children (2). A meta-analysis has shown that school-based interventions are effective in increasing childhood obesity awareness, which is consistent with the findings of this study (6). Similarly, in another study, an

increase in obesity awareness of students was found after the training (28). The active participation of middle school students in creative drama-based learning activities and encouraging students to imagine and think during the application activity may have increased obesity awareness.

In this study, self-report scales were used to investigate the effect of healthy nutritious and obesity awareness education for middle school students using drama-based learning activities. The Cronbach's alpha values of the highly reliable scales used as data collection tools in this study were also found to be highly reliable (29). This may be due to the fact that the scales in this study were used with a similar sample, and the researchers were attentive and active in the data collection process by going to the institution.

However, there are some limitations to this study. Firstly, due to the high workload of 8th-grade students during exam years, they were not included in the sample. Secondly, the study only involved students. Future research could develop an education program involving both children and parents. Thirdly, the research was conducted in a public middle school in a single province in the Western Black Sea Region, which limits the generalisation of the findings. In order to increase the representativeness of the sample, it may be considered to select students from different provinces in future studies. Fourthly, this research design utilised a single-group pre-test-post-test quasi-experimental approach. Participants were pre-selected and pre-tested, then exposed to an educational intervention before a post-test was administered. Quasi-experimental designs are used to evaluate interventions for time and ease of implementation, but do not use randomisation. The aim of quasi-experimental designs is to demonstrate causality between an intervention and an outcome. One limitation of this design is that internal and external validity are lower than in experimental studies with control groups, due to the absence of a control or comparison group (30). It is recommended to include a control or comparison group in future studies. Despite these limitations, the study has several strengths. All students who participated in the study completed the education programme. The main strength of the study was that it included simple, easily applicable, accessible, fun and actively participatory activities to increase student interest and motivation.

Our findings demonstrated that interactive, engaging interventions that promote experiential learning effectively increased students' obesity awareness, healthy nutrition-exercise behaviors, and decreased BMI values. To increase children's awareness of obesity and encourage healthy nutrition-exercise, innovative educational methods are nec-

essary. In future studies, it can be evaluated by comparing drama-based learning activities and different learning activities related to healthy nutrition practices in middle school children.

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Author Contributions

Conceptualization: **Fatma Dinç**. All authors contributed to the article and approved the submitted version. Healthy nutrition and obesity awareness training was given to the middle school students in the study together with **Rukayye Eryiğit**, **Murat Etiğ**, **Melike Kılıç**, **Suda Naz Özer** under the supervision of **Fatma Dinç**, a faculty member in child health and diseases nursing, one of the researchers.

Conflict of Interest

The authors report no conflicts of interest.

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Ethical Approval

Ethical approval was obtained from Bartın University Social and Human Ethics Committee (Decision date: 29.03.2023, Decision no: 07), and institutional permission was obtained from Bartın Provincial Directorate of National Education (Number: E-64441482-605.01-80957138, Date: 07.08.2023, Number of Documents: 2300078680).

Peer Review Process

Extremely and externally peer-reviewed.

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Investigation of the Relationship Between Health Anxiety and Cyberchondria in Obese Cases

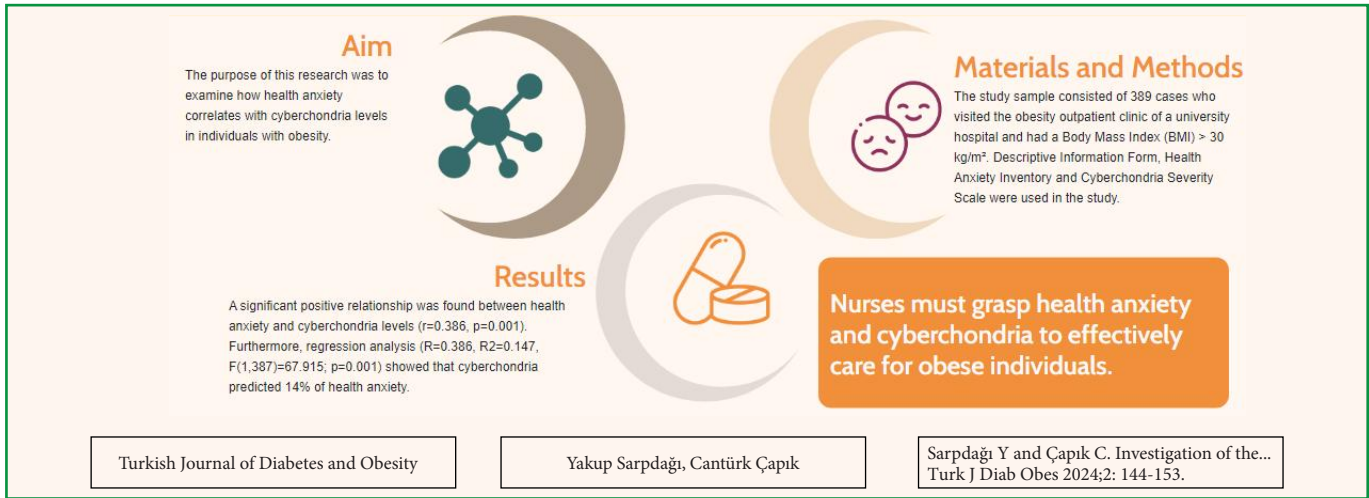
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GRAPHICAL ABSTRACT



ABSTRACT

Aim: The purpose of this research was to examine how health anxiety correlates with cyberchondria levels in individuals with obesity.

Material and Methods: This descriptive and correlational study was conducted between 15 July and 21 November 2022. The study sample consisted of 389 cases who visited the obesity outpatient clinic of a university hospital and had a Body Mass Index (BMI) > 30 kg/m². Descriptive Information Form, Health Anxiety Inventory and Cyberchondria Severity Scale were used in the study. Data were collected and analysed using IBM SPSS statistical software (SPSS-22). In the analysis, various statistical methods were employed, including descriptive statistics such as counts, percentages, minimum and maximum values, means, and standard deviations, as well as Pearson Correlation and simple regression analyses.

Results: The total score of the participants in this study was 21.87 ± 9.70 on the Health Anxiety Scale and 81.37 ± 20.11 on the Cyberchondria Severity Scale. A significant positive relationship was found between health anxiety and cyberchondria levels ($r=0.386$, $p=0.001$). Furthermore, regression analysis ($R=0.386$, $R^2=0.147$, $F(1,387)=67.915$; $p=0.001$) showed that cyberchondria predicted 14% of health anxiety.

Conclusion: Nurses working in public health and mental health need to comprehend health anxiety and cyberchondria to recognize possible attitudes and behaviors that may emerge in physical, social, and mental areas among obese individuals and to implement appropriate nursing interventions when required.

Keywords: Obesity, Health anxiety, Cyberchondria

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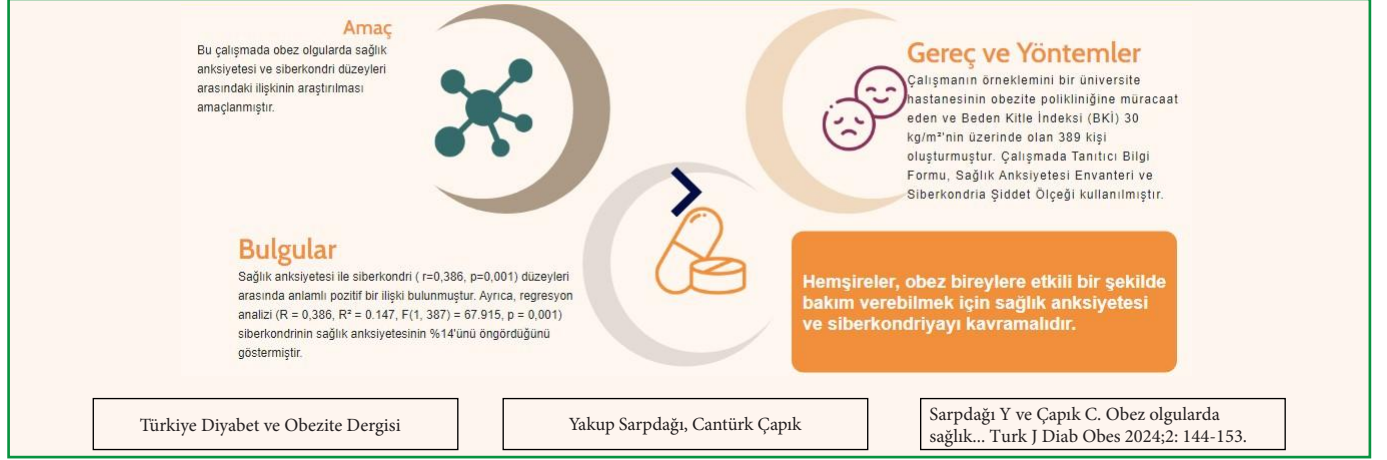
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Obez Olgularda Sağlık Anksiyetesi ve Siberkondri Arasındaki İlişkinin İncelenmesi

GRAFİKSEL ÖZET



ÖZ

Amaç: Bu çalışmada obez olgularda sağlık anksiyetesi ve siberkondri düzeyleri arasındaki ilişkinin araştırılması amaçlanmıştır.

Gereç ve Yöntemler: Tanımlayıcı ve ilişkisel nitelikteki bu çalışma 15 Temmuz-21 Kasım 2022 tarihleri arasında yürütülmüştür. Çalışmanın örneklemini bir üniversite hastanesinin obezite polikliniğine müracaat eden ve Beden Kitle İndeksi (BKİ) 30 kg/m^2 'nin üzerinde olan 389 kişi oluşturmuştur. Çalışmada Tanıtıcı Bilgi Formu, Sağlık Anksiyetesi Envanteri ve Siberkondria Şiddet Ölçeği kullanılmıştır. Veriler, SPSS istatistik programı (SPSS-22) ile değerlendirilmiştir. Analizlerde, frekanslar, yüzdeler, minimum ve maksimum değerler, ortalama ve standart sapmalar, Pearson Korelasyon ve basit regresyon analizleri uygulanmıştır.

Bulgular: Bu çalışmaya katılan katılımcıların Sağlık Anksiyetesi Ölçeği'nde toplam puanı $21,87 \pm 9,70$ ve Siberkondri Şiddet Ölçeği'nde $81,37 \pm 20,11$ olarak bulunmuştur. Sağlık anksiyetesi ile siberkondri ($r=0,386$, $p=0,001$) düzeyleri arasında anlamlı pozitif bir ilişki bulunmuştur. Ayrıca, regresyon analizi ($R=0,386$, $R^2=0,147$, $F(1, 387)=67,915$, $p=0,001$) siberkondrinin sağlık anksiyetesinin %14'ünü öngördüğünü göstermiştir.

Sonuç: Halk sağlığı ve ruh sağlığı alanında çalışan hemşireler, obez olgularda fiziksel, sosyal ve zihinsel alanlarda ortaya çıkabilecek tutum ve davranışları belirlemek ve gerektiğinde hemşirelik müdahalelerini uygulamak için sağlık anksiyetesi ve siberkondriyi anlamalıdır.

Anahtar Sözcükler: Obezite, Sağlık anksiyetesi, Siberkondri

INTRODUCTION

Obesity is a rapidly growing public health issue that affects an increasing frequency of countries worldwide, creating significant economic and health burdens (1). According to the World Obesity Atlas 2023, it was reported that there were 988 million people globally classified as obese, with a Body Mass Index (BMI) of 30 kg/m^2 or greater, in 2020. In addition, according to the report, this rate is estimated to be 1 billion 249 million in 2025, 1 billion 556 million in 2030 and 1 billion 914 million in 2035 (2). According to the World Health Organization (WHO) European Region Obesity Report 2022, Turkey has the highest rates of obesity within the WHO European Region. Specifically, 66.8% of adults in Turkey are classified as overweight, and 32.1% are categorized as obese (3).

Obesity is stated to have destructive effects on both physical and mental health (4). In a systematic review, it is stated that obesity has a significant and adverse impact on physical and mental health, social relationships, environmental, and economic factors (5). Excess weight and obesity are well-established risk factors for the development of various chronic health issues, including cardiovascular diseases, type 2 diabetes, and various cancers (6). In a study, it was found that obesity is associated with physical fatigue, back and joint pain, shortness of breath, binge eating behavior, and irritability (4). Psychologically, the most common conditions observed in obese individuals are depression, burnout and anxiety (7,8). Depression and anxiety are associated with social stigma, negative body image, and low self-esteem (9,10). Studies focusing on obese individuals have indicated that

these individuals often exhibit elevated levels of anxiety and depressive symptoms relative to those who are not obese (11). In a meta-analysis, it was observed that individuals with obesity experience anxiety more frequently than those with normal weight (12,13). Although closely associated with various social factors, obesity is a leading cause of low quality of life, disability, and social disadvantage (14). Although previous studies have found an association between health anxiety and body symptoms, no published study is known to date that has specifically assessed this relationship among obese individuals (15).

Health anxiety, a type of anxiety disorder, refers to the condition where an individual interprets normal bodily changes as signs of a serious illness and experiences persistent excessive worry about their health (16). It has been observed that individuals who are particularly worried about their health are more likely to frequently seek health-related information online (17,18) and for longer periods (19). People utilize the internet, particularly to acquire knowledge on maintaining their health, investigating potential health risks, self-diagnosing, and obtaining information about their health conditions (20,21). Online resources related to obesity can provide assistance on topics such as diet tips, exercise plans, motivational resources, and support groups. However, accessing accurate and reliable information is crucial. However, due to the unregulated dissemination of information on the internet, encompassing both accurate and inaccurate content, individuals may encounter both reliable and misleading information about their health (22). While it is normal for individuals to experience some concerns about their health, these concerns can have a negative impact on their well-being when they become persistent (23). This situation can lead to cyberchondria.

Cyberchondria is characterized by an excessive pattern of online medical research, often accompanied by heightened levels of anxiety or distress (24). Online searches for medical information can result in encountering conflicting, inconsistent, and low-quality information, thereby elevating the perceived risk (25,26). The rapid dissemination of unfiltered information in this manner weakens public health measures and can lead to incorrect behaviors (27). There is substantial evidence indicating that cyberchondria may lead to various adverse effects, including diminished trust in medical professionals (28), functional impairment (29), a tendency to engage in self-diagnosis (30), and increased utilization of healthcare services (31).

Understanding the psychological aspects of obesity is an important part of providing more comprehensive healthcare and improving patient outcomes (32). There are differences in the extent of the link between health anxiety

and cyberchondria; some studies report a weak connection (33), while others find a strong association. (34). There is no consensus on how seeking health information online correlates with health anxiety (35). Understanding the degree of association between health anxiety and seeking health information online, as well as the relationship between health anxiety and cyberchondria, is essential (34).

The goal of this study is to explore the connection between health anxiety and cyberchondria among individuals with obesity.

MATERIAL and METHODS

This descriptive and correlational study was conducted between July and November 2022 in the Obesity outpatient clinic of Van Yüzüncü Yıl University Dursun Odabaş Medical Center. Van province is one of the metropolitan cities in eastern Turkey.

Participants

Individuals with a Body Mass Index (BMI) >30, aged 18 years or older, literate, with internet access, without cognitive problems, and willing to participate were included in the study. Data were collected from 389 individuals who met the research criteria through face-to-face interviews conducted by the researcher. A post hoc power analysis was conducted to assess whether the sample size was sufficient, utilizing the G*Power 3.1 software.. According to the power analysis results, the power of the study was calculated to be 99% at a 0.05 significance level and a 95% confidence interval for a medium effect size (36). Pearson correlation test was used in the analysis and effect size calculations were made. The power analysis showed $H1=0.621$ correlation, -0.099 lower critical r , 0.099 upper critical r and 0.99 power."This value indicates that the sample is sufficient (37).

Data Collection Tools

Demographic information form: It was prepared by the researchers by reviewing the relevant literature (34,38-41). The form consists of two parts. The first part includes the participants' characteristics such as age, gender, marital status, and educational status, while the second part includes variables related to the disease

Health Anxiety Scale (HAS): Salkovskis et al. created it in 2002 (42). The Turkish validity and reliability of the scale were assessed by Aydemir et al. in 2013. The Health Anxiety Scale is a self-report tool comprising 18 items in total (43). Each item on the scale is rated on a scale from 0 to 3. A higher score on the scale reflects increased levels of health anxiety. The scale is divided into two factors. The initial 14 items constitute the first factor. This factor, known as hypersensitivity and anxiety towards physical symptoms, cap-

tures the dimension of sensitivity and worry about physical symptoms. The second factor, consisting of the final 4 items, addresses the impact of illness. This factor, called the negative consequences of the disease, represents the dimension related to the negative consequences of the disease (43). The internal consistency of the Turkish version was determined using Cronbach's alpha, which yielded a coefficient of 0.91. This ratio was 0.89 for the Body sub-dimension and 0.72 for the Negative Consequences of Illness sub-dimension (37). In this study, Cronbach's alpha was found to be 0.89 for the HAS, 0.88 for its sub-dimensions of hypersensitivity to physical symptoms and anxiety, and 0.72 for the negative consequences of the disease. In both studies, the overall Cronbach alpha values were high (0.91 and 0.89) and the sub-dimensions showed a similarly wide range.

Cyberchondria Severity Scale (CSS): It was developed by McElroy and Shevlin in 2014. It is a psychometric scale characterized by excessive health research on the Internet and is intended to measure cyberchondria (44). Turkish validity and reliability analyses were conducted by Uzun and Zencir in 2016 (45). The scale includes questions about how people conduct their health research on the internet and to what extent these researches affect them physically, socially and spiritually in daily life. The scale consists of 33 items and 5 sub-dimensions in 5-point Likert type. Sub-dimensions; Coercion, Distress, Excessiveness, Assurance and Distrust of the Medical Professional. The questions forming the "Mistrust of medical Professional" sub-dimension are reverse scored. There is no cut-off point. The total cyberchondria score is determined by adding up the scores from each question, with higher scores indicating a greater level of cyberchondria (45). The internal consistency of the Turkish version was assessed using Cronbach's alpha, which was determined to be 0.89. Cronbach alpha internal consistency coefficients for the 5 sub-dimensions in the scale vary between 0.65 and 0.85 (39). In this research, the Cronbach's alpha for the CSS was 0.91, and for its sub-dimensions, the values were as follows: compulsion 0.92, distress 0.84, excessiveness 0.83, reassurance 0.76, and mistrust of medical professionals 0.62. In both studies, the overall Cronbach alpha values were high (0.89 and 0.91) and the sub-dimensions showed a similarly wide range.

Statistical Analysis

The data were analyzed with IBM SPSS for Windows 22 package program. Frequency, percentages, minimum and maximum values, mean and standard deviations, Pearson Correlation Analysis and simple regression analysis were used to analyze the data. Normality distribution was determined by Kurtosis and Skewness coefficients and it was determined that all continuous variables in the study showed

a normal distribution of ± 1.50 . Internal validity of the scales was determined by Cronbach α coefficient (46). For all analyses, $p < 0.05$ was set as the significance level.

RESULTS

Table 1 summarizes the demographic details of the participants.

As presented in Table 1, 58.4% of the participants were female, 32.1% were university graduates, 58.6% were married, and 47.6% had income less than expenses. 81.5% of the participants live in urban areas, 52.4% are obese to 1st degree, 78.7% do not have chronic diseases and 43.7% have moderate health perceptions. 45% of the participants are not ostracized by the society due to obesity, 69.7% have information about health problems that may develop due to obesity, 73.3% are concerned about their health due to their weight, 44.2% use the internet for 3-6 hours daily, 40.4% are negatively affected mentally due to the information about obesity obtained from the internet, and 57.1% sometimes make health-related decisions based on the information obtained from the internet. 49.6% of the participants were undecided about trusting health-related information on the internet, and the average age of the participants was 35.01 ± 12.13 years.

The distribution of the scores obtained from the Health Anxiety Scale, Cyberchondria Severity Scale and its sub-dimensions is presented in Table 2.

As seen in Table 2, the participants scored 17.12 ± 7.77 on the Hypersensitivity to Physical Symptoms and Anxiety subscale, 4.75 ± 2.83 on the Negative Consequences of Illness subscale, and 21.87 ± 9.70 on the Health Anxiety Scale total. The participants scored 16.02 ± 6.65 on the Compulsion sub-dimension, 20.23 ± 6.26 on the Excessive Anxiety sub-dimension, 21.88 ± 6.35 on the Excessiveness sub-dimension, 16.03 ± 4.96 on the Relaxation sub-dimension, 7.21 ± 3.03 on the Distrust of Physicians sub-dimension, and 81.37 ± 20.11 on the total Cyberchondria Severity Scale.

As shown in Table 3, a statistically significant, positive, and low-level correlation exists between the Hypersensitivity and Anxiety to Physical Symptoms, Negative Consequences of Illness sub-dimension scores and the Health Anxiety Scale total score, as well as the Obsession, Overanxiety, Excessive Anxiety, Excessiveness, Relaxation sub-dimensions, and the Cyberchondria Severity Scale total score ($p < 0.05$). As Hypersensitivity to Physical Symptoms and Anxiety, Negative Consequences of Illness sub-dimension scores and Health Anxiety Scale total score increase, so do Compulsion, Excessive Anxiety, Excessiveness, Relaxation sub-dimensions and Cyberchondria Severity Scale total score. There is no significant correlation between Hypersensitivity and

Table 1: Demographic Characteristics of Participants

Characteristics*	Findings (n=389)	
Gender	Male	162 (41.6)
	Female	227 (58.4)
Education Status	Literate	52 (13.4)
	Primary school graduate	43 (11.1)
	Secondary school graduate	60 (15.4)
	High school graduate	109 (28.0)
	University graduate	125 (32.1)
Marital Status	Married	228 (58.6)
	Single	161 (41.4)
Income Level	My income is less than my expenses	185 (47.6)
	My income is equal to my expenses	173 (44.5)
	My income is more than my expenses	31 (8.0)
Settlement	Rural	72 (18.5)
	Urban	317 (81.5)
Body Mass Index	First-degree obese (30 - 34.9 kg/m ²)	204 (52.4)
	Quadratic obese (35- 39.9 kg/m ²)	128 (32.9)
	Third-degree obese (≥ 40 kg/m ²)	57 (14.7)
Chronic disease	No	306 (78.7)
	Yes	83 (21.3)
Health Perception	Very bad	25 (6.4)
	Bad	57 (14.7)
	Middle	170 (43.7)
	Good	107 (27.5)
	Very good	30 (7.7)
Social Stigma Due to Obesity	Yes	95 (24.4)
	No	175 (45.0)
	Partially	119 (30.6)
Information on Health Problems Related to Obesity	Yes	271 (69.7)
	No	118 (30.3)
Worrying About Your Health Because of Your Weight	Yes	285 (73.3)
	No	104 (26.7)
Daily Internet Usage Time	0-2 hours	150 (38.6)
	3-6 hours	172 (44.2)
	7-10 hours	46 (11.8)
	10 hours or more	21 (5.4)
Negative Psychological Effects Due to Information About Obesity Obtained from the Internet	Yes	136 (35.0)
	No	96 (24.7)
	Partially	157 (40.4)
Making Health Decisions Based on Information Obtained from the Internet	Never ever	90 (23.1)
	Occasionally	48 (12.3)
	Sometimes	222 (57.1)
	Frequently	10 (2.6)
Trusting Health Information Published on Websites	Always	19 (4.9)
	Yes	80 (20.6)
	No	116 (29.8)
	Undecided	193 (49.6)
Age, year±SD, (min.-max.)	35.0±12.1	(18.0 -65.0)

*Data are shown as n(%), **SD:** Standard Deviation

Anxiety to Physical Symptoms, Negative Consequences of Illness sub-dimension scores and Health Anxiety Scale total score and Distrust in Doctors sub-dimension score. The regression analysis between the Health Anxiety Scale and Cyberchondria Severity Scale is presented in Table 4.

As seen in Table 4, simple regression analysis was applied to reveal to what extent the Cyberchondria Severity Scale variable, which is thought to be effective on the participants' Health Anxiety, predicts Health Anxiety. This analysis revealed a significant relationship between the Cyberchondria

Severity Scale variable and the Health Anxiety variable ($R = 0.386$, $R^2 = 0.147$, $F(1, 387) = 67.915$, $p = 0.001$). Cyberchondria Severity Scale score explained 14.7% of the change in Health Anxiety. Based on the regression analysis results, the equation predicting Health Anxiety is as follows: Health Anxiety = $(0.186 \times \text{Cyberchondria Severity Scale}) + (24.706)$.

DISCUSSION

In this section, the results related to the connection between health anxiety and cyberchondria in obese cases are discussed in the context of existing literature.

The mean score obtained in the health anxiety inventory, one of the dependent variables in this study, was 21.87 ± 9.70 . Since no cut-off point was determined in the scale, the mean score obtained cannot be interpreted. However, a higher score on the scale corresponds to an increased level of health anxiety. Fergus et al. In their study conducted in the community health center of a city located in the south of the USA, they found that the mean score of obese cases on the health anxiety inventory was 22.60 ± 17.52 (15). Since there are not enough studies in the literature on the health anxiety of obese cases, the average scores obtained in the studies conducted on different sample groups were discussed. In the study conducted by Tamer and Güçlü on healthy individuals, 16.81 ± 7.54 (47), In the research by Bozkurt et al. on women, 17.11 ± 6.95 (48), and Mrayyan et al. found 19.08 ± 7.8 in their study on students (49). We think that the reason why the mean score obtained in this study

Table 2: Distribution of Scores from the Health Anxiety Scale, Cyberchondria Severity Scale and Subscales

Scale and Subscales*	All Participants (n=389)
Hypersensitivity to physical symptoms and anxiety	17.12±7.77 (0-38.0)
Negative consequences of the disease	4.75±2.83 (0-12.0)
Health Anxiety Scale	21.87±9.70 (0-48.0)
Compulsion	16.02±6.65 (8.0-40.0)
Distress	20.23±6.26 (8.0-38.0)
Excessiveness	21.88±6.35 (8.0-40.0)
Reassurance	16.03±4.96 (6.0-30.0)
Mistrust of medical professional	7.21±3.03 (3.0-15.0)
Cyberchondria Severity Scale	81.37±20.11 (33.0-142.0)

* Data are shown as mean SD (minimum - maximum).

SD: Standard Deviation

Table 3: Investigation of the Relationship Between the Health Anxiety Scale and Cyberchondria Severity Scale and Its Subscales

		Compulsion	Distress	Excessiveness	Reassurance	Mistrust of medical professional	Cyberchondria Severity Scale
Hypersensitivity to physical symptoms and anxiety	r	0.237	0.456	0.258	0.270	0.056	0.377
	p	<0.001	<0.001	<0.001	<0.001	0.270	<0.001
	n	389	389	389	389	0389	389
Negative consequences of the disease	r	0.221	0.351	0.158	0.170	0.099	0.289
	p	<0.001	<0.001	<0.002	<0.001	0.052	<0.001
	n	389	389	389	389	389	389
Health Anxiety Scale	r	0.254	0.468	0.253	0.266	0.074	0.386
	p	<0.001	<0.001	<0.001	<0.001	0.147	<0.001
	n	389	389	389	389	389	389

($p < 0.05^*$)

Table 4: Regression Analysis Between Health Anxiety Scale and Cyberchondria Severity Scale

	Beta	Standard Defect	Standard Beta	t	p	%95 Confidence Interval	
Constant coefficient	24.706	1.896	-	13.028	<0.001	20.978	28.435
Cyberchondria Severity Scale	0.186	0.023	0.386	8.241	<0.001	0.142	0.231

($p < 0.05^*$)

was higher than the mean scores obtained in the aforementioned studies was that approximately half of the individuals in the study were obese in the second (32.9%) and third (14.7%) degree, and the aforementioned studies were conducted on healthy individuals. In addition, 69.7% of the participants had information about obesity, 73.3% were concerned about their health due to their weight, and 75.9% (yes 35.0%, partially 40.4%) stated that they were negatively affected mentally due to the information about obesity obtained from the internet, which supports the findings in this study.

The mean score obtained in the Cyberchondria Severity Inventory, another dependent variable of this study, was 81.37 ± 20.11 . A higher score obtained from the scale indicates a higher level of cyberchondria in the individual. When we look at the mean scores in the studies conducted on different sample groups using the Cyberchondria Severity Inventory in the literature; in the study conducted by Arsenakis et al. on adult individuals, the mean score was 73.1 ± 23.1 (50) and Turhan Çakır found 78.54 ± 22.09 in their study on women with human papillomavirus. (51). The higher mean score of obese cases compared to the other sample groups can be interpreted as the fact that obesity is a condition that can often lead to various health problems and increase individuals' anxiety about their own health, that increased sensitivity to health-related symptoms and problems leads obese cases to constantly seek and follow health-related information, and that widespread prejudice and stigmatization of obesity in society may contribute to obese cases' excessive awareness and anxiety about their own health.

In this study, a significant positive relationship was found between obese cases' health anxiety and cyberchondria. In other words, as the health anxiety of obese cases increases, their cyberchondria levels increase. When the studies conducted on different sample groups in the literature are analyzed; (52-55) identified a strong positive association between health anxiety and cyberchondria. A recent meta-analysis of 20 studies revealed a positive link between health anxiety and cyberchondria (34). Considering the results of the correlation analysis, a basic regression analysis was performed to assess to what extent the cyberchondria severity variable, which influences health anxiety, predicts health anxiety. In the analysis, cyberchondria was found to be a significant positive predictor of health anxiety. However, although the relationship is significant, the fact that the correlation coefficient ($R=0.386$) is at a moderate level indicates that the strength of the relationship is not high and that there are other important factors that may be effective on Health Anxiety. Therefore, it can be suggested to

increase the explanatory power by including additional variables in the model. When the studies in the literature were analyzed, it was found that cyberchondria was a significant positive predictor of health anxiety in the studies conducted by Doğan et al. and Nadeem et al. (53,56). Obese cases, who constitute the sample of this study, may be concerned about their health due to the change in their physical structure and some symptoms that occur with it. In fact, the fact that obesity is both a risk factor for many health problems and characterized as a chronic disease may cause negative physical, social and mental consequences in obese cases. Obese cases trying to overcome this may need medical information to feel safe. Aiken and Kirwan found that the Internet is considered a useful resource for self-managed healthy individuals, while it is interpreted as an important source of concern for susceptible individuals, given the increasing behavioral patterns of individuals to take responsibility for their "health biographies"(57). Therefore, cyberchondria has a positive correlation with health anxiety symptoms. (29). These results show that there is a significant relationship between Health Anxiety and Cyberchondria and Cyberchondria plays a determinant role on Health Anxiety. In other words, both that there is a significant relationship between Health Anxiety and Cyberchondria and that Cyberchondria is effective on Health Anxiety (are supported.

This study plays a crucial role in investigating the association between health anxiety and cyberchondria in obese cases. Since the study was conducted in a designated center, it is not appropriate to generalize the findings to the whole of Turkey.

The purpose of this study was to investigate the relationship between health anxiety and cyberchondria levels in obese cases. A notable positive correlation was observed between health anxiety level and its sub-dimensions and cyberchondria and its sub-dimensions (except for the dimension of distrust in doctors). In addition, cyberchondria predicts the level of health anxiety by 14% in the regression analysis. This result shows that obese cases may have high levels of health anxiety due to obesity and this may lead to an increase in the number of cyberchondriac individuals. In addition, it contributed to the literature in terms of raising awareness of nurses caring for obese cases.

This study may contribute to gaining insights into the connection between health anxiety experienced by obese cases and cyberchondria. Nurses working in the field of public health and mental health need to understand health anxiety and cyberchondria in order to identify attitudes and behaviors that may occur in obese cases in physical, social and mental areas and to apply nursing interventions when necessary. As a matter of fact, it is important for nurses, who

are an important member of the multidisciplinary team and are in the most communication with individuals in the society, to prioritize their roles as educators and researchers as well as caregivers. In addition, this study will contribute to nurses to raise awareness on this issue. In order to reduce the level of health anxiety and cyberchondria in obese cases; online cognitive therapy trainings, e-health literacy trainings and motivational interview trainings can gain momentum in a positive direction.

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Author Contributions

Study design: Y. S and C. C, Data collection: S. Y, Data analysis: C. C, Manuscript writing: S. Y and C. C

Conflict Interests

The authors declare there is no conflict of interest.

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Ethical Approval

Approval was obtained from Atatürk University Faculty of Nursing Unit Ethics Committee (dated 07.07.2022 and numbered 2022-6/4). Institutional permission (dated 28.06.2022 and numbered E-54355720-800-224423) was also obtained in the institution where the research was conducted. Participants were informed about the purpose, methodology, and the time commitment required for the study, ensuring that participation involved no harm and was entirely voluntary. Consent to participate in the research was obtained based on these statements.

Peer Review Process

Extremely and externally peer-reviewed.

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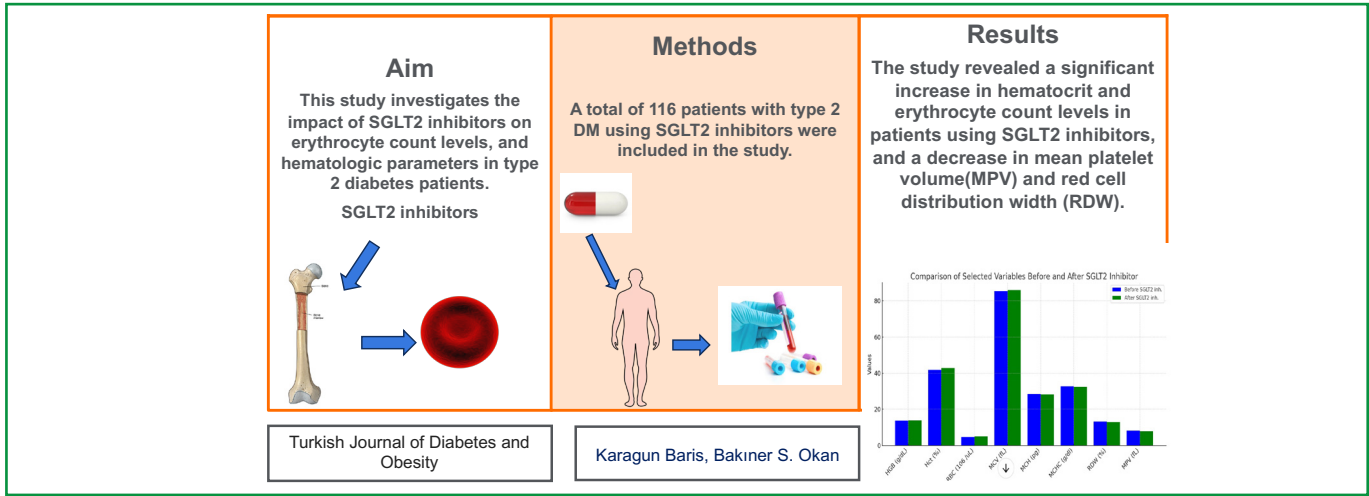
Effects of SGLT2 Inhibitors on Hematologic Parameters in Patients with Type 2 Diabetes Mellitus: A Retrospective Study

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GRAPHICAL ABSTRACT



ABSTRACT

Aim: SGLT2 (Sodium-Glucose Cotransporter 2) inhibitors have demonstrated significant benefits in reducing cardiovascular events and improving renal outcomes in patients with type 2 diabetes mellitus (DM). However, their effects on hematopoiesis are not fully understood. This study aimed to investigate the impact of SGLT2 inhibitors on hematocrit, erythrocyte count levels, and various hematologic parameters in patients with type 2 DM.

Material and Methods: A total of 116 patients with type 2 DM using SGLT2 inhibitors were included in the study. Demographic and clinical characteristics, as well as laboratory parameters, were collected at baseline and during control examinations. The patients were stratified based on the specific SGLT2 inhibitor received (dapagliflozin or empagliflozin), and comparisons were made between baseline and control values.

Results: The study found a significant increase in hematocrit and erythrocyte count levels among patients using SGLT2 inhibitors compared to baseline values ($p=0.002$; $p<0.001$). This increase was more pronounced in patients treated with empagliflozin compared to dapagliflozin. Additionally, mean platelet volume (MPV) and red cell distribution width (RDW) values decreased following SGLT2 inhibitor use, potentially indicating favorable cardiovascular effects ($p=0.038$; $p=0.005$).

Conclusion: SGLT2 inhibitors exert significant effects on hematopoiesis, leading to increased hematocrit and erythrocyte count levels in patients with DM. These findings contribute to our understanding of the hematologic effects of SGLT2 inhibitors and highlight their potential benefits beyond glycemic control in patients with type 2 DM. Further research is warranted to elucidate the underlying mechanisms and clinical implications of these findings.

Keywords: Dapagliflozin, Erythrocytosis, Empagliflozin, Hematologic parameters

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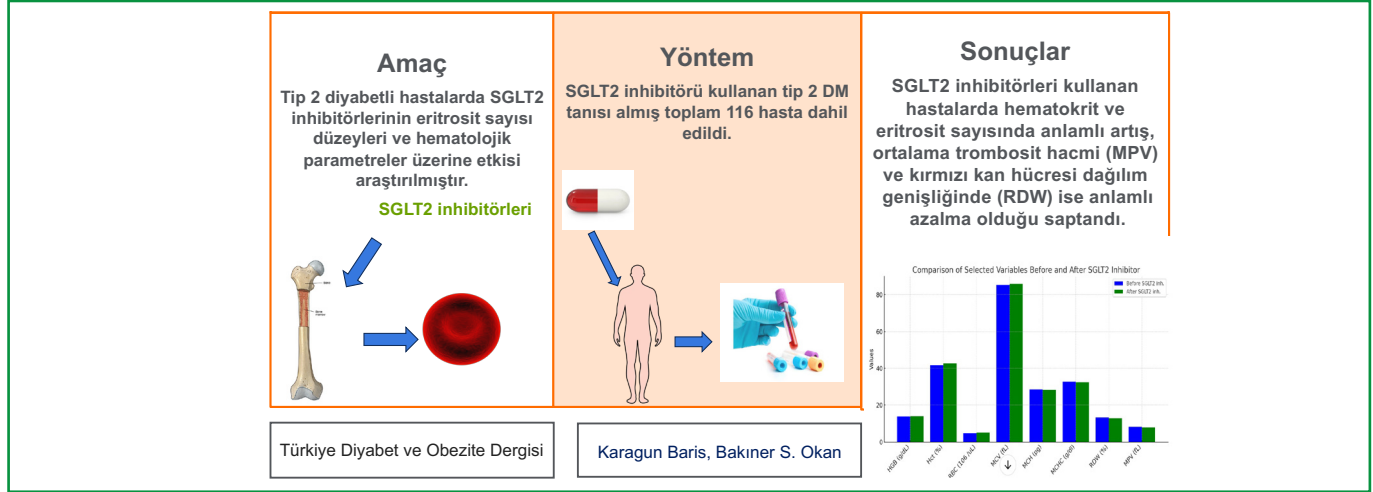
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Tip 2 Diyabetli Hastalarda SGLT2 İnhibitörlerinin Hematolojik Parametreler Üzerindeki Etkileri: Retrospektif Bir Çalışma

GRAFİKSEL ÖZET



ÖZ

Amaç: SGLT2 (Sodyum-Glukoz Kotransporter 2) inhibitörleri, tip 2 diyabetes mellitus (DM) hastalarında kardiyovasküler olayları azaltmada ve böbrek sonuçlarını iyileştirmede önemli faydalar göstermiştir. Ancak, bu ilaçların hematopoez üzerindeki etkileri tam olarak anlaşılmamıştır. Bu çalışma, SGLT2 inhibitörlerinin tip 2 DM hastalarındaki hematokrit, eritrosit sayısı düzeyleri ve çeşitli hematolojik parametreler üzerindeki etkilerini araştırmayı amaçladı.

Gereç ve Yöntemler: Çalışmaya SGLT2 inhibitörleri kullanan toplam 116 tip 2 DM hastası dahil edilmiştir. Demografik ve klinik özellikler ile laboratuvar parametreleri, başlangıçta ve kontrol muayenelerinde toplanmıştır. Hastalar, aldıkları spesifik SGLT2 inhibitörüne (dapagliflozin veya empagliflozin) göre gruplandırılmış ve başlangıç ile kontrol değerleri arasında karşılaştırmalar yapılmıştır.

Bulgular: Çalışma, SGLT2 inhibitörleri kullanan hastalar arasında hematokrit ve eritrosit sayısı düzeylerinde başlangıç değerlerine kıyasla anlamlı bir artış olduğunu buldu ($p=0,002$; $p<0,001$). Bu artış, dapagliflozin ile tedavi edilen hastalara kıyasla empagliflozin ile tedavi edilen hastalarda daha belirgindi. Ayrıca, ortalama trombosit hacmi (MPV) ve kırmızı hücre dağılım genişliği (RDW) değerleri SGLT2 inhibitörü kullanımından sonra azaldı ve bu durum potansiyel olarak olumlu kardiyovasküler etkileri gösterebilir ($p=0,038$; $p=0,005$).

Sonuç: SGLT2 inhibitörleri, hematopoez üzerinde önemli etkiler göstererek DM hastalarında hematokrit ve eritrosit sayısı düzeylerinde artışa yol açar. Bu bulgular, SGLT2 inhibitörlerinin hematolojik etkilerini anlamamıza katkıda bulunur ve tip 2 DM hastalarında glisemik kontrolün ötesindeki potansiyel faydalarını vurgular. Bu bulguların altında yatan mekanizmaları ve klinik sonuçları açıklığa kavuşturmak için daha fazla araştırma gereklidir.

Anahtar Sözcükler: Dapagliflozin, Eritrositoz, Empagliflozin, Hematolojik parametreler

INTRODUCTION

Sodium-Glucose Cotransporter-2 (SGLT2) inhibitors are a group of oral antidiabetic medicine which consist of canagliflozin, empagliflozin, dapagliflozin, ertugliflozin, and sotagliflozin. The primary site of expression for SGLT2 is the proximal renal tubule, where it plays a crucial role in facilitating glucose reabsorption (1). SGLT2 inhibitors facilitate the renal clearance of glucose, leading to reduction in elevated blood glucose levels in individuals diagnosed with diabetes (2). This class of drugs decreases the reabsorption of sodium in the proximal renal tubule, resulting in elevated

excretion of sodium in the urine, and finally, this natriuretic impact causes a reduction in both intravascular and interstitial volume (3,4). SGLT inhibitors not only enhance glycemic control in persons diagnosed with Type 2 diabetes mellitus (DM) but also mitigate the risk of cardiovascular mortality, reduce hospitalizations resulting from heart failure, and slow the advancement of end-stage kidney disease (5). Vulvovaginal candidal infections are the major adverse effects associated with SGLT2 medications. Additional infrequent adverse effects encompass urinary tract infections, perineal necrotizing fasciitis, euglycemic diabetic ketoacidosis (DKA), heightened susceptibility to lower extremity

amputation, and bone fractures (6). The association between SGLT2 inhibitors and erythrocytosis is becoming more well acknowledged (7). The initial identification of this syndrome is ascribed to hemoconcentration caused by natriuresis and the constriction of plasma volume. However, the impact of SGLT2 inhibitors on the reduction of urine plasma volume is transient (8). The rise in hematocrit and red blood count associated with SGLT2 treatment is attributed to enhanced erythropoiesis rather than hemoconcentration. This increase is thought to be a result of improved oxygenation and more effective erythropoietin production prompted by SGLT2i treatment (9,10). Hypoxic conditions in renal tubular cells reduce erythropoietin (EPO) production by transforming EPO-producing fibroblasts into myofibroblasts. SGLT-2 inhibitors relieve metabolic stress on tubules, hence enhancing their microenvironment. This reverses myofibroblasts into fibroblasts, partially restoring EPO production and correcting anemia (11–13). The mechanism behind erythrocytosis induced by SGLT2 inhibitors may involve several factors. Stimulation of EPO production can occur via the hypoxia-inducible factor 2 alpha (HIF2a) pathway. Additionally, SGLT2 inhibitors may influence iron metabolism by affecting hepcidin levels, which could further impact erythropoiesis (14–16). In addition to erythrocytosis, SGLT-2 inhibitors have been shown to affect other hemorheological parameters. It was observed that while blood viscosity and erythrocyte aggregation appeared to increase with SGLT2 inhibitor use, erythrocyte deformability showed a notable improvement. This could potentially have beneficial effects on the cardiovascular system (17).

Understanding the complex interactions between hematological parameters and SGLT-2 inhibitor use is crucial, as they significantly impact the cardiovascular safety and overall efficacy of SGLT-2 inhibitors in practical application. The literature has provided limited discussion on the erythropoiesis associated with SGLT2 inhibitors. The goal of this research is to examine the impact of SGLT-2 inhibitors on erythrocytosis and other hematological parameters, shedding light on the mechanisms behind these changes and their potential protective effects on the cardiovascular system.

METHODS

This retrospective research was realized out at the University Hospital in Adana, Türkiye. The study included patients aged 18 and above, diagnosed with type 2 diabetes, and prescribed either dapagliflozin or empagliflozin, both of which are classified as SGLT2 inhibitors, between January 2019 and January 2024. The individuals enrolled in the study had been on a regimen of SGLT-2 inhibitors for a minimum duration of 3 months. The demographic pro-

files of the patients, along with their initial assessments and subsequent follow-up laboratory findings, were recorded from the hospital's database. The time to obtain follow-up results varied among patients, with the average being 6 (4–12) months. The exclusion criteria included diseases that result in secondary polycythemia, such as obstructive sleep apnea, obesity hypoventilation syndrome, and chronic obstructive pulmonary disease (COPD), as well as testosterone replacement therapy and erythropoietin-secreting tumors (e.g., hepatocellular carcinoma, renal cell carcinoma, adrenal adenoma). A power analysis was performed out using G*Power software 3.1.9.6. Considering the reference study (16), the analysis was set at an alpha error of 0.05, a desired power of 95%, and an effect size of 0.755. This analysis determined a required minimum total sample size of 25 patients. In order to enhance the study's power, the sample size was expanded to include 116 patients. The study took approval from the institutional Ethics Committee of Baskent University and was accomplished in accordance with the moral guidelines specified in the Helsinki Declaration (KA24/160).

Statistical Analysis

The data were examined using the SPSS (Statistical Package for Social Sciences) 18.0 software. The descriptive analyses yielded frequency data represented by the number (n) and percentage (%). Numerical data were reported as the arithmetic mean \pm standard deviation (SD) and the median (1st-3rd quartile (IQR)). The suitability of numerical data for a normal distribution was evaluated using the Kolmogorov-Smirnov test. The Paired Samples T test was used to evaluate numerical variables in the two dependent groups with a normal distribution. The Wilcoxon Signed Rank test was used to examine the distribution of numerical variables in the two dependent groups with a non-normal distribution. The Mann Whitney U test was used to assess the distribution of numerical variables in two independent groups with non-normal distribution, and the Independent Samples T test was used to assess numerical variables in two independent groups with normal distribution. Two-way analysis of variance was used to assess the distribution of numerical data based on two independent variables. The Spearman Correlation study was done to look at the link between non-normally distributed numerical data. Correlation relationships can be categorized as follows: a correlation is considered low if the value of rho (ρ) falls between 0.05 and 0.30, low-moderate if it falls between 0.30 and 0.40, moderate if it falls between 0.40 and 0.60, good if it falls between 0.60 and 0.70, very good if it falls between 0.70 and 0.75, and excellent if it falls between 0.75 and 1.00. A statistical significance criterion of $p < 0.05$ was used for the tests.

RESULTS

The study encompassed 116 type 2 DM patients who were prescribed SGLT2 inhibitors. Among them, 52 (44.8%) were female, and 64 (55.2%) were male, with an average age of 59.77 ± 9.47 years. Of the patients, 45.7% received dapagliflozin, while 54.3% received empagliflozin. Table 1 displays the demographic and clinical attributes of all patients. The distribution of other oral antidiabetic medications used by the patients was as follows: 87 patients (75%) were using Metformin, 26 patients (22.4%) were using Pioglitazone, 24 patients (20.7%) were using Gliclazide, and 44 patients (37.9%) were using Insulin

Table 1: Demographic and clinical characteristics in patients.

Variables	Values (n=116)
Gender (female/male) , n (%)	52(44.8)/64(55.2)
Age (years \pm SD)	59.77 \pm 9.47
FPG (mg/dl), median(min.-max.)	148(121.25-188.25)
HbA1c (%), median(min.-max.)	7.50 (6.70-8.70)
Creatinine (mg/dl), median(min.-max.)	0.80 (0.63-0.90)
ALT (mg/dl) , median(min.-max.)	24 (18-34)
Duration of DM (years \pm SD)	15.42 \pm 7.44
Smoking, n (%)	23 (19.8)
Time on SGLT2 inhibitors (months), median(min.-max.)	6.0 (4.0-12.0)
Dapagliflozin, n (%)	53 (45.7)
Empagliflozin, n (%)	63 (54.3)

n (%); Mean \pm Standard Deviation; Median (IQR). **FPG:** Fasting plasma glucose; **ALT:** Alanine aminotransferase

Table 2 displays the distribution of laboratory values for all participants diagnosed with DM who were included in the study, both before and after receiving treatment with SGLT2 inhibitors. Hematocrit and RBC count significantly increased compared to the baseline after SGLT2 inhibitors administration ($p=0.002$; $p<0.001$). It was determined that MCHC, RDW, and MPV values declined significantly ($p=0.019$; $p=0.038$; $p=0.005$, respectively).

Individuals who received dapagliflozin revealed a statistically significant increase in RBC count compared to their initial levels ($p<0.001$). Additionally, RDW and MPV values exhibited a significant decrease ($p=0.001$, and $p=0.019$) (Table 3).

The group that received empagliflozin revealed a significant rise in both hematocrit and RBC count compared to the first measurement. In addition, there was a substantial decrease in the MCHC values (p values; $p<0.001$; $p<0.001$; $p=0.020$, respectively) as shown in Table 4.

The study's results indicated that the distribution of laboratory parameters after the administration of either empagliflozin or dapagliflozin in the groups was statistically similar. ($p > 0.05$) (Table 5). However, it was shown that the delta RDW level was considerably elevated in individuals receiving empagliflozin compared to those receiving dapagliflozin ($p = 0.002$). The study found no statistically significant impact of smoking, metformin usage, or other therapies on the difference in delta RDW.

A statistically significant negative correlation was discovered between the length of diabetes and hemoglobin levels ($\rho = -0.238$, $p = 0.010$). Similarly, a significant negative correlation was identified between the length of diabetes and the hematocrit levels measured after SGLT2 inhibitor

Table 2: Before and after SGLT2 inhibitor laboratory test results (n=116).

Variables	Before SGLT2 inh.	After SGLT2 inh.	p
HGB (g/dL \pm SD)	13.75 \pm 1.76	13.85 \pm 1.93	0.369*
Hct (% \pm SD)	41.66 \pm 5	42.77 \pm 5.07	0.002*
RBC (10^6 /uL) , median(min.-max.)	4.75 (4.46-5.20)	5.10 (4.72-5.45)	<0.001**
MCV (fL) , median(min.-max.)	85.25 (82.02-89.95)	85.86 (81.96-89.95)	0.389**
MCH (pg) , median(min.-max.)	28.50 (26.56-29.87)	28.32 (26.25-29.55)	0.236**
MCHC (g/dl \pm SD)	32.72 \pm 1.49	32.35 \pm 1.82	0.019*
RDW (%), median(min.-max.)	13.27 (12.31-14.07)	12.90 (12.05-13.85)	0.038**
WBC (10^3 /uL) , median(min.-max.)	7.97 (6.84-9.09)	7.84 (6.57-9.35)	0.982**
MPV (fL) , median(min.-max.)	8.11 (7.49-9.10)	7.79 (7.08-8.83)	0.005**
PLT (10^3 /uL) , median(min.-max.)	237.80 (200.40-307.47)	247.70 (198.10-302.82)	0.866**

*: Paired Samples T Testi, **: Wilcoxon Testi. **HGB:** Hemoglobin, **MCH:** Mean corpuscular hemoglobin, **RDW:** Red blood distribution width, **MCHC:** Mean corpus-cular hemoglobin concentration, **MCV:** Mean cell volume, **Htc:** Hematocrit, **RBC:** Red blood cell, **WBC:** White blood cell, **PLT:** Platelet count.

Table 3: Before and after Dapagliflozin laboratory test results (n=53).

Variables	Before SGLT2 inh.	After SGLT2 inh.	p value
HGB (g/dL)	14.03 ± 1.97	14 ± 2.09	0.870*
Hct (%)	42.13 ± 5.31	42.74 ± 5.34	0.295*
RBC (10 ⁶ /uL)	4.82 (4.51-5.37)	5.1 (4.88-5.51)	<0.001**
MCV (fL)	84.90 (82.74-90.25)	85.88 (83.2-89.21)	0.580**
MCH (pg)	28.60 (27.34-30.15)	28.42 (26.93-29.96)	0.989**
MCHC (g/dl)	33.12 (32.33-33.90)	32.90 (31.78-33.6)	0.195**
RDW (%)	13.60 (12.60-14.97)	12.68 (11.72-13.98)	0.001**
WBC (10 ³ /uL)	7.84 ± 1.83	7.83 ± 2.07	0.983*
MPV (fL)	8.10 (7.55-9.1)	7.74 (7.08-8.93)	0.019**
PLT (10 ³ /uL)	236 (200-299.4)	234.1 (194.1-295.95)	0.620**

*: Paired Samples T Testi, **: Wilcoxon Testi. **HGB:** Hemoglobin, **MCH:** Mean corpuscular hemoglobin, **RDW:** Red blood distribution width, **MCHC:** Mean corpus-cular hemoglobin concentration, **MCV:** Mean cell volume, **Htc:** Hematocrit, **RBC:** Red blood cell, **WBC:** White blood cell, **PLT:** Platelet count.

Table 4: Before and after Empagliflozin laboratory test results (n=63).

Variables	Before SGLT2 inh.	After SGLT2 inh.	p value
HGB (g/dL)	13.51 ± 1.54	13.73 ± 1.8	0.104*
Hct (%)	41.26 ± 4.73	42.79 ± 4.87	<0.001*
RBC (10 ⁶ /uL)	4.73 ± 0.64	5.05 ± 0.58	<0.001*
MCV (fL)	85.12 ± 7.31	85.23 ± 7.76	0.832*
MCH (pg)	28.24 (26.26-29.73)	28.15 (25.97-29.42)	0.153**
MCHC (g/dl)	32.59 ± 1.38	32.05 ± 1.85	0.020*
RDW (%)	13.08 (12.25-13.79)	13.04 (12.23-13.72)	0.771**
WBC (10 ³ /uL)	8.19 (6.98-9,3)	8 (6.57-10.02)	0.804**
MPV (fL)	8.25 ± 1.35	7.936 ± 1.38	0.054*
PLT (10 ³ /uL)	243.2 (200.2-324)	256.1 (199.8-304)	0.739**

*: Paired Samples T Testi, **: Wilcoxon Testi. **HGB:** Hemoglobin, **MCH:** Mean corpuscular hemoglobin, **RDW:** Red blood distribution width, **MCHC:** Mean corpus-cular hemoglobin concentration, **MCV:** Mean cell volume, **Htc:** Hematocrit, **RBC:** Red blood cell, **WBC:** White blood cell, **PLT:** Platelet count.

administration ($\rho = -0.278$, $p = 0.003$). It was found that the MCHC level measured after SGLT2 inhibitor administration exhibited a statistically significant negative correlation with age, while showing a positive correlation with the duration of SGLT2 inhibitor use, as well as ALT levels (ρ and p values, respectively; $\rho = -0.226$; $p = 0.015$; $r = 0.269$; $p = 0.004$; $\rho = 0.221$; $p = 0.017$). Additionally, a statistically significant inverse relationship was discovered between the duration of SGLT2 inhibitor use and RDW levels measured after SGLT2 inhibitor administration ($\rho = -0.210$, $p = 0.024$) (Table 6).

There appears to be a statistically significant positive link between the change (Δ) in hematocrit levels and HbA1c ($\rho = 0.206$; $p = 0.026$). Similarly, a statistically significant negative correlation was found between the change in MCHC levels and fasting blood glucose levels ($\rho = -0.227$;

$p = 0.014$). A statistically significant inverse relationship was found between the change in RDW levels and the duration of SGLT2 inhibitor treatment and ALT. (ρ and p values, respectively; $\rho = -0.299$; $p = 0.001$; $\rho = -0.197$; $p = 0.034$). A negative correlation was observed between the change in MPV levels and the duration of SGLT2 inhibitor treatment ($\rho = -0.249$; $p = 0.007$) (Table 6).

DISCUSSION

This study intended to explore the impact of SGLT2 inhibitors on hematocrit, RBC count levels, and various other hematologic parameters. The key findings of the study suggest that individuals using SGLT2 inhibitors experienced increases in both RBC count and hematocrit levels. This finding constitutes a valuable addition to our understanding of how SGLT2 inhibitors influence erythrocytosis. The ob-

Table 5: Distribution of Control and Delta Laboratory Parameters by SGLT2i Type(n=116)

	Variables	Dapagliflozin (n=53)	Empagliflozin (n=63)	p value
Control	HGB (g/dL)	14 ± 2.09	13.3 ± 1.80	0.469*
	Hct (%)	42.74 ± 5.34	42.79 ± 4.87	0.956*
	RBC (10 ⁶ /uL)	5.1 (4.88-5.51)	5.10 (4.62-5.42)	0.107**
	MCV (fL)	85.88 (83.2-89.21)	85.79 (80.90-90.53)	0.971**
	MCH (pg)	28.42 (26.93-29.96)	28.15 (25.97-29.42)	0.446**
	MCHC (g/dl)	32.71 ± 1.72	32.05 ± 1.85	0.052*
	RDW (%)	12.68 (11.72-13.98)	13.13 (12.23-13.72)	0.241**
	WBC (10 ³ /μL)	7.83 ± 2.07	8.42 ± 2.4	0.165*
	MPV (fL)	7.74 (7.08-8.93)	7.95 (6.9-8.67)	0.788**
	PLT (10 ³ /μL)	251.91 ± 91.31	255.83 ± 79.44	0.806*
Delta	HGB (g/dL)	-0.03 ± 1.43	0.21 ± 1.05	0.293*
	Hct (%)	0.61 ± 4.21	1.53 ± 3.22	0.184*
	RBC (10 ⁶ /uL)	0.25 (-0.01-0.64)	0.24 (0.03-0.51)	0.6**
	MCV (fL)	0.11 ± 3.72	0.1 ± 4.08	0.998*
	MCH (pg)	0.2 (-0.85-0.81)	-0.17 (-1.10-0.43)	0.217**
	MCHC (g/dl)	-0.62 (-1.75-0.47)	-0.29 (-0.96-0.56)	0.162**
	RDW (%)	-0.78 (-1.53-0.09)	0.00 (-0.77-0.99)	0.002**
	WBC (10 ³ /μL)	-0.14 (-1.03-1.22)	-0.24 (-1.02-1.05)	0.851**
	MPV (fL)	-0.42 ± 1.21	-0.28 ± 1.15	0.526*
	PLT (10 ³ /μL)	1(-17.65-33)	1.60 (-29.7-25)	0.551**

*: Independent Samples T Testi, **: Mann Whitney U Testi. **HGB:** Hemoglobin, **MCH:** Mean corpuscular hemoglobin, **RDW:** Red blood distribution width, **MCHC:** Mean corpus-cular hemoglobin concentration, **MCV:** Mean cell volume, **Htc:** Hematocrit, **RBC:** Red blood cel, **WBC:** White blood cell, **PLT:** Platelet count.

served increase in hematocrit and RBC count levels during the control examination emphasizes the potential impact of SGLT2 inhibitors on the hematopoietic system.

SGLT2 inhibitors have demonstrated substantial advantages in decreasing the likelihood of cardiovascular events and enhancing renal consequences in people with type 2 diabetes mellitus. Clinical trials have consistently shown that SGLT2 inhibitors offer significant benefits for patients with type 2 DM. These benefits include a reduction in major adverse cardiovascular events (MACE), comprising cardiovascular death, nonfatal myocardial infarction, and nonfatal stroke, when compared to placebo (18,19). Additionally, SGLT2 inhibitors have demonstrated renal protective effects, such as slowing the progression of chronic kidney disease (CKD) and decreasing the risk of end-stage renal disease (ESRD) or the necessity for renal replacement therapy (20,21). SGLT2 inhibitors have revealed beneficial effects in vulnerable patient populations, including the geriatric population and those with chronic kidney disease undergoing peritoneal dialysis (22,23). Similar to these findings, SGLT2 inhibitors have been demonstrated to exert numerous pleiotropic effects (24).

SGLT2 inhibitors have been shown to influence hematopoiesis and they can regulate hematopoiesis and promote erythropoiesis by affecting various cellular pathways. Nevertheless, the specific intermediary pathways have not been completely clarified, although it is probable that cellular mechanisms are implicated (25). These cellular mechanisms involve increased production of erythropoietin (EPO) through hypoxia-induced activation of HIF2a, modulation of iron metabolism via hepcidin, and/or hemoconcentration (7,26). In our study, we noted a noteworthy increment in hematocrit and RBC count levels among patients using SGLT2 inhibitors compared to their baseline values. The elevation in hematocrit and erythrocyte count levels aligns with findings reported in the literature (14–16,27). The patients in the study were stratified based on the SGLT2 inhibitor they received (empagliflozin or dapagliflozin) and then compared according to their baseline values. We noted statistically a significant increase in hematocrit and RBC count levels among patients treated with empagliflozin compared to their baseline values. Similarly, we observed a statistically significant increase in RBC counts and a notable, though not statistically significant, rise in hematocrit

Table 6: The correlation between demographic, clinical, and laboratory parameters post-administration of SGLT2 inhibitor and delta findings.

		HGB (g/dL)	Hct %	RBC (10 ⁶ /uL)	MCV (fL)	MCH (pg)	MCHC (g/dl)	RDW (%)	WBC (10 ³ /uL)	MPV fL	PLT (10 ³ /uL)
Age (years)	rho	-0.175	-0.100	-0.213	0.068	-0.044	-0.226	0.148	-0.042	0.003	-0.082
	p	0.060	0.287	0.022	0.466	0.642	0.015	0.112	0.653	0.977	0.384
FPG (mg/dL)	rho	0.038	0.060	0.009	0.036	0.010	-0.023	0.005	0.019	-0.011	0.069
	p	0.688	0.521	0.920	0.701	0.918	0.806	0.956	0.838	0.910	0.465
HbA1c	rho	0.065	0.071	0.118	0.024	0.019	0.006	-0.105	0.027	0.150	-0.090
	p	0.485	0.448	0.207	0.799	0.838	0.946	0.261	0.777	0.108	0.336
Creatinine (mg/dL)	rho	0.188	0.204	-0.001	0.163	0.156	0.001	-0.121	0.088	0.045	-0.210
	p	0.043	0.028	0.996	0.080	0.094	0.996	0.196	0.348	0.635	0.024
ALT (IU/L)	rho	0.131	0.082	0.151	-0.019	0.101	0.221	-0.037	-0.057	0.031	-0.123
	p	0.162	0.384	0.105	0.841	0.278	0.017	0.691	0.691	0.738	0.190
Duration of DM (years)	rho	-0.238	-0.278	-0.169	-0.053	-0.050	0.026	0.012	-0.097	-0.152	0.026
	p	0.010	0.003	0.069	0.572	0.593	0.780	0.895	0.298	0.103	0.784
Time on SGLT2 inhibitors (months)	rho	0.048	-0.019	-0.015	-0.077	-0.008	0.269	-0.210	0.029	-0.085	0.022
	p	0.610	0.839	0.877	0.408	0.928	0.004	0.024	0.759	0.364	0.813

DELTA											
		HGB (g/dL)	Hct %	RBC (10 ⁶ /uL)	MCV (fL)	MCH (pg)	MCHC (g/dl)	RDW (%)	WBC (10 ³ /uL)	MPV fL	PLT (10 ³ /uL)
Age (years)	rho	0.010	0.089	0.108	-0.061	-0.135	-0.086	0.117	0.144	0.013	-0.025
	p	0.917	0.341	0.250	0.513	0.149	0.357	0.211	0.122	0.892	0.787
FPG (mg/dL)	rho	0.013	0.112	0.108	0.012	-0.127	-0.227	0.114	0.055	-0.007	0.024
	p	0.891	0.232	0.247	0.900	0.174	0.014	0.223	0.560	0.941	0.796
HbA1c	rho	0.156	0.206	0.175	0.177	0.034	-0.105	0.062	-0.017	0.149	-0.060
	p	0.094	0.026	0.060	0.057	0.720	0.262	0.511	0.857	0.110	0.521
Creatinine (mg/dL)	rho	-0.034	0.053	0.015	-0.042	-0.128	-0.115	0.183	0.249	0.102	-0.048
	p	0.713	0.572	0.873	0.656	0.169	0.219	0.050	0.007	0.277	0.612
ALT (IU/L)	rho	-0.073	-0.152	-0.007	-0.072	-0.009	0.071	-0.197	-0.029	-0.148	0.176
	p	0.433	0.104	0.944	0.443	0.924	0.449	0.034	0.754	0.112	0.059
Duration of DM (years)	rho	0.046	0.002	0.155	0.008	0.020	0.018	-0.127	0.047	-0.160	-0.037
	p	0.627	0.984	0.097	0.935	0.828	0.847	0.174	0.619	0.085	0.696
Time on SGLT2 inhibitors (months)	rho	0.030	-0.046	-0.112	-0.099	0.027	0.088	-0.299	0.131	-0.249	-0.083
	p	0.749	0.626	0.229	0.292	0.773	0.350	0.001	0.162	0.007	0.376

rho= Spearman korelasyon katsayısı. FPG: Fasting plasma glucose, ALT: alanine aminotransferase, HGB: hemoglobin, MCH: mean corpuscular hemoglobin, RDW: red blood distribution width, MCHC: mean corpuscular hemoglobin concentration, MCV: mean cell volume, Hct: hematocrit, HGB: Hemoglobin, RBC: red blood cell, WBC: white blood cell, PLT: platelet count.

levels compared to baseline values in patients treated with dapagliflozin.

A thorough meta-analysis of randomized controlled trials' findings showed that SGLT2 inhibitors exhibited a class effect by elevation hematocrit levels and among them, empagliflozin demonstrated the most pronounced effect on hematocrit levels, followed by canagliflozin, ertugliflozin, dapagliflozin, and ipragliflozin (28). In our study, it was noteworthy the analysis of delta data indicated a greater increase in hematocrit favoring empagliflozin, consistent with the findings of this meta-analysis. The exact reason why

empagliflozin exhibits a greater potency in increasing hematocrit levels compared to dapagliflozin has not received enough clarification in the literature.

In the study, we observed a reduction in MPV and RDW values following the use of SGLT2 inhibitors compared to baseline values. Elevated MPV has been associated with various inflammatory and chronic conditions, as well as numerous cardiovascular diseases, making it a significant indicator of cardiovascular risk (29,30). Similarly, RDW, which serves as an indicator of increased anisocytosis, has also been linked to elevated cardiovascular risk (31). The

decrease in MPV and RDW observed in our study could potentially indicate the favorable cardiovascular effects of SGLT inhibitors.

Individuals with type 2 diabetes mellitus exhibit a low serum erythropoietin level, which further falls as the level of glycosylated hemoglobin increases (32). The excessive uptake of glucose by tubular epithelial cells can lead to metabolic stress in the proximal tubules, creating a hypoxic setting. This, in turn, can drive the transformation of erythropoietin-producing fibroblasts into myofibroblasts. This phenomenon can potentially account for the reduced serum erythropoietin levels observed in people with type 2 diabetes mellitus (13). During the control examination, a study found a negative link between the length of diabetes and the levels of hematocrit and hemoglobin. In our study, we hypothesize that the observed correlation may be attributed to the diminishing levels of erythropoietin and subsequent reduction in hematocrit. This decline is likely a consequence of prolonged exposure to a hypoxic microenvironment, which becomes more pronounced with the duration of diabetes. Similarly, our analysis revealed a positive statistically significant correlation between changes in hematocrit (hematocrit delta) and HbA1c levels. This suggests that higher HbA1c levels, reflecting lower erythropoietin levels, may correspond to greater potential benefits from SGLT2 inhibitors. SGLT2 inhibitors reduce ATP consumption and metabolic stress in cells of the proximal tubular epithelium, thereby decreasing hypoxia. This reduction enables the transformation of myofibroblasts into erythropoietin-producing fibroblasts, which in turn enhances hematopoiesis and increases hematocrit levels (13).

This study has a number of intrinsic limitations. The study's sample size might not have been sufficiently large to fully capture the effects of SGLT2 inhibitors on people with diabetes mellitus. A larger sample size would offer increased statistical power and enhance the reliability and generalizability of the study findings to the wider population of individuals using these inhibitors for diabetes management. Additionally, its retrospective nature, relying on past data and medical records, could introduce limitations during data collection and analysis. Expanding to multiple centers and employing prospective designs could improve the study's external validity and mitigate potential biases.

In conclusion, the findings indicate a significant correlation between the use of SGLT2 inhibitors and increased levels of hematocrit and RBC count, suggesting a potential impact on erythropoiesis. A reduction in (MPV and RDW following SGLT2 inhibitor use observed in the study may indicate potential cardiovascular benefits. Further investigation is

required to elucidate the fundamental mechanisms of the effects of SGLT2 inhibitors on hematopoiesis and to explore their potential implications for clinical practice.

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None

Author Contributions

Baris Karagun and **Okan Sefa Bakiner** performed the literature searches and selected the studies. **Baris Karagun** drafted the manuscript. **Baris Karagun** designed the study and revised the manuscript. All authors have read and approved the final manuscript. Data availability statement: The data that support the findings of this study are available from the corresponding author, **Baris Karagun**, upon reasonable request.

Conflicts of interest

The authors declare that they have no conflicts of interest.

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Ethical approval

The study protocol was approved by the Ethics Committee of Baskent University (KA24/160). The study was conducted in accordance with the principles of the Declaration of Helsinki.

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Evaluation of Work-Related Factors Affecting the Frequency of Overweight and Obesity Among Healthcare Workers in Intensive Care Units in a Training and Research Hospital

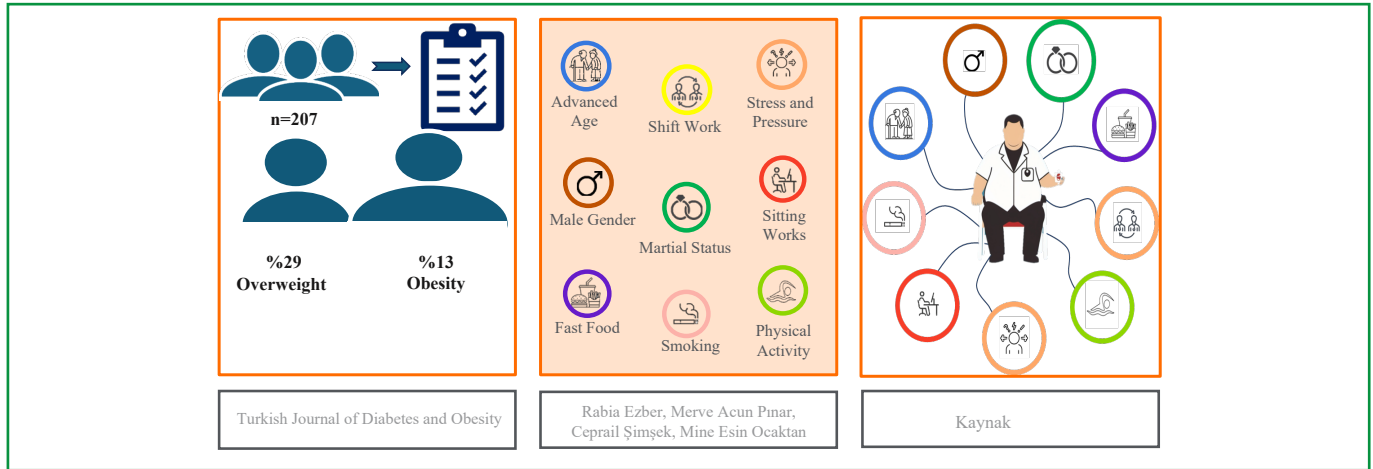
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GRAPHICAL ABSTRACT



ABSTRACT

Aim: This study aimed to determine the prevalence of overweight and obesity among healthcare workers (HCWs) in intensive care units (ICU) and to evaluate the affecting work-related factors.

Material and Methods: The cross-sectional study was conducted between 01.09.2022 and 01.11.2022 in HCWs (working in the ICUs) in a training and research hospital. Personal information form, international physical activity questionnaire (IPAQ short) were used in the study, and their self-reported height and body weights were recorded.

Results: According to the Body Mass Index of the participants, 29.0% (n=60) were overweight and 13.0% (n=27) were obese. There are differences between advanced age (p=0.007), male gender (p<0.001), marital status (p=0.008), presence of obesity in family history (p=0.018), smoking (p=0.028), exposure to stress and pressure at work (p<0.001), lack of physical activity (p<0.001), sitting down to work for more than 3.5 hours in a day (p=0.007), shift work duration of more than 9.5 days per month (p<0.001), eating fast food (p=0.002), not being educated about obesity and overweight (p<0.001).

Conclusion: Protecting workers against risk factors associated with overweight and obesity will increase the level of workers' health and the quality of service received from the workers. This situation will have a positive impact on public health, reducing health costs and reducing losses for both the workers and the country's economy.

Keywords: Obesity, Overweight, Shift work, Work stress, Physical activity

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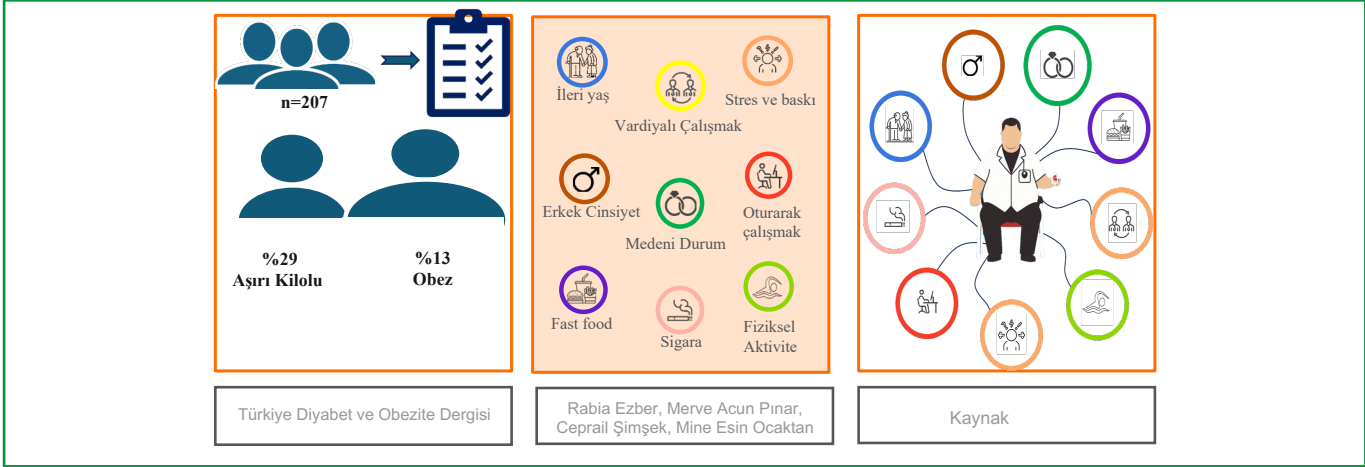
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Bir Eğitim Araştırma Hastanesindeki Yoğun Bakım Çalışanlarında Aşırı Kiloluluk ve Obezite Sıklığına Etki Eden İş ile İlişkili Faktörlerin Değerlendirilmesi

GRAFİKSEL ÖZET



ÖZ

Amaç: Bu çalışmada yoğun bakım çalışanlarında aşırı kiloluluk ve obezite sıklığına etki eden iş ile ilişkili faktörlerin değerlendirilmesi amaçlanmaktadır.

Gereç ve Yöntemler: Kesitsel tipteki bu çalışma, 01.09.2022 ile 01.11.2022 tarihleri arasında bir eğitim ve araştırma hastanesindeki (yoğun bakım ünitelerinde çalışan) sağlık çalışanlarında gerçekleştirildi. Araştırmada kişisel bilgi formu, uluslararası fiziksel aktivite anketi (UFAFAA kısa) kullanılmış ve katılımcıların beyan ettikleri boy ve vücut ağırlıkları kaydedilmiştir.

Bulgular: Katılımcıların %29,0'u (n=60) aşırı kilolu, %13,0'ü (n=27) obezdir. İleri yaş (p=0,007), erkek cinsiyet (p<0,001), medeni durum (p=0,008), aile öyküsünde obezite varlığı (p=0,018), sigara kullanmak (p=0,028), iş yerinde stres ve baskıya maruz kalmak (p<0,001), fiziksel aktivite azlığı (p<0,001), günde 3,5 saatten fazla oturarak çalışmak (p=0,007), ayda 9.5 günden fazla vardiyalı çalışmak (p<0,001), fastfood tüketimi (p=0,002) ve obezite hakkında eğitim almış olmak (p<0,001) aşırı kiloluluk ve obezite ile ilişkili bulunmuştur.

Sonuç: Çalışanları aşırı kiloluluk ve obezite ile ilişkilendirilmiş risklere karşı korumak çalışan sağlığını ve çalışandan alınan hizmetin kalitesini artıracaktır. Bu durum sağlık maliyetlerini azaltarak hem çalışan hem de ülke ekonomisi için kayıpların azalmasını sağlayacaktır.

Anahtar Sözcükler: Obezite, Aşırı kiloluluk, Vardiyalı çalışma, İş stresi, Fiziksel aktivite

INTRODUCTION

Overweight and obesity, which is a very important public health problem, causes negative effects on individual health, social welfare and economy, and ultimately increases the risk of chronic diseases and decreases the quality of life, in connection with modern sedentary life and poor nutritional choices (1). Obese individuals are at risk for comorbidities such as cardiovascular diseases, gastrointestinal disorders, type 2 diabetes mellitus, musculoskeletal diseases, respiratory problems, and psychological problems that may affect their daily lives (2).

It is estimated that approximately 300,000 adults die from obesity-related causes each year in the United States (3).

Among 200 countries, Our country ranks 42nd in terms of obesity rates for women; it ranks 60th among men(4). The prevalence of obesity in the adult population in our country has exceeded the critical high rate of 30%. Although the prevalence of obesity is higher in women, the rapid increase in men in recent years has also attracts attention (5).

HCWs constitute a large part of the working population. According to the statistics of the Ministry of Health, there are approximately 1 million 200 thousand HCWs in our country (6). This rate constitutes 8.4% of the total working population (7). Determining the factors that threaten the health of workers is one of the primary tasks of occupational health and safety in terms of preventive medicine. As a requirement of their duties, HCWs in ICU work in long

shifts, stay awake, waive their rest hours in emergencies, and stay up for long periods of time. For these reasons, they may miss their feeding times, and then skip meals with unhealthy snacks called 'fast food'. In addition to the size of the decisions they make, they constantly encounter patients with poor general conditions, a high probability of resulting in mortality, and their anxious relatives. All these factors threaten the health of HCWs in ICUs and facilitate the development of many systemic diseases.

This study aimed to determine the frequency of overweight and obesity, which are preventable risk factors for many comorbidities and work-related risk factors among HCWs in ICUs.

MATERIAL and METHOD

This analytical cross-sectional study was started on 01.09.2022 after the approval of the ethics committee numbered 2012-KAEK-15/2550 and the institutional permission from Ankara Atatürk Sanatoryum Training and Research Hospital dated 28.06.2022 and was conducted by the principles of the Declaration of Helsinki. Informed voluntary consent was obtained from all participants in the study. The universe of this study consists of all HCWs in ICUs of a training and research hospital (n=213). It was planned to include all workers in the study without calculating the sample size. Data were collected through face-to-face interviews. In the study, the personal information form and the Turkish version of the international physical activity questionnaire (IPAQ short) were used with permission. Since a total of six HCWs did not agree to participate in the study, the study was completed with 207 participants.

In the personal information form; sociodemographic characteristics of individuals, disease and treatment information, presence of obesity in family history, health-related characteristics such as smoking and alcohol use, working life characteristics such as shift work, eating habits, stress and feeling under pressure, and the form consists of a total of 57 questions.

The IPAQ short form consists of seven questions and its validity and reliability studies in Turkey were performed by Öztürk in 2005 (8).

The height and weights of the HCWs were recorded according to their statements. Body Mass Index (BMI) was calculated by dividing weight in kilograms by the square of height in meters. BMI <18.5 kg/m² underweight, 18.5-24.99% kg/m² normal, 25-29.99% kg/m² overweight, 30-34.99% kg/m² slightly obese, 35-39.99% kg/m² moderately obese, 40-49.99% kg/m² morbidly obese, and ≥50% kg/m² were considered super obese (5).

Workers were divided into three groups according to their working style: only night(17:00-08:00), only during the day (08:00-17:00) and alternating day-night shift systems.

Statistical Analysis

Data analysis was performed using IBM SPSS (Statistical Package for the Social Sciences) 20 program. The conformity of the quantitative data to the normal distribution was evaluated with the Kolmogorov-Smirnov test. Mann Whitney U test and Kruskal Wallis analysis of variance (Dunn's test was used as a posthoc test) for statistical analysis of quantitative data. Spearman rho test was used for correlation analysis of quantitative data. Roc curve analysis was used to calculate the cut-off value. For the statistical significance of the difference, p<0.05 was accepted.

RESULTS

A total of 207 HCWs with a mean age of 34.6±10.1 (21-58) were included in the study. 72.5% (n=150) of the HCWs are female and 27.5% (n=57) are male. According to the BMI distribution of the participants, 29.0% (n=60) were overweight and 13.0% (n=27) were obese (Table 1).

There is a correlation between age and BMI (p=0.007, rho=0.187). BMIs of male participants were higher than female participants (p<0.001). A significant relationship was found between marital status and BMI (p=0.008). BMIs

Table 1: Distribution of participants' working style and BMI table.

BMI Categories *		Working style			
		Total (n=207)	Only night (n=13)	Only during the day (n=41)	Alternating day and night (n=153)
<18.50 kg/m ²	Underweight	6 (2.9)	0 (0.0)	1 (2.4)	5 (3.3)
18.5-24.99 kg/m ²	Normalweight	114 (55.1)	11 (84.6)	27 (65.9)	76 (49.7)
25.00-29.00 kg/m ²	Overweight	60 (29.0)	1 (7.7)	8 (19.5)	51 (33.3)
30.00-34.99 kg/m ²	Slightly obese	16 (7.7)	1 (7.7)	4 (9.8)	11 (7.2)
35.00-39.99 kg/m ²	Moderately obese	11 (5.3)	0 (0.0)	1 (2.4)	10 (6.5)

*Data are shown as number(percent), n (%). **BMI:** Body Mass Index

of married participants were found to be higher than singles ($p=0.012$). 52.2% ($n=108$) of the HCWs have children. There was no significant relationship between the number of children, pregnancies and live births, the time passed since pregnancy, and the BMI of the participants ($p=0.104$, $p=0.256$, $p=0.185$, $p=0.548$, respectively). There was no significant relationship between the educational status, economic situation, occupational group, and BMI of the participants ($p=0.422$, $p=0.181$, $p=0.279$, respectively)

The BMIs of those with a family history of obesity were found to be significantly higher ($p=0.018$). The BMIs of the

participants with a chronic disease were found to be significantly higher ($p=0.017$). Anxiety disorder was observed in 8.2% ($n=17$) of the participants, diabetes mellitus in 3.8% ($n=8$), hypertension in 3.3% ($n=7$), hypothyroidism in 3.3% ($n=7$), sleep disturbance in 1.4% ($n=3$) and 0.4% ($n=1$) were diagnosed with rheumatoid arthritis, but no significant correlation was found between chronic disease groups and BMI ($p=0.312$).

32.4% ($n=67$) of the participants were smokers and the BMIs of the smokers were higher than those who had never smoked ($p=0.028$). 22.7% ($n=47$) of the participants consume alcohol. No significant correlation was found between alcohol consumption and BMI ($p=0.726$).

73.9% ($n=153$) of the participants work alternating shifts day and night. The average number of shifts per month is 8.27 ± 1.77 days. 19.8% ($n=41$) of the participants work only during the day and 6.3% ($n=13$) only work at night. The average weekly working hours are 45.7 ± 6.54 hours. The relationship between participants' working style and BMI groups is given in Table 1.

There is a correlation between shift work time and BMI ($p < 0.001$, $\rho = 0.318$). Shift work duration of more than 9.5 days per month provided 53% sensitivity and 85% specificity in predicting overweight and obesity (Area under the curve: $AUC = 0.720$, $p < 0.001$) (Figure 1). 80.7% of the participants ($n=167$) stated that the shift work pattern affected their sleep duration negatively, but no significant relationship was found between sleep duration and BMI ($p=0.416$).

As seen in Table 2, 78.7% of the participants stated that they were under stress and pressure at work. Anxiety disorder was diagnosed in 8.2% ($n=17$) of the participants. The BMI levels of the participants who always felt under stress and pressure were found to be significantly higher than the

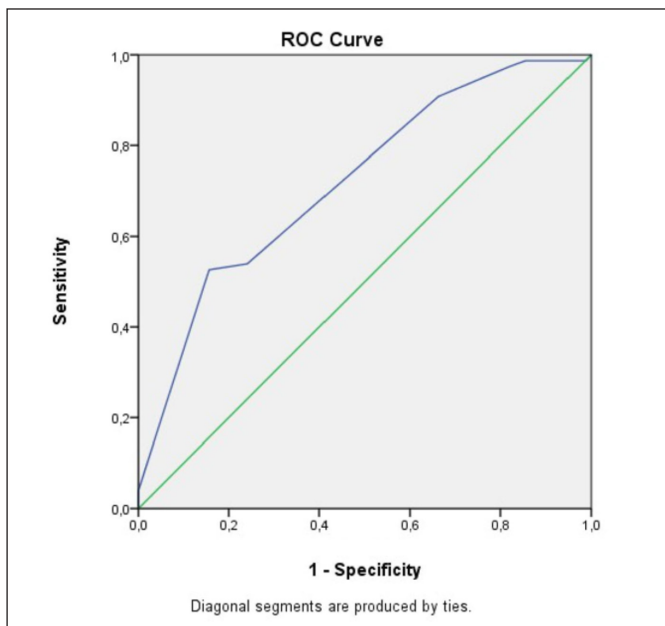


Figure 1: The relationship between shift working hours and overweight and obesity. Shift work duration of more than 9,5 days per month provided 53% sensitivity and 85% specificity in predicting overweight and obesity.

Table 2: Distribution of the stress and pressure feeling at the workplace of the HCWs participating in the research by BMI ($n=207$).

Stress and pressure at work		Total (n=207)	BMI, Median (25-75%)	p
Do you feel under stress and pressure at work? *	Yes	163 (78.7)	24.62 (22.43-27.92)	0.006**
	No	44 (21.3)	23.13 (21.34-25.07)	
How often do you feel stressed and pressured? *	Never	44 (21.3)	23.13 (21.34-25.07)	<0.001 #
	Rarely	16 (7.7)	26.56 (24.24-28.32)	
	Sometimes	60 (29.0)	23.77 (22.23-26.19)	
	Often	55 (26.6)	24.09 (21.45-26.99)	
	Anytime	32 (15.5)	28.06 (25.62-31.44)	
What are your eating habits like when you are under stress and pressure? *	No change	45 (21.7)	24.02 (22.72-27.34)	0.037 #
	I eat more often	115 (55.6)	24.86 (22.49-27.76)	
	My appetite decreases	47 (22.7)	23.29 (20.70-26.03)	

*Data are shown as number (percent), n (%). **Mann-Whitney U test, #Kruskal-Wallis test, BMI: Body Mass Index, HCWs: Healthcare workers

Table 3: Distribution of physical activity levels of HCWs participating in the research by BMI (n=207).

Physical activity levels		Total (n=207)	BMI Median (25-75%)	p **
What is your physical activity level at your workplace? *	Sedentary	5 (2.4)	31.56 (28.04-34.53)	<0.001
	Less active	60 (29.0)	26.00 (23.72-26.89)	
	Medium motion	62 (30.0)	24.22 (22.66-26.89)	
	Energetic	80 (38.6)	22.88 (20.83-25.18)	
What do you do to increase your physical activity at work? *	I don't make changes	106 (51.2)	24.06 (21.26-27.08)	0.450
	I use stairs instead of an elevator	76 (36.7)	24.38 (22.40-27.76)	
	I go for a walk in the afternoon	15 (7.2)	25.54 (23.24-28.65)	
	I act every chance I get	10 (4.8)	23.77 (22.60-25.25)	
According to the (short) form of the international physical activity questionnaire *	Inactive	135 (65.2)	24.89 (22.68-28.04)	<0.001
	Minimally active	35 (16.9)	23.74 (22.49-25.81)	
	Very active	37 (17.9)	22.15 (20.83-24.80)	

*Data are shown as number (percent), n (%). ** Kruskal - Wallis test, **BMI:** Body Mass Index, **HCWs:** Healthcare workers

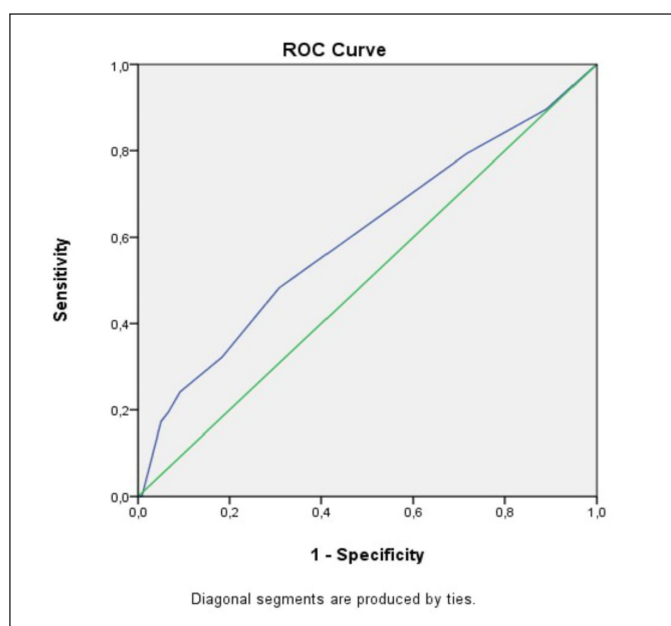


Figure 2: The relationship between sitting working hours and overweight and obesity. *Sitting for more than 3.5 hours a day provided 48% sensitivity and 69% specificity in predicting overweight and obesity.*

participants who never, occasionally, and often felt stress ($p<0.001$, $p=0.001$, $p=0.003$). The BMIs of the participants who stated that they ate more frequently under stress and pressure were found to be higher than those who stated that their appetite decreased ($p=0.033$).

BMIs of the participants working in sedentary and less active jobs were found to be higher than those working in highly active jobs ($p=0.002$, $p<0.001$). A correlation was found between daily sitting work time and BMI ($p=0.007$ $\rho=0.188$). Sitting for more than 3.5 hours a day provided

48% sensitivity and 69% specificity in predicting overweight and obesity. (AUC=0.598, $p=0.016$) (Figure 2). According to the IPAQ short form, the median MET-min/week of energy spent is 1200 (720-2440). The BMIs of the sedentary and less active participants were found to be higher than the active participants, and the decrease in BMI as the level of activity increased ($p<0.001$) (Table 3).

34.2% (n=71) of the participants skip breakfast, 20.2% (n=42) skip lunch and 10.1% (n=21) skip dinner. Of those who skipped meals, 26.1% (n=42) stated that they could not find time to eat, 46.6% (n=75) did not eat because they didn't want to, and 27.3% (n=44) stated that their eating habits were like this. There was no significant relationship between skipping meals and BMI ($p=0.916$). Fast food consumption was present in 63.8% of the participants (n=132), and the BMIs of those who consumed fast food were found to be higher ($p=0.002$). 68.6% (n=142) of the HCWs stated that they consumed snacks in the evening hours, 26.1% (n=52) in the afternoon, and 5.3% (n=11) in the morning hours. There was no correlation between snack consumption status, time of consumption, type of snack consumed and BMI ($p=0.310$, $p=0.293$, $p=0.895$, respectively) (Table 4). The median daily water consumption of the workers is 8 glasses, and no correlation was found between water consumption and BMI ($p=0.773$ $\rho=-0.020$).

60.4% (n=125) of the participants stated that there was an increase in weight after starting work, 30.9% (n=64) stated that there was no change and 8.7% (n=18) decreased. 23.9% (n=38) of those who had a change in weight after starting work, had disturbed sleep patterns, 23.3% (n=37) reported that the menus did not suit their taste, 18.2% (n=29) reported that they had a job not being able to reach healthy foods at the workplace, 15.1% (n=24) eating and drinking

Table 4: Distribution of the nutritional characteristics of the HCWs at work according to BMI (n=207).

Nutritional characteristics at work		Total (n=207)	BMI Median (25-75%)	P
Do you skip meals at work? *	Yes	161 (77.8)	24.36 (22.31-27.04)	0.173**
	No	46 (22.2)	24.09 (22.04-27.99)	
Do you think that the meals at work are prepared in a way that supports healthy eating? *	Yes	23 (11.1)	25.22 (21.33-27.76)	0.832**
	No	184 (88.9)	24.22 (22.31-27.54)	
Do you consume snacks while working? *	Yes	97 (46.9)	24.61 (22.31-28.03)	0.310**
	No	110 (53.1)	23.94 (22.23-27.38)	
What do you consume as a snack? *	Fruits and vegetables	27 (13.0)	24.51 (22.49-26.64)	0.895 #
	Nuts	40 (19.4)	23.73 (22.31-27.21)	
	Toast, pastry, bagel	27 (13.0)	24.09 (23.18-27.68)	
	Packaged foods (chips, crackers, biscuits, chocolate...etc)	113 (54.6)	24.54 (21.60-27.76)	
Do you drink while working? *	Yes	171 (82.6)	24.22 (22.31-27.68)	0.394**
	No	36 (17.4)	24.22 (21.16-26.72)	
Do you consume fast food? *	Yes	132 (63.8)	24.83 (22.67-27.84)	0.002**
	No	75 (36.2)	23.44 (20.83-26.03)	
Do you think your fast food consumption is related to the workplace? *	Yes	111 (53.6)	24.61 (22.66-27.55)	0.130**
	No	96 (46.4)	24.01 (21.30-27.42)	

*Data are shown as number (percent), n (%). ** Mann-Whitney U test, # Kruskal-Wallis test, **BMI**: Body Mass Index, **HCWs**: Healthcare workers

frequently to wake up at night, 8.2% (n=13) not trusting the menus prepared at work in terms of hygiene, 7.5% (n=12) cited workplace stress, 2.5% (n=4) sitting down, and 1.3% (n=2) not finding enough time to do physical activity.

61.4% of the participants (n=127) received at least one education on obesity. The BMIs of the participants who did not receive any education were found to be higher than those who received training (p<0.001). 41.7% (n=53) of the participants received education from the workplace, 37% (n=47) from TV /radio/social media, and 21.3% (n=27) from a private institution. There was no significant difference between the units where the participants received education in terms of BMI (p= 0.712).

DISCUSSION

Genetic factors contribute 40% to BMI (9). Therefore; determining workplace risk factors should be the most basic goal of occupational health and safety services and preventive medicine for the workers who spend most of their days at their workplaces.

In a study conducted at a training and research hospital, it was stated that 13.7% of the participants were obese and 38.7% were overweight. These results are similar to our study (10).

Shift work can cause obesity through various mechanisms such as disruption of circadian rhythm, decrease in blood

leptin levels and increase in ghrelin levels due to decreased sleep hours, formation of oxidative stress due to melatonin deficiency, and development of insulin resistance (11-14). In a study, the rate of abdominal obesity in night shift workers was found to be 3 times higher than in day shift workers (15). In another study; It has been observed that the risk of obesity increases in those who work night shifts for 8 days or more per month (16). In this study, 73.9 % of the participants work in alternating shifts day and night. The BMI of those working alternating shifts between day and night was found to be higher than those working only night shifts. Shift work duration of more than 9.5 days per month provided 53% sensitivity and 85% specificity in predicting overweight and obesity.

In a study, workers who sat for less than 4 hours a day had a significantly lower risk of obesity than workers who sat for 4 hours or more per day (17). In this study, sitting for more than 3.5 hours a day provided 48% sensitivity and 69% specificity in predicting overweight and obesity. According to the IPAQ short form, the BMIs of the inactive participants were higher than the very active participants. In a study, it has been observed that the rate of those who do not exercise at all in our country has increased to 69.5% in the 19-30 age group, 73.2% in the 31-50 age group, and 83.7% in the group over 75 years old (18). In this study, 65.2% of the HCWs were physically inactive.

Employees spend a large part of their day at work and have to get about two-thirds of their daily nutritional needs at work. Nutrition habits directly affect the health of the employee. In a study, it was shown that obesity is associated with eating out, consuming refined products, increased nutrition with fast food foods, and increased consumption of fat and sugar (19). In another study, it was stated that energy-dense snacks with low nutritional value, especially consumed at noon and in the evening, are more unhealthy (20). In this study, 63.8% of the participants have fast food consumption and similar to the literature, the BMIs of those who consume fast food were found to be significantly higher.

HCWs in ICUs make important decisions due to their profession, and they constantly encounter life-threatening patients and their anxious relatives. In this study, 78.7% of the workers stated that they were under stress and pressure. Moreover; Anxiety disorder was diagnosed in 8.2% (n=17) of the participants. It is noteworthy that the diagnosis of anxiety disorder is so common among HCWs in ICUs. In the literature, some of the studies examining the relationship between workload, stress and obesity found a significant relationship, while some could not (21-24). In this study, the BMIs of the participants who always felt under stress and pressure were found to be significantly higher than the other participants. The BMIs of the participants who stated that they ate more frequently under stress and pressure were found to be significantly higher than those whose appetite decreased.

The limitations of the study are that the height and weight information of the participants was recorded with their own statements and the job stress status of the HCWs was determined according to the questions prepared by the researchers in this study. On the other hand, rather than determining the prevalence of obesity especially in healthcare workers, attention has been drawn to the workplace risk factors and effects of overweight and obesity that healthcare workers are exposed to.

Shift work is an unchangeable risk factor for ICUs due to the requirement to provide 24-hour service, but the effects of this risk factor can be reduced by administrative arrangements such as shift work rotations and increasing the number of personnel when necessary. Warning signs and audible warning systems should be considered to support physical activity in the workplace, especially to remind employees to move for certain periods while sitting. Preparing menus with sufficient energy, nutritional diversity to support healthy nutrition in the workplace, having the opportunity to access alternative healthy foods in case the menus do not suit the palate, and planning training on obesity and

healthy nutrition at regular intervals can protect workers against overweight and obesity. In order to reduce stress and pressure among HCWs, it may be beneficial to organize some administrative organizations such as collective nature walks, dance, food, and artistic activities.

It is possible to protect the health of employees with the measures to be taken against workplace risk factors and health surveillance. With the support of weight control and exercise by the workplace health unit of employees who are determined to be overweight or obese, and the facilitation of managerial approaches, the emergence of many chronic diseases will be prevented, the comfort of employees will be increased, and work accidents and injuries will be reduced. This will contribute to public health, resulting in a reduction in health costs both for the employee and for the country's economy.

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None.

Authorship Contributions

Concept: **Rabia Ezber**, Design: **Rabia Ezber, Merve Acun Pınar**, Data Collection or Processing: **Rabia Ezber, Merve Acun Pınar, Ceprail Şimşek, Mine Esin Ocaktan**, Analysis or Interpretation: **Rabia Ezber**, Literature Search: **Rabia Ezber, Merve Acun Pınar, Ceprail Şimşek, Mine Esin Ocaktan**, Writing: **Rabia Ezber, Merve Acun Pınar, Ceprail Şimşek, Mine Esin Ocaktan**.

Conflicts of Interest

The authors declare that they have no competing interest.

Financial Disclosure

The authors received no financial support for this study.

Ethical Approval

This analytical cross-sectional study was started on 01.09.2022 after the approval of the ethics committee numbered 2012-KAEK-15/2550 and the institutional permission from Ankara Atatürk Sanatoryum Training and Research Hospital dated 28.06.2022. The participants were informed about the aim and purpose of the study, and their verbal consent was obtained.

Peer Review Process

Extremely and externally peer-reviewed.

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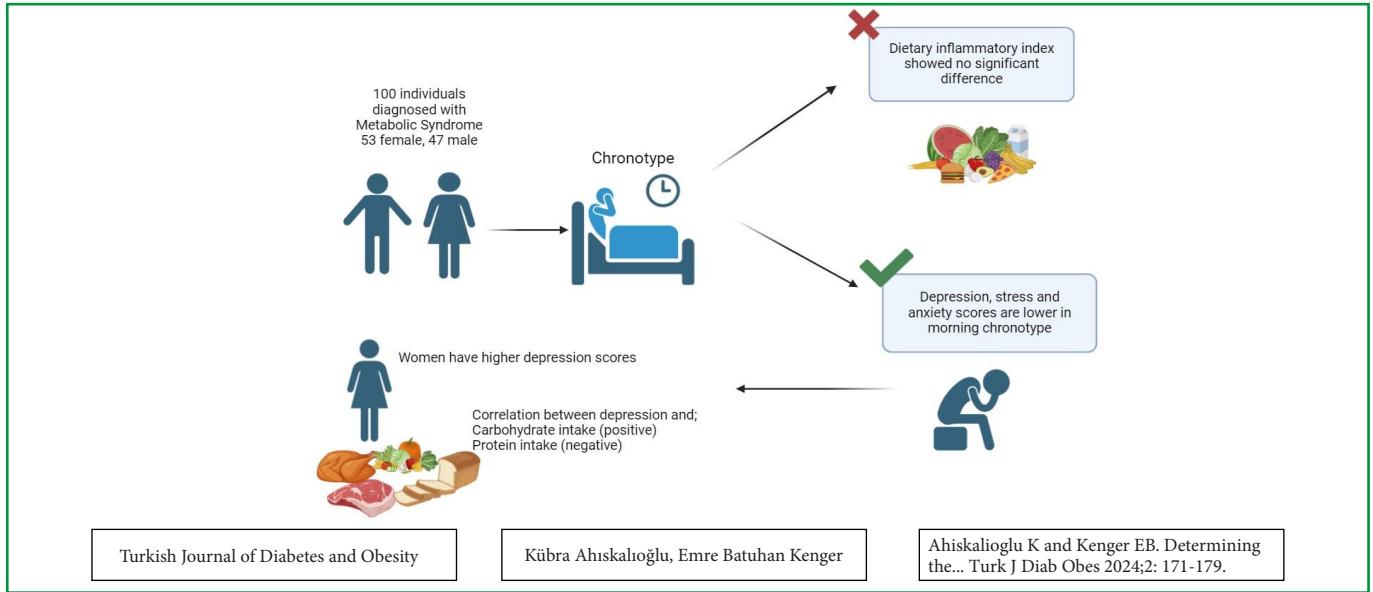
Determining The Relationship Between Diet Inflammatory Index Score, Depression and Chronotype In Individuals with Metabolic Syndrome: An Example of a Training and Research Hospital

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GRAPHICAL ABSTRACT



ABSTRACT

Aim: This study aimed to examine the relationship between the depression, chronotype and Dietary Inflammatory Index score in individuals diagnosed with metabolic syndrome.

Material and Methods: This study included 100 individuals with metabolic syndrome. The Depression-Anxiety Stress Scale was utilized to assess the depression, stress, and anxiety levels of the participants. Chronotypes were determined using the Morningness-Eveningness Questionnaire, and the Dietary Inflammatory Index (DII) was calculated based on a three-day food consumption record. ANOVA, independent samples t-tests and Pearson correlation coefficients were used in statistical analyses.

Results: Of the participants, 53.0% were women and 47.0% were men. Evening type was significantly higher for depression score (10.64 ± 3.91 ; $p=0.001$) than morning type and intermediate type; anxiety (10.38 ± 3.51 ; $p=0.001$) and stress scores (13.12 ± 3.89 ; $p=0.013$) were significantly higher than morning type. Female participants had significantly higher depression scores (9.68 ± 4.39) compared to male participants (8.00 ± 3.35) ($p=0.033$). Analysis of the Dietary Inflammatory Index (DII) scores revealed that women had a more

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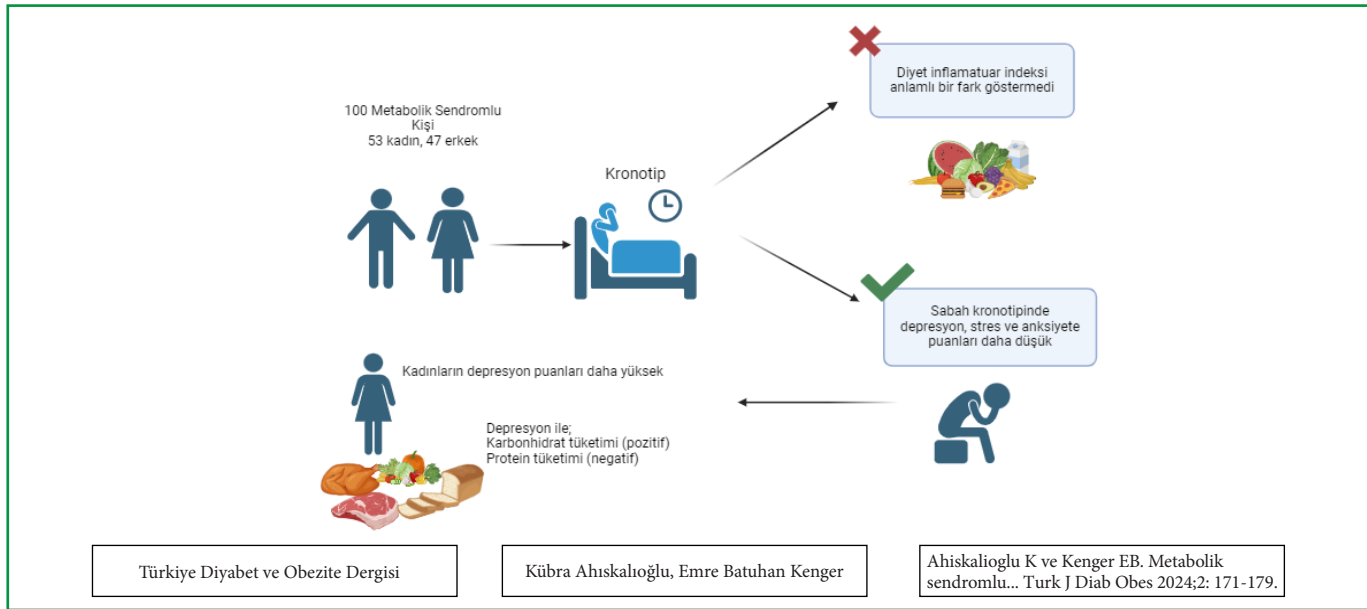
pro-inflammatory diet (3.23 ± 5.69). Additionally, depression score was positively correlated with carbohydrate consumption ($r=0.264$; $p=0.002$) and negatively correlated with the percentage of energy from protein ($r=-0.336$; $p=0.001$).

Conclusion: The study revealed that the majority of individuals with metabolic syndrome exhibit an evening chronotype and are at increased risk for depression, anxiety, and stress. Additionally, it was found that these individuals tend to follow a pro-inflammatory diet. Therefore, it is recommended that the treatment of individuals with metabolic syndrome includes the assessment of their chronotypes, nutritional habits, and psychological states.

Keywords: Chronotype, Dietary inflammatory index, Depression and anxiety, Metabolic syndrome

Metabolik Sendromlu Bireylerde Diyet İnflamatuvar İndeks Skoru, Depresyon ve Kronotip Arasındaki İlişkinin Belirlenmesi: Bir Eğitim Araştırma Hastanesi Örneği

GRAFİKSEL ÖZET



ÖZ

Amaç: Bu çalışma, metabolik sendromlu bireylerde diyet inflamatuvar indeks skoru, depresyon ve kronotip arasındaki ilişkinin belirlenmesi amacıyla yapılmıştır.

Gereç ve Yöntemler: Bu çalışmaya 100 metabolik sendromlu birey dahil edilmiştir. Katılımcıların, depresyon, stres ve anksiyete durumlarını değerlendirmek için Depresyon-Anksiyete Stres Ölçeği ölçeği, kronotiplerini belirlemek için sabahçıl-akşamcıl anketi ve Dİİ'lerini belirlemek için üç günlük besin tüketim kaydı yöntemi kullanılmıştır. İstatistiksel analizlerde ANOVA, bağımsız örnekler t-testleri ve Pearson korelasyon katsayılarından yararlanılmıştır.

Bulgular: Katılımcıların %53'ü kadın ve %47'si erkektir. Akşamcıl tip depresyon skoru için ($10,64 \pm 3,91$; $p=0,001$) sahaçıl ve ara tipe göre; anksiyete ($10,38 \pm 3,51$; $p=0,001$) ve stres skorları için ($13,12 \pm 3,89$; $p=0,013$) sahaçıl tipe göre anlamlı şekilde yüksek çıkmıştır. Kadın katılımcıların depresyon skorları ($9,68 \pm 4,39$) erkeklere ($8,00 \pm 3,35$) göre anlamlı olarak daha yüksek bulunmuştur ($p=0,033$). Diyet inflamatuvar indeks skorları incelendiğinde, kadınların daha pro-inflamatuvar ($3,23 \pm 5,69$) bir beslenme tarzına sahip oldukları belirlenmiştir. Ayrıca, depresyon skoru ile karbonhidrat tüketimi arasında pozitif ($r=0,264$; $p=0,002$), enerjinin proteinden gelen yüzdesi ile ise negatif yönde ($r=-0,336$; $p=0,001$) korelasyon saptanmıştır.

Sonuç: Çalışma, metabolik sendromlu bireylerin çoğunluğunun akşamcıl tipte olduğunu ve bu bireylerin depresyon, anksiyete ve stres açısından risk altında olduğunu göstermiştir. Ayrıca bireylerin pro-inflamatuvar bir beslenme tarzına sahip olduğu saptanmıştır. Metabolik sendromlu bireylerin tedavisinde kronotiplerinin belirlenmesi, beslenme alışkanlıklarının ve psikolojik durumlarının değerlendirilmesi önerilmektedir.

Anahtar Sözcükler: Diyet inflamatuvar indeksi, Depresyon ve anksiyete, Kronotip, Metabolik sendrom

INTRODUCTION

Metabolic syndrome (MetS) is emerging as a significant public health concern globally, often manifesting without noticeable symptoms (1). MetS, hyperglycaemia, abdominal obesity, is a clinical picture characterised by the coexistence of several major risk factors such as hypertension and dyslipidaemia. The National Cholesterol Education Program III (NCEP-ATP III) diagnosis for metabolic syndrome is cardiovascular-centered and must include 3 or more of the risk factors. These risk factors; abdominal obesity (female: >88 cm; male: >102 cm), high blood pressure ($\geq 130/85$ mmHg), low high-density lipoprotein (HDL) (male: < 40 mg/dL; female: <50 mg/dL) hypertriglyceridemia (> 150 mg/dL), high fasting blood sugar (≥ 100 mg/dL) (2-4). Approximately one-quarter of the global population is affected by MetS, and the chronic conditions associated with this syndrome were estimated to account for approximately \$543 billion in healthcare costs in the United States in 2017 (5,6). In Turkey, the prevalence of MetS was reported to be 32.9% in general, 38.3% in women and 26.8% in men (7).

MetS, which has multiple pathophysiological underpinnings, encompasses insulin resistance, chronic inflammation, and abdominal fat accumulation associated with increased adipose tissue. Inflammation is essential in the onset and advancement of MetS (8). Elevated inflammatory cytokine activity initiates both prothrombotic and proinflammatory processes (9). In obesity, cells in adipose tissue, liver, muscle, and pancreas shift from an anti-inflammatory to a pro-inflammatory state, resulting in the recruitment of macrophages and other immune cells (10). Additionally, MetS-related complications are triggered by the imbalance in the inflammatory components of adipose tissue (11).

Depression is also thought to be linked with MetS. Adipokines are reported to play a crucial role in the common pathophysiology between obesity and depression (12). Depression and anxiety levels were found to be significantly higher in obese individuals than in non-obese individuals (13). It has also been shown that depression score is significantly higher in individuals with diabetes (14). Additionally, numerous environmental factors are shared between depression and diabetes. The observation that individuals with depression, even those who are otherwise physically healthy, have a 1.5- to 2-fold higher risk of cardiovascular complications further underscores the link between depression and cardiovascular health (15).

Circadian rhythm disorder, increasingly prevalent among lifestyle factors related to MetS, has been shown to contribute to the development of both MetS and depression (16). All components of MetS have been associated with

abnormal circadian rhythms, and it has been reported that individuals who work shifts are significantly more likely to develop overweight and diabetes mellitus due to circadian rhythm disruption (17).

In light of this information, this study aimed to determine the relationship between the Dietary Inflammatory Index (DII) score, depression, and chronotype in individuals with MetS. It is crucial to identify disturbances in sleep patterns and associated depression in individuals who are already experiencing an inflammatory process due to MetS. This identification can help to emphasize the importance of their eating habits and sleep patterns.

MATERIAL and METHODS

Study Design

This cross-sectional study was carried out to explore the relationship between the Dietary Inflammatory Index (DII) measurements and the levels of depression, stress, anxiety, and chronotype in individuals with MetS. All participants volunteered for the study, provided verbal consent after receiving information about the study, and subsequently signed written informed consent forms. Ethical principles, including confidentiality, protection of privacy, non-maleficence/beneficence, and respect for personal rights, were strictly adhered to throughout the study period. Permission to use the scale was obtained from the relevant authors.

Place, Time and Sample Selection of Research

The sample for this study comprised adults diagnosed with MetS (18) who volunteered to participate and were followed up at the Internal Medicine Polyclinic Hospital in Istanbul between May and June 2023. The sample size of the study was calculated in G*Power 3.1.9.4. power analysis programme (19). Power analysis determined that at least 82 participants were needed for this research to achieve a power level of $1-\beta=0.95$ (20).

Data Collection Tools of the Research

The Depression Anxiety Stress Scale 21 (DASS-21) was used to assess the depression status of individuals who volunteered to participate in the study. Furthermore, the Morningness-Eveningness Questionnaire was utilized to identify participants' chronotype, and a three-day food consumption record was collected to calculate the Dietary Inflammatory Index (DII).

Morningness-Eveningness Questionnaire

The questionnaire consists of a total of 19 questions and evaluates individuals' sleep and wakefulness patterns, performance levels, and lifestyles. Chronotypes are determined

based on the score calculated from the survey responses. Specifically, a total score between 59 and 86 categorizes an individual as a 'morning type,' a score between 42 and 58 as an 'intermediate type,' and a score between 16 and 41 as an 'evening type.' The Turkish adaptation and reliability studies of the Morningness-Eveningness Questionnaire were conducted by Pündük et al. (21). The Cronbach's alpha value for the morningness-eveningness questionnaire was 0.838 in this study.

Depression Anxiety Stress Scale 21

DASS-21 was adapted to Turkish in 2018. Following an explanatory factor analysis, the 21-item scale was organized into three subscales: depression, anxiety, and stress. Each item on the scale is scored from 0 (Never) to 3 (Always). To determine the overall score, the scores from each subscale are summed. It is indicated that higher scores correspond to an increased risk of depression, anxiety, and stress (22). The Cronbach's alpha value for DASS-21 was 0.798 in this study.

Diet Inflammatory Index

The DII was developed to establish a scoring system for specific nutrients that are believed to influence inflammation either positively or negatively. Negative DII scores reflect an anti-inflammatory diet, whereas positive DII scores reflect a pro-inflammatory diet (23).

Assessment of Data

Statistical analysis was performed using SPSS (Statistical Package for the Social Sciences) version 26.0. A significance

threshold of $p < 0.05$ was used. Descriptive statistics for continuous variables included mean, standard deviation, minimum, and maximum values, while categorical variables were summarized with frequency and percentage distributions. The Kolmogorov-Smirnov and Shapiro-Wilk tests were used to verify the normality of the data distribution. Consequently, ANOVA was employed for comparisons among three or more groups, and independent samples t-tests were used for comparisons between two groups. Pearson correlation coefficients were utilized for relationship analyses.

RESULTS

Among the participants, 53.0% were female and 47.0% were male. Furthermore, 74.0% of the participants were married, and 26.0% were single. Table 1 provides the demographic details of the participants.

Table 2 presents the percentage distributions of participants based on their DASS-21 scores and chronotype groups. The analysis of depression scores indicated that 13.0% of participants fell into the normal range, 15.0% were classified as severe, and 14.0% were in the very severe range. For anxiety scores, 10.0% of participants were in the normal range, 20.0% in the severe range, and 41.0% in the very severe range. Regarding stress scores, 12.0% of participants fell into the normal category, 27.0% were in the severe category, and 19.0% were in the very severe category. Examination of the chronotype scores indicated that 18.0% of participants were morning types, 32.0% were intermediate types, and 50.0% were evening types.

Table 1: Demographic characteristics of the participants.

Variables	Female (n=53)	Male (n=47)	Total (n=100)
Age (year±SD)	45.92 ± 9.25	47.83 ± 9.12	46.96 ± 9.16
Body Weight (kg±SD)	76.45 ± 6.84	91.49 ± 7.17	83.81 ± 10.03
Height (cm±SD)	160.13 ± 5.42	174.26 ± 4.74	166.73 ± 8.62
Body Mass Index (kg/m ² ±SD)	29.85 ± 2.75	30.14 ± 2.17	30.10 ± 2.36
Body Mass Index Categories, n (%)			
Overweight	31 (31.0)	21 (21.0)	52 (52.0)
Obese	22 (22.0)	26 (26.0)	48 (48.0)
Marital Status n (%)			
Married	44 (44.0)	30 (30.0)	74 (74.0)
Single	9 (9.0)	17 (17.0)	26 (26.0)
Education Level, n (%)			
Primary school	6 (6.0)	6 (6.0)	12 (12.0)
Middle school	28 (28.0)	16 (16.0)	44 (44.0)
High school	18 (18.0)	21 (21.0)	39 (39.0)
University	1 (1.0)	4 (4.0)	5 (5.0)

*SD: Standard Deviation

Table 3 shows the DASS-21, chronotype, and DII scores of the participants according to gender. The depression scores of female participants were found to be significantly higher than those of male participants ($p<0.05$). Conversely, male

Table 2: Percentage Distribution Values of Participants for DASS-21 and Chronotype Groups (n= 100).

Parameters	Values (n=100)	
Depression Score, n (%)	Normal	13 (13.0)
	Mild	19 (19.0)
	Moderate	39 (39.0)
	Severe	15 (15.0)
	Extremely Severe	14 (14.0)
Anxiety Score, n (%)	Normal	10 (10.0)
	Mild	14 (14.0)
	Moderate	15 (15.0)
	Severe	20 (20.0)
	Extremely Severe	41 (41.0)
Stress Score, n (%)	Normal	12 (12.0)
	Mild	18 (18.0)
	Moderate	24 (24.0)
	Severe	27 (27.0)
	Extremely Severe	19 (19.0)
Morning-Evening Score, n (%)	Morning Type	18 (18.0)
	Intermediate Type	32 (32.0)
	Evening Type	50 (50.0)

participants had significantly higher stress scores ($p<0.05$). Analysis of the DII scores indicated that women had a more pro-inflammatory diet, though this difference approached but did not reach statistical significance ($p=0.066$).

Table 4 presents the DASS-21 and DII scores of participants categorized by their chronotype groups. The anxiety, depression, and stress scores of participants varied significantly across the chronotype groups, with the “evening type” group exhibiting significantly higher scores in all three areas ($p<0.05$). However, the DII scores did not significantly differ among the various chronotype groups.

Significant differences in anxiety scores were identified between morning types and evening types, as well as between morning types and intermediate types. For depression scores, notable differences were found between morning types and evening types, and between evening types and intermediate types. In terms of stress scores, significant differences were observed between morning and evening groups.

Figure 1 shows the DII scores of participants according to their BMI groups. Obese individuals (score: 3.17 ± 0.89) seem to follow a more pro-inflammatory diet compared to those who are overweight (score: 1.17 ± 0.87 ; $p=0.114$).

The depression score was significantly linked to both protein percentage and carbohydrate intake ($p<0.05$). There was a notable negative correlation between the depression score and protein percentage ($r=-0.336$, $p<0.01$), as well as a significant positive correlation between the depression score and carbohydrate intake ($r=0.264$, $p<0.01$) (Table 5).

Table 3: DASS, chronotype and DII scores of participants according to gender.

DASS, chronotype and DII scores	Women (n=53)	Men (n=47)	Total (n=100)	P
Depression Score \pm SD	9.68 \pm 4.39	8.00 \pm 3.35	8.92 \pm 4.03	0.033*
Anxiety Score \pm SD	9.30 \pm 4.29	8.43 \pm 4.08	8.95 \pm 4.13	0.299
Stress Score \pm SD	11.28 \pm 3.98	12.83 \pm 4.17	12.10 \pm 4.03	0.041*
Morning-Evening Score \pm SD	43.30 \pm 12.73	45.15 \pm 12.95	44.12 \pm 12.75	0.474
DII Score \pm SD	3.23 \pm 5.69	0.94 \pm 6.59	2.13 \pm 6.26	0.066

*T test was used in independent groups. Statistical significance level $p<0.05$. SD: Standard Deviation, DASS: The Depression Anxiety Stress Scale, DII: Dietary Inflammatory Index

Table 4: DASS and DII scores according to chronotype categories.

DASS and DII scores	Morning Type (n=18)	Intermediate Type (n=32)	Evening Type (n=50)	Total (100)	p
Depression Score \pm SD	6.27 \pm 3.78	7.62 \pm 2.94	10.64 \pm 3.91	8.92 \pm 4.03	0.001*
Anxiety Score \pm SD	4.44 \pm 4.19	9.06 \pm 4.07	10.38 \pm 3.51	8.95 \pm 4.13	0.001*
Stress Score \pm SD	10.05 \pm 4.49	11.37 \pm 3.81	13.12 \pm 3.89	12.10 \pm 4.03	0.013*
DII Score \pm SD	1.34 \pm 7.44	3.53 \pm 5.15	1.56 \pm 6.31	2.13 \pm 6.26	0.312

*One way ANOVA test was used. Statistical significance level $p<0.05$. For anxiety score, between morning person-evening type and morning person-intermediate type; For depression score, between morning-evening and evening-intermediate types; For the stress score, there are significant differences between the morning and evening groups.*SD: Standard Deviation, DASS: The Depression Anxiety Stress Scale, DII: Dietary Inflammatory Index

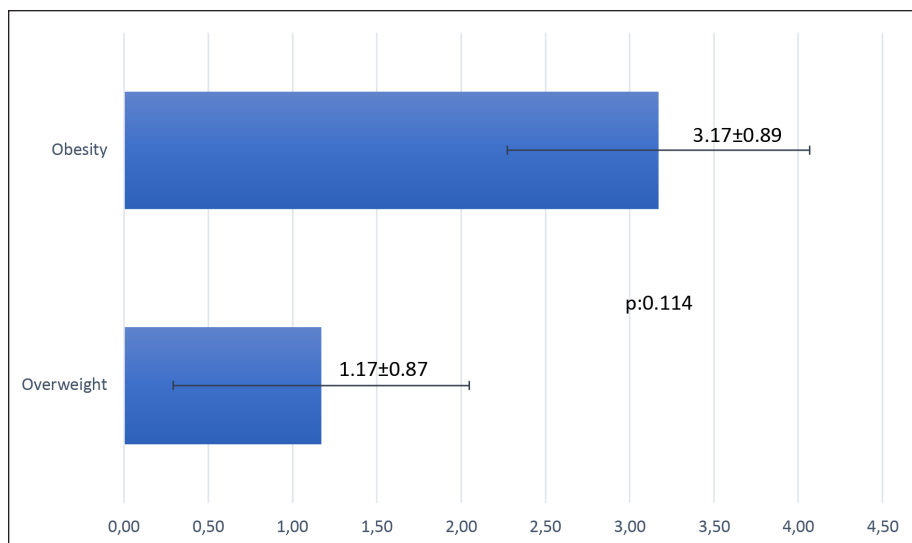


Figure 1: DII scores according to BMI categories.

Table 5: Relationship between depression score and nutrient intakes.

Parameters		Depression Score
Fat (g)	r	0.171
	p	0.090
Fat (%)	r	0.007
	p	0.945
Protein (g)	r	-0.097
	p	0.336
Protein (%)	r	-0.336*
	p	0.001
Carbohydrate (g)	r	0.264*
	p	0.002
Carbohydrate (%)	r	0.171
	p	0.089
Fiber (g)	r	0.051
	p	0.612
Cholesterol (mg)	r	-0.146
	p	0.147

* Pearson correlation was used. Statistical significance level $p < 0.05$.

DISCUSSION

This study was conducted to determine the relationship between DII, depression and chronotype in individuals with MetS.

Eighteen percent of the participants are classified as morning types, 32.0% as intermediate types, and 50.0% as evening types. It has been reported that evening types generally ex-

perience more health and behavioral problems compared to morning types. Disturbances in the circadian system can influence energy expenditure, sleep, appetite, and other factors that may lead to obesity (24). Individuals with an evening chronotype have been linked to having a higher BMI, increased triglycerides, reduced HDL-cholesterol levels, elevated HOMA-IR, and a significantly higher overall MetS score (25). The predominance of evening types among the participants underscores its close relationship with MetS, corroborating existing literature. When examining the depression scores of the participants, 13.0% were in the normal category, 19.0% in the mild category, 39.0% in the moderate category, 15.0% in the severe category, and 14.0% in the very severe category. A bidirectional relationship between depression and MetS has been suggested. A study investigating the prevalence of MetS in patients with major depressive disorder found that the prevalence of MetS was 2.4 times higher in this population (26). Another study indicated that individuals with depression are strongly associated with being in a high-risk group for MetS, and consequently, with increased cardiovascular morbidity and mortality (27).

In this study, no significant difference in DII scores was observed between genders. Similarly, Muhammad et al. reported no statistically significant gender-specific difference in a study using the DII score (28). Additionally, it has been reported that a pro-inflammatory diet is associated with an increased risk of future depression (29). In this study, although the difference was not statistically significant, women exhibited a more pro-inflammatory diet compared to men. This dietary pattern may contribute to the higher depression scores observed in women compared to men in the DASS-21 results.

Anxiety, depression, and stress scores showed significant differences among the chronotype groups ($p < 0.05$). Daily circadian rhythms are known to influence changes in human physiology and behavior, and there is increasing evidence for a strong association between a disrupted circadian system and mood disorders (30). The evening chronotype exhibited the highest prevalence of all measured psychological symptoms (31). The exact mechanisms linking chronotype to depression are still not entirely clear. It is suggested that individuals with an evening chronotype might be more prone to depression due to a misalignment in their sleep-wake cycle. People who prefer to stay up late and wake up late often have to conform to societal schedules that clash with their natural biological rhythms. This misalignment can cause sleep disturbances and disrupt the rhythmic activity of neurotransmitters, which may contribute to the development of mental disorders (32). These findings are consistent with previous studies suggesting a relationship between the evening chronotype and increased severity of anxiety and depression symptoms. The data obtained in this study align with the existing literature, as anxiety, depression, and stress scores were significantly higher in the “evening type” group.

The study shows that no statistically significant relationship was found between DII and BMI. A study evaluating the relationship between DII score and overweight status indicated having a normal body weight does not necessarily correspond to a diet with lower inflammatory potential or higher quality. It was also observed that obese participants had lower DII scores compared to normal-weight participants (33). In contrast, a study conducted in the United States of America (USA) found that a higher DII score was linked to an increased risk of obesity and had a significant impact on obesity (34). In a study conducted in Indonesia, it was concluded that there was no association between the DII score and any anthropometric measurements (28). Additionally, a cross-sectional study in Spain found that the DII score was linked to BMI in women but not in men (35). These studies suggest that the effect of DII on body weight is not yet clear. Studies with larger participants will effectively reveal the relationship between BMI and DII.

The study shows that a positive correlation was found between depression scores and carbohydrate consumption, and a negative correlation with the protein percentage of the diet. This suggests that a poor-quality diet may lead to nutritional deficiencies associated with depression and anxiety disorders (36). The intake of refined, simple, and low-quality carbohydrates has a direct impact on both physical and mental pathophysiology (37). Increasing evidence indicates that carbohydrate intake affects depression (38). Thus, the observed positive relationship between depression scores

and carbohydrate intake in this study is consistent with findings reported in the literature.

A negative relationship was found between protein consumption and depression scores in our study, indicating that a higher protein percentage is associated with lower depression scores. Amino acids, the building blocks of proteins, have been shown to have beneficial effects on mental function (39). According to data from a cross-sectional study conducted between 2007 and 2014, total protein intake and the risk of depressive symptoms were inversely related (40). The literature supports the notion that protein intake has an indirect protective effect against the risk of depression, which is consistent with the findings of this study.

This study has several limitations. Firstly, the study is that the number of samples is small. Secondly, the study was conducted in a single state hospital. Multicenter and large-participant studies can increase the generalizability of the findings.

This study investigating individuals with MetS revealed that the majority of participants were evening types, were at risk for depression, anxiety, and stress, and had a pro-inflammatory diet. Additionally, it was observed that depression scores were negatively related to the protein percentage of the diet and positively related to carbohydrate consumption. It is suggested that determining chronotypes, and evaluating eating habits and psychological states will enhance the success of treatment in individuals with MetS.

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Author's Contributions

Conceptualization: **Kubra Ahiskalioglu, Emre Batuhan Kenger**, methodology: **Kubra Ahiskalioglu, Emre Batuhan Kenger**, investigation: **Kubra Ahiskalioglu, Emre Batuhan Kenger**, data curation: **Kubra Ahiskalioglu**, analysis: **Emre Batuhan Kenger**, writing – original draft: **Kubra Ahiskalioglu, Emre Batuhan Kenger**, Writing –review & editing: **Kubra Ahiskalioglu, Emre Batuhan Kenger**, supervision: **Emre Batuhan Kenger**.

Conflict of Interest

None.

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Ethical Approve and Informed Consent

Informed consent in writing was obtained from all participants. Permission was received from Istanbul Bahçeşehir University Ethics Committee to conduct the research (approval number 2023-/03, dated 30.03.2023) and the study was conducted in accordance with the principles of the Declaration of Helsinki.

Peer Review Process

Extremely and externally peer-reviewed.

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Tip 2 Diabetes Mellitus Tanılı Hastalarda Hastalığı Farkındalık ve Kabulüne Göre Mutluluk Düzeylerinin Değerlendirilmesi

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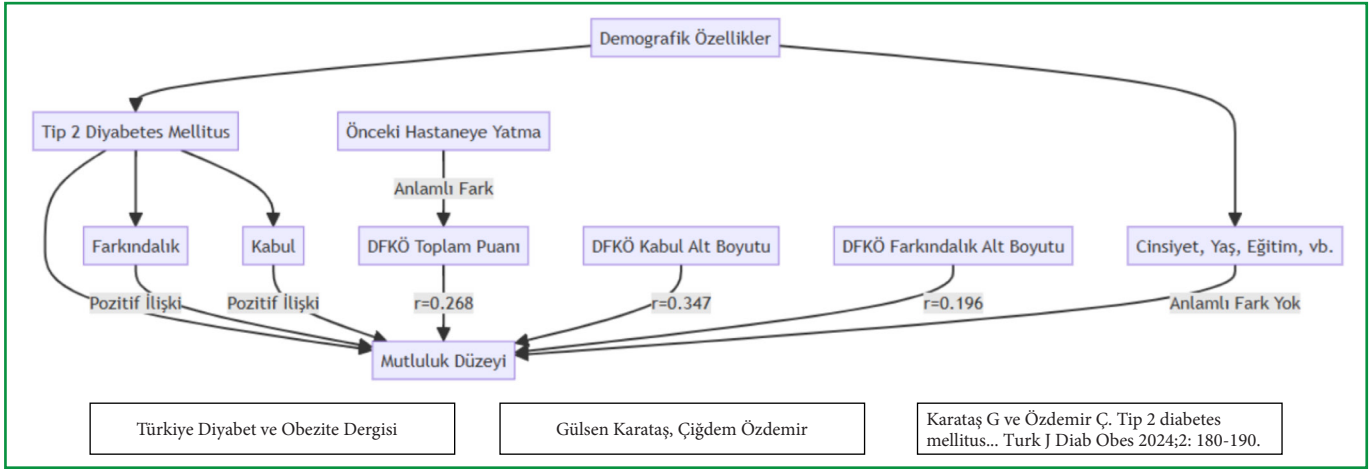
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Bu makaleye yapılacak atıf: Karataş G ve Özdemir Ç. Tip 2 diabetes mellitus tanılı hastalarda hastalığı farkındalık ve kabulüne göre mutluluk düzeylerinin değerlendirilmesi. Turk J Diab Obes 2024;2: 180-190.

GRAFİKSEL ÖZET



ÖZ

Amaç: Tip 2 Diabetes Mellitus tanılı bireylerin hastalığının farkında olup kabul etme durumu ile mutluluk düzeylerinin belirlenmesi ve bunların arasındaki ilişkinin incelenmesidir.

Gereç ve Yöntemler: Tanımlayıcı, nicel ve kesitsel tipteki çalışma, Temmuz-Ekim 2023 tarihleri arasında yapıldı. Dahiliye servislerinde yatan 18 yaş üstü 128 hasta ile yapılan çalışmada; veriler Tanıtıcı Bilgi Formu, Diyabet Farkındalık ve Kabul Ölçeği ve Oxford Mutluluk Ölçeği Kısa Formu kullanılarak toplandı ve analiz yapıldı.

Bulgular: Çalışmada Diyabet Farkındalık ve Kabul Ölçeği toplam puanı $71,28 \pm 24,68$ (min:23, max:115), farkındalık alt boyutu toplam puanı $45,09 \pm 15,49$ (min:14, max:70), kabul alt boyutu toplam puanı $26,71 \pm 9,91$ (min:9, max:45) ve OMÖ-K toplam puanı $20,0 \pm 6,32$ (min:7, max:35) bulundu. Katılımcıların DFKÖ toplam puanı ile OMÖ-K toplam puanı arasında pozitif yönde, zayıf düzeyde (Spearman rho kaysayısı=0,268, $p < 0,05$); DFKÖ kabul alt boyutu toplam puanı ile OMÖ-K toplam puanı arasında pozitif yönde, orta düzeyde (Spearman rho kaysayısı=0,347, $p < 0,05$); DFKÖ farkındalık alt boyutu toplam puanı ile OMÖ-K toplam puanı arasında pozitif yönde, zayıf düzeyde (Spearman rho kaysayısı=0,196, $p < 0,05$) ve istatistiksel olarak anlamlı bir ilişki bulundu. Katılımcıların daha önce hastaneye yatma durumu ile DFKÖ toplam puanı ve farkındalık alt boyutu toplam puanı arasında istatistiksel olarak anlamlı bir fark bulundu ($p < 0,05$). Bireylerin cinsiyet, yaş, medeni durum, yaşadığı yer, eğitim düzeyi, çalışma durumu, tip 2 Diabetes Mellitus tanı

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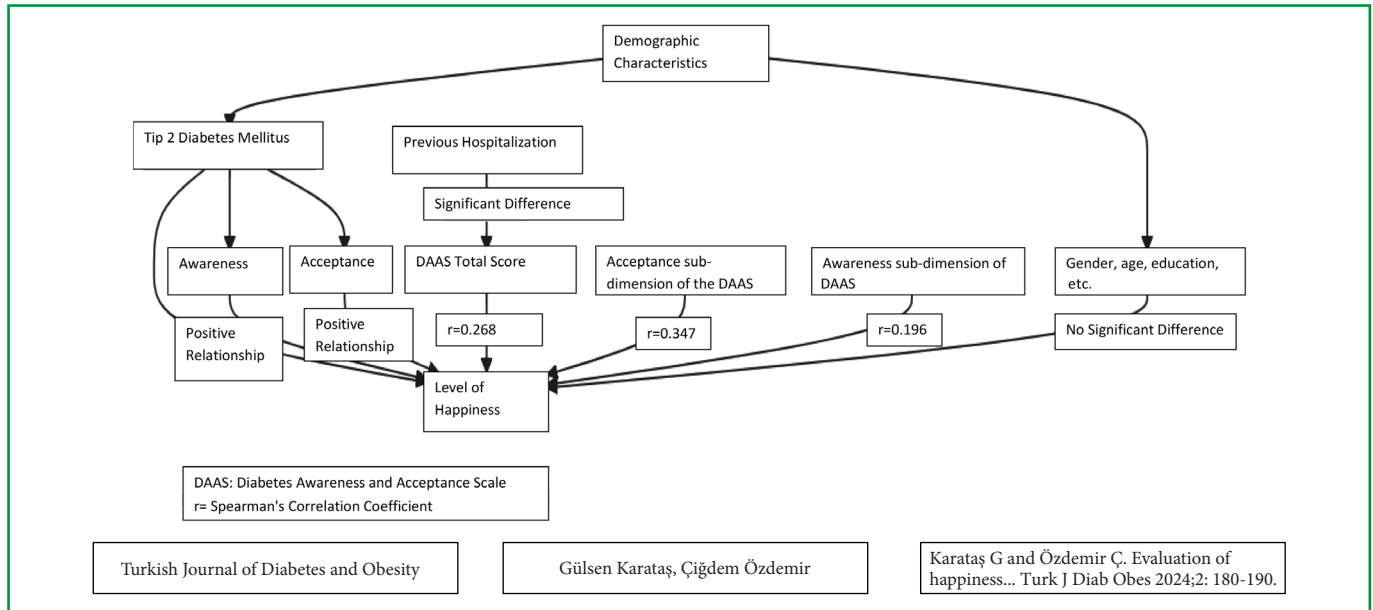
süresi, günlük kullandığı ilaç sayısı, kullandığı ilaç tipi ve başka bir kronik hastalık durumları ile OMÖ-K ve DFKÖ toplam puanı arasında istatistiksel olarak anlamlı bir fark bulunmadı ($p>0,05$).

Sonuç: Hastaların hastalığının farkında olmalarının ve hastalığı kabul etme durumlarının, kişilerin mutluluk düzeylerini artırdığı görüldü.

Anahtar Sözcükler: Diabetes Mellitus, Farkındalık, Mutluluk

Evaluation of Happiness Levels According to Disease Awareness and Acceptance in Patients with Type 2 Diabetes Mellitus

GRAPHICAL ABSTRACT



ABSTRACT

Aim: The aim of this study was to determine the awareness and acceptance of the disease and happiness levels of individuals diagnosed with Type 2 Diabetes Mellitus and to examine the relationship between them.

Material and Methods: The descriptive, quantitative and cross-sectional study was conducted between July and October 2023. Data were collected and analyzed using the Descriptive Information Form, Diabetes Awareness and Acceptance Scale and Oxford Happiness Scale Short Form.

Results: The total score of the DAAS was 71.28 ± 24.68 (min:23, max:115), the total score of the awareness subscale was 45.09 ± 15.49 (min:14, max:70), the total score of the acceptance subscale was 26.71 ± 9.91 (min:9, max:45), and the total score of the OHQ-SF was 20.0 ± 6.32 (min:7, max:35). There was a positive, weak (Spearman's rho coefficient=0.268, $p<0.05$) and statistically significant relationship between the total score of the participants' DAAS and the total score of the OHQ-SF; there was a positive, moderate (Spearman's rho coefficient=0.347, $p<0.05$) relationship between the total score of the DAAS acceptance subscale and the total score of the OHQ-SF; A positive, weak (Spearman's rho coefficient=0.196, $p<0.05$) and statistically significant relationship was found between the total score of the awareness subscale of the DAAS and the total score of the OHQ-SF. A statistically significant difference was found between the participants' previous hospitalization status and the total score of the DAAS and the total score of the mind fullness subscale ($p<0.05$). There was no statistically significant difference between the gender, age, marital status, place of residence, education level, employment status, duration of Type 2 Diabetes Mellitus diagnosis, number of medications used daily, type of medication used, and another chronic disease status of the individuals and the total score of OHQ-SF and DAAS ($p>0.05$).

Conclusion: It was observed that patients' awareness of their disease and acceptance of the disease increased their level of happiness. In this respect, it is thought that this study will contribute to the literature.

Keywords: Diabetes Mellitus, Awareness, Happiness

GİRİŞ

Diabetes Mellitus (Diyabet, DM), insülin hormonunun yokluğu (Tip 1), eksikliği veya yetersizliği (Tip 2) sebebiyle kandaki glukoz sınırının aşılmasıyla meydana gelen, karbonhidrat, yağ ve protein metabolizmalarındaki normal olmayan durumlarla ilişkili olan renal, nörolojik ve prematüre kardiyovasküler hastalıkların gelişmesine neden olan, günümüzde insanları önemli seviyede etkileyen, bulaşıcı olmayan kronik hastalıklar içinde en sık görülen hastalıklardan biridir (1). Uluslararası Diyabet Federasyonu (IDF) verilerine göre ise Dünya’da 537 milyon diyabetli hasta yer almaktadır (2). Dünya Sağlık Örgütü verilerine göre her yıl 41 milyon insanın ölümünden sorumlu hastalıklar içerisinde diyabet de yer almaktadır (3). Türkiye Diyabet, Hipertansiyon, Obezite ve Endokronolojik Hastalıklar Prevelans Çalışması-II (TURDEP II) verilerine göre; son 12 yılda diyabet sıklığı %90 artarak, 40-44 yaş grubundan itibaren erkeklerde açlıkta gizli diyabet, kadınlarda tokluk gizli diyabet olmak üzere nüfusun en az %10’u diyabetlidir (4). Uluslararası Diyabet Federasyonu’nun yayınladığı 10. Uluslararası Diyabet Atlası verilerine göre ise Türkiye’de 2021 yılında 20-79 yaş arası diyabet tanılı hasta sayısının 9 milyon olduğu ve bu sayının 2045 yılında 13,4 milyon olacağı öngörülmektedir (2). Bu veriler diyabetin ülkemiz için önemli bir kronik hastalık olduğunu göstermektedir.

Diabetes mellitus’un beyin fonksiyonu üzerindeki etkileri ile yaşam sorunlarının değerlendirilmesini olumsuz yönde etkilenmektedir. Bununla birlikte diyabetin; anksiyeteye, depresyona, mutlulukta azalmaya, enerjik uyarılmanın azalmasına yol açtığını ve ruh hali değişikliklerine neden olduğunu gösteren çalışmalar mevcuttur (5,6). Mutluluk; bireyin kendini gerçekleştirme, var olan gücünü daha iyi bir şekilde kullanması, yaşam kalitesinin artırılması, kişilerarası ilişkilere katkı sağlaması anlamına gelen önemli bir terimdir (7). Diyabet hastaları tanı konulduktan sonra yaşam tarzı değişikliğinden duygusal ve/veya fiziksel olarak etkilenmektedir. Bu durum hastaların kabullenmelerini etkilemektedir. Kişinin, hastalığını kabul etmesi, hastalık ile ilgili olumsuz duygu ve düşüncelerinde azalmanın olması hastalığı ile baş etme sürecini kolaylaştırmaktadır (8).

Literatür incelendiğinde, kişilerin hastalığı kabul durumlarının, bireyin biyopsikososyal durumuna göre değişkenlik gösterebildiği görülmüştür (8). Diyabet hastaları üzerine yapılan çalışma sonuçlarına göre; hastaların psikososyal uyumlarının zayıf olduğu, hastalık sebebiyle iş ve sosyal hayatlarında zorluk yaşadıkları, ortama uyum sağlama konusunda endişe duydukları, yalnızlık, anksiyete ve umutsuzluk gibi korkuları olduğu gösterilmiştir (9-11). Bu çalışma, Tip 2 DM tanılı hastaların hastalık farkındalığı ile hastalıklarını kabul etme durumu ve mutluluk düzeylerinin belirlenmesi

amacıyla yapılmıştır. Bu konuda yapılan çalışmaların kısıtlı olduğu fark edilmiş ve bu nedenle araştırmanın alana katkı sağlayacağı ve özellikle hastalığının farkında olmayan, hastalığını yönetemeyen, yanlış ya da eksik bilgisi olan ve tüm bunlara bağlı olarak değişken mutluluk duygusu yaşayan bireylerle yapılacak olan çalışmalara da yol göstereceği düşünülmektedir.

GEREÇ ve YÖNTEMLER

Araştırma için Türkiye’nin Güneyindeki bir üniversitenin girişimsel olmayan araştırmalar etik kurulundan (2023/09), araştırmanın uygulandığı Devlet Hastanesinin başhekimliğinden ve İl Sağlık Müdürlüğü’nden yazılı izinler alındı (Sayı: E-34007727-770-218072960). Ölçek kullanımı için yazarlardan e-mail yoluyla izin alındı. Araştırmaya katılan hastalardan bilgilendirilmiş onam alındı. Araştırma, Helsinki Bildirgesi’ne uygun olarak yürütüldü.

Çalışma, Temmuz-Ekim 2023 tarihleri arasında yapılmıştır. Çalışmanın evrenini Güneydoğu Anadolu Bölgesi’nde bir devlet Hastanesi’nin Dahiliye servislerinde yatmakta olan diyabet tanılı hastalar oluşturdu (N=130). Örneklem büyüklüğünün hesaplanmasında “Oxford Mutluluk Ölçeği-Kısa Formu” esas alınarak G-Power programında minimum örneklem genişliği $\alpha=0,05$, testin gücü $(1-\beta)$ 0,95 iken gereken örneklem sayısının 112 olduğu tespit edildi (12). Belirlenen tarihler arasında, uzman bir dahiliye hekimi tarafından en az 6 aydır Tip 2 DM tanısı ile takip edilen, 18 yaş ve üzerinde olan, iletişim sorunu olmayan ve araştırmaya katılmayı gönüllü olarak kabul eden 128 birey çalışmanın örneklemini oluşturdu.

Verilerin elde edilmesinde Tanıtıcı Bilgi Formu, Diyabet Farkındalık ve Kabul Ölçeği, Oxford Mutluluk Ölçeği Kısa Formu kullanıldı.

Tanıtıcı Bilgi Formu: Araştırmacılar tarafından geliştirilen form, bireylerin sosyodemografik özellikleri ile hastalık ve tedavisine ilişkin özelliklerini içeren 13 sorudan oluşmaktadır.

Diyabet Farkındalık ve Kabul Ölçeği: DM hastalarının farkındalık ve kabul düzeylerini objektif olarak değerlendirebilen ölçek, sağlık profesyonellerinin diyabetli yetişkin hastalar için gerekli müdahaleleri planlamasına ve uygulamasına yardımcı olacağı düşünülerek Atik ve arkadaşları tarafından 2022 yılında geliştirilmiştir (13). Madde sayısı 23 olan ölçek, iki alt boyuttan (farkındalık ve kabul) oluşmaktadır ve beşli likert tipindedir. Her zaman “5”, Sık sık “4”, Kararsızım “3”, Bazen “2” ve Hiçbir zaman “1” olarak kodlanan ölçeğin toplam puanı 23 ile 115 arasında değişmektedir. “Farkındalık” alt ölçeğinin toplam puanı 14 ile 70 arasında değişmektedir. “Kabul” alt ölçeğinin toplam puanı 9 ile 45 arasında değiş-

mektedir. Puanların artması farkındalık ve kabul düzeylerinin yüksek olduğunu göstermektedir. Cronbach'salpa katsayısı ölçeğin tamamı için 0,96; "farkındalık" alt boyutu için 0,94 ve "kabul" alt boyutu için 0,94 olarak bulunmuştur (13). Bu çalışmada, ölçeğin tamamı için Cronbach's alpha katsayısı 0,83; "farkındalık" alt boyutu için 0,98 ve "kabul" alt boyutu için 0,96 olarak bulundu.

Oxford Mutluluk Ölçeği Kısa Formu: Hills ve Argyle tarafından (14), mutluluk düzeyini değerlendirebilmek amacıyla geliştirilen 8 maddelik ölçek (Cronbach alfa=0,93), 2011 yılında Türkçe'ye uyarlanarak geçerlik ve güvenilirliği (Cronbach alfa=0,85) incelenmiştir (15). Madde sayısı 7 olan ölçek, beşli likert tipindedir. Ölçek Tamamen katılıyorum "5", Katılıyorum "4", Biraz katılıyorum "3", Katılmıyorum "2" ve Hiç katılmıyorum "1" olarak kodlanmakta ve yüksek puanlar mutluluk düzeyinin yükseldiğine işaret etmektedir. Ölçeğin Cronbach's alpha katsayısı 0,74 olarak bulunmuştur (15). Bu çalışmada, ölçeğin Cronbach's alpha katsayısı 0,97 olarak bulundu.

Veriler, hastalarla yüz yüze görüşme yoluyla araştırmacı tarafından toplandı.

İstatistiksel Analiz

İstatistiksel analizler IBM SPSS (Statistics for Windows, Version24.0) paket programı ile sağlandı. Normal dağılım kontrolü için Kolmogorov-Smirnov testi kullanıldı. Normal dağılım sağlanmadığından, ikili değişkenler karşılaştırılırken Mann Whitney U testi, çoklu değişkenler karşılaştırılırken Kruskal Wallis testi kullanıldı. Anlamlı çıkan gruplar arasında hangi farkın olduğunu belirlemek için Mann Whitney U testi kullanıldı. Sayısal değişkenlerin özetlenmesinde ortalama±standart sapma değerleri, kategorik değişkenler için ise sayı ve % değerleri verildi. Güvenirliğin test edilmesi amacıyla Cronbach's alpha katsayıları hesaplanmıştır. Tüm veriler için istatistiksel anlamlılık $p<0,05$ olarak belirlendi.

BULGULAR

Çalışmaya dahil edilen bireylerin %68,0'ı kadın, %55,5'i 18-65 yaş aralığında, %82,8'i evli ve %76,6'sı il merkezinde yaşamaktadır. Katılımcıların %35,9'unun okuma yazması bulunmamakta ve %75,8'i çalışmamaktadır. Tip 2 DM tanısı dışında kronik hastalığa sahip olanların oranı %83,6'dır. Tip 2 DM tanısı süresi 19 yıl ve üstünde olanların oranı %22,7, kullandığı ilaç sayısı 5 ve üstü olanların oranı %53,9 ve insülin kullananların oranı %15,6'dır. Geçtiğimiz yıl boyunca Tip 2 DM tanısı ile 3 veya daha fazla hastaneye yatanların oranı %22,7'dir (Tablo 1).

Bu çalışmada DFKÖ ortanca değeri 79 (min:23, max:115), DFKÖ farkındalık alt boyutu ortanca değeri 49 (min:14, max:70), DFKÖ kabul alt boyutu ortanca değeri 29 (min:9,

Tablo 1: Katılımcıların tanıtıcı özellikleri.

Özellikler, n (%)*	Sonuç (n=128)
Cinsiyet	
Kadın	87 (68,0)
Erkek	41 (32,0)
Yaş	
18-65 yaş	71 (55,5)
66 yaş ve üstü	57 (44,5)
Medeni Durum	
Evli	106 (82,8)
Bekar	22 (17,2)
Yaşadığı Yer	
Köy	22 (17,2)
İlçe	8 (6,3)
İl	98 (76,6)
Eğitim Düzeyi	
Okur yazar değil	46 (35,9)
Okur yazar	15 (11,7)
İlköğretim	59 (46,1)
Lise	4 (3,1)
Üniversite	4 (3,1)
Çalışma durumu	
Çalışıyor	7 (5,5)
Çalışmıyor	97 (75,8)
Emekli	24 (18,8)
Diyabet Tanı Süresi	
1-9 yıl	46 (35,9)
10-18 yıl	53 (41,4)
19 yıl ve üstü	29 (22,7)
Günlük Kullandığı İlaç Sayısı	
1-4	59 (46,1)
5 ve üstü	69 (53,9)
Kullanılan İlaç Tipi	
Hap/Tablet	80 (62,5)
İnsülin Enjeksiyonları	20 (15,6)
Hap/tablet ve İnsülin Enjeksiyonları	28 (21,9)
Başka Bir Kronik Hastalık Durumu	
Var	107 (83,6)
Yok	21 (16,4)
Hastaneye Yatış	
İlk kez yatış yapılan	70 (54,7)
1-2 kere	29 (22,7)
3 veya daha fazla	29 (22,7)

* Sonuç (n=128)

Tablo 2: DFKÖ ve alt boyutları ile OMÖ-K arasındaki ilişki.

		DFKÖ Toplam	Farkındalık Alt Boyutu	Kabul Alt Boyutu	OMÖ-K Toplam	Medyan (Min-Max)
DFKÖ Toplam	Spearman rho kaysayısı	1.000	0.967*	0.940*	268*	79 (23-115)
	p		0.001	0.001	0.002	
Farkındalık Alt Boyutu	Spearman rho kaysayısı	0.967*	1	0.837*	0.196*	49 (14-70)
	p	0.001		0.001	0.026	
Kabul Alt Boyutu	Spearman rho kaysayısı	0.940*	0.837*	1	0.347*	29 (9-45)
	p	0.001	0.001		0.001	
OMÖ-K Toplam	Spearman rho kaysayısı	0.268*	0.196*	0.347*	1	20 (7-35)
	p	0.001	0.02	0.001		

*Spearman Korelasyon Analizi

DFKÖ: Diyabet Farkındalık ve Kabul Ölçeği, OMÖ:OMÖ-K: Oxford Mutluluk Ölçeği- Kısa Formu

max:45) ve OMÖ-K ortanca değeri 20 (min:7, max:35) olarak bulundu (Tablo 2).

Katılımcıların DFKÖ kabul alt boyutu toplam puanı ile OMÖ-K toplam puanı arasında pozitif yönde, orta düzeyde ve istatistiksel olarak anlamlı bir ilişki bulundu (Spearman rho kaysayısı=0,347, p<0,05).

Katılımcıların DFKÖ toplam puanı ile OMÖ-K toplam puanı arasında pozitif yönde, zayıf düzeyde ve istatistiksel olarak anlamlı bir ilişki bulundu (Spearman rho kaysayısı=0,268, p<0,05).

Katılımcıların DFKÖ farkındalık alt boyutu toplam puanı ile OMÖ-K toplam puanı arasında pozitif yönde, zayıf düzeyde ve istatistiksel olarak anlamlı bir ilişki bulundu (Spearman rho kaysayısı=0,196, p<0,05).

Çalışmaya dahil edilen bireylerin cinsiyetleri, yaşları, medeni durumları, yaşadığı yer, eğitim düzeyi, çalışma durumu, diyabet tanı süresi, günlük kullandığı ilaç sayısı, kullandığı ilaç tipi ve başka bir kronik hastalık durumu ile DFKÖ toplam puanı arasında istatistiksel olarak anlamlı bir fark bulunmadı (p>0,05).

Katılımcıların daha önce hastaneye yatma durumu ile DFKÖ toplam puanı ve farkındalık alt boyutu toplam puanı arasında istatistiksel olarak anlamlı bir fark bulundu (p<0,05). Hastaneye üç veya daha fazla yatışı olanların, bir-iki kez yatışı olan ve ilk kez yatış yapılan bireylere göre DFKÖ toplam puanı ve farkındalık alt boyutu toplam puanının daha yüksek olduğu saptandı.

Çalışmaya dahil edilen bireylerin cinsiyetleri, yaşları, medeni durumları, yaşadığı yer, eğitim düzeyi, çalışma durumu, tip 2 diyabet tanı süresi, günlük kullandığı ilaç sayısı, kullandığı ilaç tipi, başka bir kronik hastalık durumu ve daha önce hastaneye yatış olması durumu ile OMÖ-K toplam puanı arasında istatistiksel olarak anlamlı bir fark bulunmadı (p>0,05).

TARTIŞMA

Çalışmada OMÖ-K toplam puanı 20,0±6,32 bulundu. Yapılan bir çalışmada OMÖ-K toplam puanı 24,27±3,68 (12), bir diğer çalışmada OMÖ-K toplam puanı 18,4±4,2 olarak bulunmuştur (16). Çalışmada, hastaların mutluluk seviyelerinin ölçek ortalama değerine (ortanca:20p) denk olduğu görülmektedir. Mutluluk durumunun birçok sosyo-ekonomik değişkenden etkilendiği bilinmektedir (17). Hastaların olaylara olumlu yaklaşmasının, pozitif düşünme eğiliminin, ekonomik bağımsızlığının ve yaşanan her şeyden mutluluk duymaya çalışmalarının mutluluk seviyelerini yükselttiği söylenebilir.

Çalışmada DFKÖ toplam puanı 71,28±24,68, farkındalık alt boyutu toplam puanı 45,09 ±15,49, kabul alt boyutu toplam puanı 26,71±9,91 olarak bulundu. Literatürde DFKÖ ile ilgili yapılmış çalışmalara rastlanmamakla birlikte, diyabet hastalarında farkındalığın incelendiği bir çalışmada hastaların yeterli farkındalığa sahip olmadığı gösterilmiş ve diyabet farkındalık puan ortalaması 27,5±5,7 olarak bulunmuştur (18). Yapılan bir çalışmada; bakım veren bireylerin diyabet hastalığındaki göz, kalp ve nörolojik semptomlarla ilgili farkındalığının yeterli düzeyde olmadığı belirlenmiştir (19). Çalışmada hastaların farkındalığının (ortanca:49p) ve kabulünün (ortanca:29p) ölçek ortalama değerinden düşük olduğu görülmektedir. Literatür; hastalık hakkında eğitim verilip farkındalık oluşturulduğunda, bireylere kan şekerini düzenleme ve diyabetle ilişkili komplikasyonları önleme konularında yardımcı olduğunu belirtmektedir (20). Hastalarda, hastalık hakkında, takip ve tedavi konusunda bilgi eksikliğinin olmasının, komplikasyonların fark edilip kontrolünü sağlamada yetersizlik yaşamalarının ayrıca çalışmanın yapıldığı popülasyon ve kültürel özelliklerin farklı oluşunun puan durumlarını etkilediği düşünülebilir.

Tablo 3: Katılımcıların tanıtıcı özellikleri ile ölçek puanları karşılaştırılması.

		DFKÖ Toplam	Farkındalık Alt Boyutu	Kabul Alt Boyutu	OMÖ-K Toplam
Özellikler		$\bar{x}\pm SS$	$\bar{x}\pm SS$	$\bar{x}\pm SS$	$\bar{x}\pm SS$
Cinsiyet	Kadın	75,37±24,30	47,21±15,29	28,16±9,78	20,45±6,23
	Erkek	64,27±24,05	40,61±15,14	23,66±9,60	19,05±6,51
		Z=-1,736 p=0,155	Z=-1,422 p=0,070	Z=-1,811 p=0,399	Z=-,843 p=0,083
Yaş	18-65 yaş	74,73±24,58	47,24±15,52	27,49±9,88	19,31±6,16
	66 yaş ve üstü	68,18±24,53	42,42±15,18	25,75±9,96	20,86±6,48
		Z=-1,422 p=0,155	Z=-1,811 p=0,070	Z=-,843 p=0,399	Z=-1,736 p=0,083
Medeni durum	Evli	71,79±24,79	45,04±15,55	26,75±10,01	20,12±6,08
	Bekar	71,91±24,92	45,36±15,56	26,55±9,65	19,41±7,53
		Z=-,051 p=0,960	Z=-,126 p=0,899	Z=-,136 p=0,892	Z=-,652 p=0,515
Yaşadığı Yer	Köy	62,14±25,29	39,27±16,60	22,86±9,61	19,09±5,77
	İlçe	71,13±34,02	47,25±21,87	23,88±12,88	20,37±6,80
	İl	74,04±23,44	46,22±14,52	27,82±9,56	20,17±6,45
		KW=4,05 p=0,132	KW=3,14 p=0,208	KW=5,45 p=0,065	KW=,506 p=0,777
Eğitim Düzeyi	Okur yazar değil	68,93±22,34	43,61±14,21	25,33±8,86	18,63±7,00
	Okur yazar	72,33±26,89	45,13±17,24	27,20±10,76	21,27±5,76
	İlköğretim	73,61±25,57	45,92±16,02	27,69±10,23	20,53±5,91
	Lise	77,75±31,78	49,75±19,19	28,00±13,32	19,75±6,75
	Üniversite	70,50±32,17	45,25±18,61	25,25±13,77	23,50±5,07
		KW=1,87 p=0,760	KW=1,42 p=0,840	KW=1,83 p=0,767	KW=4,38 p=0,357
Çalışma durumu	Çalışıyor	65,00±20,26	41,14±11,11	23,86±9,56	18,29±4,54
	Çalışmıyor	72,95±24,64	45,68±15,60	27,27±9,74	19,62±6,50
	Emekli	69,21±26,37	43,88±16,41	25,33±10,81	22,04±5,79
		KW=1,27 p=0,528	KW=1,24 p=0,537	KW=1,20 p=0,547	KW=3,11 p=0,211
Diyabet tanı süresi	1-9 yıl	68,30±24,26	43,02±14,95	25,28±10,15	19,91±6,55
	10-18 yıl	71,11±25,21	44,68±16,18	26,43±9,73	20,26±6,51
	19 yıl ve üstü	78,66±23,81	49,14±14,80	29,52±9,63	19,66±5,81
		KW=4,61 p=0,100	KW=3,58 p=0,167	KW=4,08 p=0,130	KW=,44 p=0,800
Kullandığı ilaç tipi	Hap/Tablet	68,75±25,88	43,04±16,10	25,71±10,48	20,11±6,32
	İnsülin Enjeksiyonları	78,25±20,60	49,30±12,70	28,95±8,56	18,10±5,51
	Hap/tablet ve İnsülin Enjeksiyonları	75,96±23,04	47,96±14,93	28,00±9,00	21,04±6,80
		KW=2,49 p=0,287	KW=2,91 p=0,233	KW=1,65 p=0,437	KW=2,91 p=0,233
Başka bir kronik hastalık durumu	Evet	71,80±25,73	45,02±16,18	26,79±10,25	20,00±6,44
	Hayır	71,86±18,95	15,18±11,69	26,38±8,17	20,00±5,87
		Z=-,444 p=0,657	Z=-,473 p=0,636	Z=-,377 p=0,706	Z=-,129 p=0,897
Hastaneye yatış	İlk kez yatış yapılan ^a	68,61±26,62	42,91±16,58	25,70±10,64	19,96±6,96
	1 veya 2 kez ^b	68,55±23,47	43,14±15,24	25,41±8,96	18,76±5,23
	3 veya daha fazla ^c	82,79±17,44	52,31±10,45	30,48±8,20	21,34±5,61
		KW=7,85 p=0,020*	KW=9,19 p=0,010*	KW=5,88 p=0,053	KW=3,25 p=0,196
		c>b>a**	c>b>a**		

DFKÖ: Diyabet Farkındalık ve Kabul Ölçeği, OMÖ:OMÖ-K:Oxford Mutluluk Ölçeği- Kısa Formu, $\bar{x}\pm SS$: ortalama±Standart sapma, *p<0,05, KW: Kruskal Wallis testi, Z: Mann whitney u testi, **Harfler, gruplar arası farkı belirtmektedir ve bu fark Mann Whitney U testi ile bulunmuştur.

Çalışmaya dahil edilen katılımcıların DFKÖ toplam puanı ile OMÖ-K toplam puanı arasında pozitif yönde, zayıf düzeyde; DFKÖ kabul alt boyutu toplam puanı ile OMÖ-K toplam puanı arasında pozitif yönde, orta düzeyde; DFKÖ farkındalık alt boyutu toplam puanı ile OMÖ-K toplam puanı arasında pozitif yönde, zayıf düzeyde ve istatistiksel olarak anlamlı bir ilişki bulundu. Yapılan çalışmalarda hastalık konusunda farkındalığın yüksek olmasının, bireylerde mutluluğu önemli ölçüde artırabileceği ortaya koyulmuştur (21,22). Çalışmada; bireylerin, hastalığını kabul etmeleri hastalığının farkında olma durumlarını artırmaktadır. Aynı zamanda, hastalığı kabul edip yaşayabilecekleri olumsuz durumların farkında olmalarının da mutluluk seviyelerini artırdığı görülmektedir. Hastalığın var olan ve getireceği durumlar hakkında bilgi sahibi olmanın bireyde farkındalık oluşturması hastalığını yönetme konusunda etkili olabilir (23). Tip 2 DM'li bireyler hastalıklarını tanıyıp bilgi sahibi oldukça hem hastalığı kontrol altına alma hem de komplikasyonları yönetme açısından kontrolün kendi ellerinde olduğu bilinci geliştigi için mutluluk seviyelerinin de yükseldiği düşünülebilir.

Çalışmada kullanılan ölçeklerin orijinallerinde; Cronbach's alpha katsayısı DFKÖ tamamı için 0,96; "farkındalık" alt boyutu için 0,94 ve "kabul" alt boyutu için 0,94 bulunmuş (13) ve OMÖ-K Cronbach's alpha katsayısı 0,74 bulunmuştur (15). Bu çalışmada, DFKÖ tamamı için Cronbach's alpha katsayısı 0,83; "farkındalık" alt boyutu için 0,98 ve "kabul" alt boyutu için 0,96 ve OMÖ-K Cronbach's alpha katsayısı 0,97 bulunarak güvenilir ölçekler olduğu doğrulanmıştır.

Literatürde, çalışmalara katılanların cinsiyeti ile mutluluk düzeyleri arasında istatistiksel olarak anlamlı farklılık bulunmadığı görülmektedir (12,15,24-26). Öztaş'ın çalışmasında, erkek katılımcıların OMÖ-K puanının (3,70±0,69) kadın katılımcıların OMÖ-K puanından (3,60±0,62) yüksek olmasına rağmen bu farkın anlamlı olmadığı tespit edilmiştir (26). "Rekreasyonel egzersize katılan yetişkinlerde mutluluk algısı" konulu bir çalışmada cinsiyet ve eğitim ile mutluluk düzeyleri arasında anlamlı olarak farklılaşma olmadığı belirlenmiştir (27). Çalışmadaki bu sonuç literatür ile benzerlik göstermektedir. Kadın katılımcıların OMÖ-K toplam puanı daha yüksek bulunmasına rağmen erkek katılımcılar ile arasında anlamlı bir farklılık bulunmadı. Bu durum literatürde; kadınların kendilerine has özelliklerine, beklentinin düşük olmasına, kadınların spor yaptıkça serotonin hormonunun artış göstermesine, ev içinde veya bir işte aktif bir şekilde çalışmaya hareketli olmaya bağlanabilir (28-30). Toplumda kadınların, anaç ruh bilinciyle olaylara pozitif bakma eğiliminin fazla olması, kültürel özelliklerin baskın olması da mutluluk seviyelerinin yükselmesine katkı sağlayabilir.

Çalışmada 66 yaş ve üstü grupta OMÖ-K toplam puanı (20,86±6,48) daha yüksek bulunmasına rağmen 18-65 yaş grubu ile bu grup arasında istatistiksel olarak anlamlı bir farklılık bulunmadı. Obezite ile mutluluğun araştırıldığı bir çalışmada yaş ile mutluluk arasında pozitif bir ilişki olduğu belirlenmiştir (24). Yaşla birlikte mutluluğun artış gösterdiği, kişilerin hayatlarından daha memnun oldukları ve yaşamdan doyum sağlayan kişiler oldukları yapılan çalışmalarda gösterilmiştir (31-34). Yapılan bir diğer çalışmada ise, yaşın mutluluk ile bir ilişkisi olmadığı bulunmuştur (35). Yaşla birlikte yaşam kalitesinin artırılmasıyla fiziksel sağlığı korumak kişilerin daha uzun ve daha mutlu yaşamalarını etkileyebilmektedir (30). Çalışmada, 66 yaş ve üstü olan grubun diğer gruba oranla tecrübe ve yaşamışlıkları daha fazla olabileceğinden yaşam doyumunun ve mutluluğunun daha yüksek olduğu söylenebilir.

Çalışmadaki analiz sonuçlarına göre, evli katılımcıların OMÖ-K toplam puanı (20,12±6,08) bekâr katılımcıların puanından (19,41±7,53) yüksek olmasına rağmen bu fark anlamlı bulunmadı. Yapılan çalışmalarda, katılımcıların medeni durum ile mutluluk düzeyleri arasında istatistiksel olarak anlamlı bir farklılık bulunmamıştır (12,26). Eşi ve çocukları ile veya çocukları ile birlikte kalan hastaların aile desteğinin daha yüksek olduğu görülmüştür (36). Literatürdeki araştırma sonucunun bu konu ile ilişkisi olduğu düşünülmekle beraber, kişilerin ev içerisinde destekçileri ile dayanışma, iletişim ve paylaşımlarının artmasının ayrıca buna bağlı olarak evli bireylerin yalnızlık duygularının azalmasının ve daha düzenli bir hayatının olmasının mutluluğu pozitif yönde etkilediği söylenebilir.

Çalışmada, ilçede yaşayan katılımcıların OMÖ-K toplam puanı (20,37±6,80) daha yüksek bulunmasına rağmen diğer bölgede yaşayanlar ile arasında istatistiksel olarak anlamlı bir farklılık bulunmadı. Literatürde, kişilerin yaşadıkları yer ile OMÖ-K toplam puanı arasında istatistiksel olarak anlamlı farklılık olduğu belirlenmiş ve il merkezinde yaşayanların toplam puanının daha yüksek olduğu bulunmuştur (12). Çalışmada, il ve ilçede yaşayan hastaların köyde yaşayanlara göre mutluluk düzeyleri puanlarının yüksek çıkmasının sebebi olarak; ulaşım olanaklarının, iş istihdamının ve sosyal faaliyetlerin daha ulaşılır olmasıyla ilişkili olduğu düşünülmektedir. Bu faaliyetlerin sağlayacağı madde ve manevi iyileşmenin mutluluk düzeyine olumlu etkisi olduğu söylenebilir.

Çalışmada, üniversite mezunu olan katılımcıların OMÖ-K toplam puanı (23,50±5,07) daha yüksek bulunmasına rağmen diğer eğitim düzeylerine sahip olanlar arasında istatistiksel olarak anlamlı bir farklılık bulunmadı. Bir çalışmada ortaöğretim mezunu kişilerin diğer eğitim seviyesinde olanlara göre OMÖ-K toplam puanının daha yüksek olduğu

(12), bir diğer çalışmada ise üniversite mezunu bireylerin puanının lise mezunu bireylerin puanından yüksek olduğu (26) ancak bu farkların istatistiksel olarak anlamlı bulunmadığı belirtilmiştir. Yapılan çalışmalar, katılımcıların algıladıkları refah düzeyinin artmasının, gelir durumunun yükselmesinin, ekonomik bağımsızlık yaşamının ve bilinçlenmenin mutluluk düzeylerini olumlu yönde etkilediğini belirtmiştir (37,38). Bu durumda, üniversite mezunu kişilerin iş istihdamı konusunda daha avantajlı olmaları sebebiyle mutluluk seviyelerinin doğru orantılı olduğu söylenebilir. Aynı zamanda Tip 2 DM tanılı bireylerin, eğitim durumları arttıkça okuma ve öğrenme seviyelerinde artış ile birlikte, hastalıklarını yönetme konusunda bireyselleştikleri ve daha mutlu hissettikleri düşünülebilir.

Çalışmada, hastalık süresi ve ek kronik hastalığa sahip olma durumu ile OMÖ-K toplam puanları arasında istatistiksel olarak anlamlı bir farklılık bulunmadı ($p>0,05$). Yapılan bir çalışmada benzer şekilde hastaların; hastalık süresi, ek kronik hastalığa sahip olma durumu ile OMÖ-K toplam puanları arasındaki farkın istatistiksel olarak anlamlı olmadığı saptanmıştır (12). Bu çalışmada, başka bir kronik hastalığı olanlar ($20,00\pm 6,44$) ile olmayanların ($20,00\pm 5,87$) OMÖ-K toplam puanları eşit sonuçlandığı için karşılaştırma yapılamamakla birlikte, standart sapmalarına bakıldığında tip 2 DM dışında başka bir kronik hastalığa sahip olanların OMÖ-K toplam puanları daha yüksek bulunmuştur. Bu durumun sebebinin; bireylerin tip 2 DM tedavisiyle ilgili takip ve bakımlarını üstlenmeleri ile ek bir kronik hastalık yönetiminde de kontrolü sağlayabilmeleri, komplikasyonları tanıyabilmeleri ve baş etme becerilerinin gelişmesi sonucunda daha mutlu hissetmeleri olduğu söylenebilir.

Katılımcıların yaş, cinsiyet ve tip 2 diyabet tanı süresi ile DFKÖ toplam puanı ve alt boyutları toplam puanı arasında anlamlı bir farklılık bulunmadı ($p>0,05$). Yapılan bir çalışmada, DM tanılı kadınların, artan yaşla birlikte farkında olmayan ve tedavi edilmeyen hasta grubunda azalma eğilimi gösterdiğinin bulunmasına rağmen erkeklerde farkındalık ile ilgili anlamlı bir farklılık görülmemiştir (39). Bir diğer çalışmada 36-64 yaş aralığında olan bireylerin, 65 yaş ve üzeri gruba göre daha yüksek oranda diyabeti kabul ettiği gösterilmiştir (40). Bir diğer çalışmada ise, tip 2 diyabet tanı süresi arttıkça hastalığı kabullenmenin olumsuz etkilendiği, yaş ile hastalığı kabul düzeyi arasında anlamlı bir ilişkinin saptanmadığı belirtilmektedir (41). Çalışmada, 18-64 yaş aralığında olanların daha ileri yaştakilere göre farkındalık ve kabul puanlarının daha yüksek bulunmasının; genç yaşta tanı alan bireylerin bilişsel işlevlerinin ve anlama yeteneklerinin daha iyi oluşu; aynı zamanda takip ve tedavide güncel uygulamaları takip edebilmeleri ile ilişkili olduğu düşünülmektedir. Kadınların erkeklere göre farkındalık ve

kabul puanlarının daha yüksek bulunmasının sebebi olarak; toplumumuzda kadınların erkeklere göre hasta bireylere ve çocuklarına karşı birincil bakım verici rollerinin daha fazla olması ve bunun sonucunda hastalıklarla ilgili bilgi düzeylerinin artması olduğu düşünülebilir. Tip 2 DM tanı süresi 19 yıl ve üstü olanların yeni tanı alan/daha az tanı yılı olan hastalara göre farkındalık ve kabul puanları daha yüksek bulunmasının sebebi olarak; uzun yıllar aynı hastalıkla mücadele etmenin alışkanlık oluşturduğu; ilaç takibini, kullanımını dolayısıyla tedaviye uyumu kolaylaştırdığı söylenebilir. Daha geniş örneklem grubu ile benzer çalışmaların yapılması, hastalığı farkındalık ve kabul düzeyini etkileyebilecek tanıtıcı özellikler ve hastalık ile ilgili özelliklerin belirlenmesinde yol gösterici olabilir.

Çalışmada, hastaların medeni durumu, başka bir kronik hastalık varlığı ve kullandığı ilaç tipine göre DFKÖ toplam puanı arasında anlamlı bir farklılık bulunmadı ($p>0,05$). Tip 2 diyabetli bireylerin hastalığı kabul düzeylerinin araştırıldığı bir çalışmada medeni durum, eşlik eden başka kronik hastalık varlığı, tedavi şekli ile hastalığı kabul puanları arasında anlamlı bir fark bulunmamıştır (8). Literatürde; sosyokültürel değerlerin, aile bağlarının destek ile hastalığı kabul durumunu etkilediği, karmaşık ilaçtansa tek tip ilaç kullananların kabulünün daha yüksek olduğu ve yalnız yaşayanların diyetle uyum sağlamada başarısız oldukları belirtilmiştir (36,42,43). Bu durumda, tip 2 diyabet yılı arttıkça bireyin ve ailesinin hastalığa ve yaşam tarzı değişikliklerine daha iyi uyum sağlamaları, evli bireylerin aile içinde iletişim sağlamaları ve komplikasyon takibi açısından rahat olmaları ayrıca tek bir ilaç tipi kullananların takibinin daha kolay olması sebebiyle hastalığı kabul ve farkındalık düzeylerinin yüksek olduğu söylenebilir.

Çalışmada; kişilerin yaşadıkları yer, eğitim durumu ve çalışma durumu ile DFKÖ toplam puanı arasında anlamlı bir farklılık bulunmamakla beraber; şehirde yaşayanların, lise mezunu olanların ve çalışmayanların diğer gruptakilere oranla DFKÖ toplam puanları daha yüksek bulundu. Yapılan çalışmalarda, okuryazar olmayanların ve kırsal alanda yaşayanların farkındalıklarının düşük olduğu ve istatistiksel olarak anlamlı olduğu belirlenmiştir (39,44). Tip 2 diyabetli bireylerin hastalığı kabul düzeyinin araştırıldığı bir çalışmada, diyabetli bireyin çalışma ve eğitim durumuna göre hastalığı kabul düzeyi puanı arasında anlamlı bir fark olduğu, çalışan diyabetli bireylerin çalışmayanlara göre ve lise mezunu diyabetli bireylerin hastalığı kabul düzeyinin daha iyi olduğu bulunmuştur (8). Yapılan diğer çalışmalarda ise, eğitim durumu ile hastalığı kabul arasında ilişki olmadığı belirtilmiştir (36,45,46). Kişilerin, eğitim durumunun hastalık yönetiminde etkili olduğu, şehirde yaşayanların diyabet riskinin fazla olduğu belirtilmektedir (8). Bu duru-

mun, şehirde yaşayanların daha fazla diyabetli hasta görüp tanımlarına, yerel eğitim ve bilgilendirme toplantılarına katılma fırsatı yakalamalarına ve okuryazarlığın artmasıyla kişilerde anlama ve becerilerinin artmasına bağlı olduğu söylenebilir.

Hastalık süresi 19 yıl ve üstü olanların (78,66±23,81) ve tedavide insülin enjeksiyonu kullananların DFKÖ toplam puanı (78,25±20,60) daha yüksek bulunmasına rağmen istatistiksel olarak anlamlı bir farklılık bulunmadı ($p>0,05$). Yapılan bir çalışmada, hastaların hastalığının kabulünün hastalık süresi ve tedavi tipinden etkilendiği; hastalık süresi 1-5 yıl olan ve oral antidiyabetik ilaç kullanan hastalarda daha yüksek olduğu belirlenmiştir (36). Tanı yılı ile hastalığı kabul arasında ilişki olduğunu, tanı yılı daha fazla olan kişilerin hastalığı kabul puanlarının daha düşük olduğunu bildiren çalışmalar da bulunmaktadır (36,42,47,48). Yapılan diğer çalışmalarda da benzer şekilde oral antidiyabetik kullanan hastaların hastalığı kabul düzeyinin daha yüksek olduğu tespit edilmiştir (42,47). Bu çalışmada elde edilen bulgular literatür ile paralellik göstermektedir. Beş yıldan kısa süredir tanı alanların ve karmaşık tedavi uygulananların tedaviye uyumları düşük bulunmuştur (49). Literatür sonucuna bakılarak söylenebilir ki uzun yıllardır takip ve tedavi edilen ve tek tip ilaç kullanan diyabetli hastalar kendi kendini kontrol etme ve hastalığını yönetme konusunda daha rahattır. Bu durum hastalığın kabulünü ve farkındalığını yükseltmekte aynı zamanda tedaviye uyumunu artırmaktadır.

Katılımcıların hastaneye yatış durumu ile DFKÖ kabul alt boyutu arasında anlamlı bir farklılık bulunmadı ($p>0,05$). Literatürde bu konuda çalışmaya rastlanmamakla birlikte, hastanede yatma durumu ile hastalığın kabul puanlarının incelendiği bir çalışmada da anlamlı bir farklılık bulunmamıştır (8). Ancak bu çalışmada, daha önce üç veya daha fazla hastanede yatışı olanların, ilk kez yatış yapılanlara ve daha önce bir kez yatışı olanlara göre DFKÖ toplam puanı ve farkındalık alt boyutu toplam puanının daha yüksek ve istatistiksel olarak anlamlı bir farklılık olduğu belirlenmiştir ($p<0,05$). Bu durumun, uzun süreli hastanede yatışı olanların tecrübe sahibi olmaları ile hastaneyi ve tedavi sürecini tanımlarının farkındalıklarını artırmasından kaynaklandığı söylenebilir.

Çalışmada, tip 2 DM tanılı bireylerin farkındalık, kabul ve mutluluk düzeylerinin ortalamasının üstünde olduğu belirlenmekle beraber bu değişkenler arasında pozitif yönde bir ilişki bulundu.

Hastalığının farkında olma ve hastalığını kabul etme durumları, kişilerin mutluluk düzeylerini artırmaktadır. Hastalığını ve tedavisini tanımanın bireylerde olumlu duygular

uyandırdığı, bireylerin kendi takip ve tedavisinde aktif rol almasının mutluluk duygusuna yol açtığı sonucuna varılabilir. Farkındalığı düşük olan hastalara hastalığını tanıma, tip 2 DM takip, tedavi ve komplikasyonları hakkında bilgi edinme gibi konularda destek verilmesi önerilmektedir. Farkındalığı yüksek olan hastalara ise; tip 2 DM komplikasyonlarını yönetme, acil durumlarla ilgili bilgi, eğitim ve danışmanlık alma gibi konularda destek verilebilir. Bu konuda yapılacak olan çalışmalara literatürde yer verilmesinin hastalar açısından olumlu etkisi olacağı düşünülmektedir.

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Çalışmanın yapılması için onay veren kuruma, klinikte hastaları olan hekimlere ve sağlık personellerine, çalışmaya katılan tüm hastalara teşekkür ederiz.

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Gülşen Karataş, Çiğdem Özdemir, Veri toplama: Gülşen Karataş, Çiğdem Özdemir, Veri analizi: Gülşen Karataş, Çiğdem Özdemir, Literatür taraması: Gülşen Karataş, Çiğdem Özdemir, Makalenin yazılması: Gülşen Karataş, Çiğdem Özdemir.

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"Both My Body and My Spirit are Incomplete": Care Needs and Difficulties Experienced by Patients with Amputation

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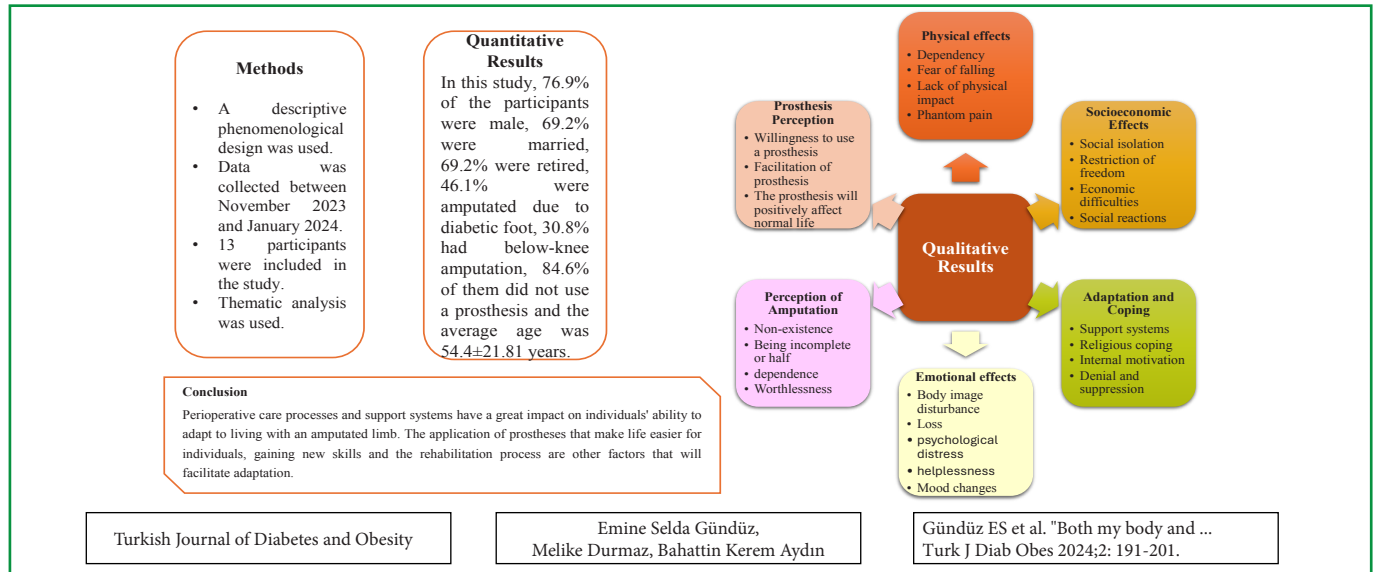
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GRAPHICAL ABSTRACT



ABSTRACT

Aim: It is frequently performed for reasons such as amputation, circulatory system problems, accidents, cancers, infections and surgical interventions due to congenital anomalies, and it affects individuals psychosocially. This research was conducted to better understand individuals' amputation experiences and care needs.

Material and Methods: Descriptive phenomenological type research, one of the qualitative research designs, was conducted with 13 participants between November 2023 and January 2024.

Results: In this study, 76.9% of the participants were male, 69.2% were married, 69.2% were retired, 46.1% were amputated due to diabetic foot, 30.8% had below-knee amputation, 84.6% of them did not use a prosthesis and the average age was 54.4±21.81years. Six themes were obtained in the thematic analysis: "Physical effects", "Socioeconomic effects", "Adaptation and coping", "Emotional effects", "Amputation perception" and "Prosthesis Perception". Most of the participants are dependent in their daily living activities. Post-amputation body image impact, emotional difficulties such as loss and helplessness, and feelings of social isolation and dependency have affected many people. Participants frequently emphasized the importance of support systems such as family and healthcare professionals. In particular, receiving support from family members played an important role in the adaptation process of individuals after amputation.

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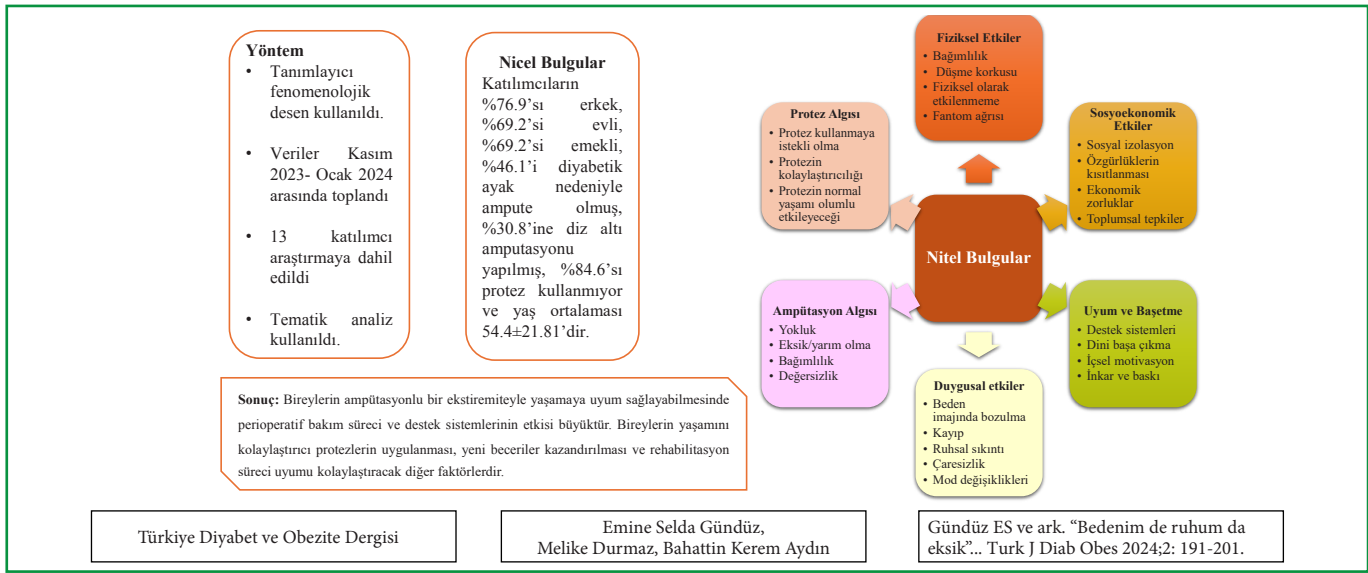
Almost all of the participants perceived amputation negatively. However, it was noted that participants using prosthesis used more positive expressions. Many of the participants talked about their desire to use a prosthesis and their hope that the prosthesis would have a positive impact on their lives.

Conclusion: Amputation is an important surgery performed due to acute or chronic health problems and affects individuals biopsychosocially. Perioperative preparation and care processes and support systems have a great impact on individuals' ability to adapt to living with an amputated limb. The application of prostheses that make life easier for individuals, gaining new skills and the rehabilitation process are other factors that will facilitate adaptation.

Keywords: Amputation, Patient experiences, Nursing care, Home care

“Bedenim de Ruhum da Eksik”: Ampütasyon Deneyimi Olan Hastaların Bakım Gereksinimleri ve Yaşadığı Güçlükler

GRAFİKSEL ÖZET



ÖZ

Amaç: Ampütasyon, dolaşım sistemi sorunları, kazalar, kanserler, enfeksiyonlar ve doğumsal anomalilere bağlı uygulanan cerrahi girişimler gibi nedenlerle sıklıkla yapılmakta ve bireyleri psikososyal olarak etkilemektedir. Bu araştırma, bireylerin amputasyon deneyimlerinin ve bakım gereksinimlerinin daha iyi anlaşılması amacıyla yapılmıştır.

Gereç ve Yöntemler: Nitel araştırma desenlerinden tanımlayıcı fenomenolojik tipteki araştırma Kasım 2023-Ocak 2024 tarihleri arasında 13 katılımcı ile yapılmıştır.

Bulgular: Katılımcıların %76,9'sı erkek, %69,2'si evli, %69,2'si emekli, %46,1'i diyabetik ayak nedeniyle ampute olmuş, %30,8'ine diz altı amputasyonu yapılmış, %84,6'sı protez kullanmıyor ve yaş ortalaması 54,4±21,81'dir. Tematik analizde “Fiziksel etkiler”, “Sosyoekonomik etkiler”, “Uyum ve baş etme”, “Duygusal etkiler”, “Ampütasyon algısı” ve “Protez Algısı” olmak üzere altı tema elde edilmiştir. Katılımcıların çoğu günlük yaşam aktivitelerinde bağımlıdır. Ampütasyon sonrası yaşanan beden imajı etkilenimi, kayıp ve çaresizlik gibi duygusal zorluklar, sosyal izolasyon ve bağımlılık duygusu birçok kişiyi etkilemiştir. Katılımcılar sıklıkla aile ve sağlık uzmanları gibi destek sistemlerinin önemini vurgulamıştır. Özellikle aile üyelerinden destek almak, bireylerin amputasyon sonrası uyum sürecinde önemli bir rol oynamıştır. Katılımcıların tamamına yakını amputasyonu olumsuz algılamıştır. Bununla birlikte protez kullanan katılımcıların daha olumlu ifadeler kullandığı dikkat çekmiştir. Katılımcıların birçoğu protez kullanma isteklerinden ve protezin yaşamlarını olumlu etkileyeceğine dair umutlarından bahsetmiştir.

Sonuç: Ampütasyon akut veya kronik sağlık sorunları nedeniyle yapılan ve bireyleri biyopsikososyal olarak etkileyen önemli bir ameliyattır. Bireylerin amputasyona bir ekstremitesiyle yaşamaya uyum sağlayabilmesinde perioperatif hazırlık ve bakım süreci ve destek sistemlerinin etkisi büyüktür. Bireylerin yaşamını kolaylaştırıcı protezlerin uygulanması, yeni beceriler kazandırılması ve rehabilitasyon süreci uyumu kolaylaştıracak diğer faktörlerdir.

Anahtar Sözcükler: Ampütasyon, Hasta deneyimleri, Hemşirelik bakımı, Evde bakım

INTRODUCTION

The increase in life expectancy and the consequent rise in the elderly population, coupled with the prevalence of uncontrollable chronic diseases and complications, have led to an increase in the rate of amputation surgeries (1). The purpose of amputation is to alleviate pain, create a stump that facilitates prosthetic use, and ensure circulation in the remaining extremity. Among the reasons for amputation are typically circulatory system problems, accidents, cancers, infections, and surgical interventions related to congenital anomalies (2).

Amputation entails various challenges, including changes in lifestyle and self-concept, diminished quality of life, impairment in physical functionality, as well as sensory effects such as phantom pain and sensation, stump pain, among others (3). Common problems encountered in individuals who have undergone amputation include bleeding, hematoma, necrosis, pain, edema, infection, phantom sensation or pain, skin issues, contractures, neuroma, psychosocial issues, immobility, difficulties adjusting to a new body image, and challenges related to prosthetic use (4).

Previous studies aiming to understand the care needs and experiences of individuals who have undergone amputation have predominantly utilized quantitative methods (2,5). A meta-synthesis study reported three main themes derived from qualitative research findings with amputee patients: the sense of being excluded from life due to amputation, the formation of a new self-identity, and the identity provided by the prosthesis (6). Another meta-synthesis identified five themes regarding the experience of being amputated and using a prosthesis: confronting amputation and prosthetic use, adapting to and coping with amputation and prosthetic use, the role of valuable relationships in recovery, amputation and prosthetic use in social interactions, and prosthetically empowered identities (7).

Nursing care for patients undergoing extremity amputation consists of preoperative, intraoperative, and postoperative care, discharge planning, and stages of reintegrating into society (8). Evidence-based guidelines have been developed in recent years to provide recommendations for the care, treatment, and rehabilitation of amputees (9). However, patients' perspectives are scarcely represented in these guidelines. Inclusion of patients' perspectives in clinical guidelines enhances the possibility of planning and implementing patient-centered treatment, care, and rehabilitation based on scientific evidence and patients' priorities (5). Therefore, this research was conducted using a phenomenological qualitative research design to better understand individuals' experiences of amputation and their care needs.

In this study, answers were sought to the questions of what the care needs and difficulties experienced by individuals who had amputation were.

MATERIAL and METHODS

Design

Phenomenological studies aim to define the shared meaning of experiences related to a phenomenon or concept (10). The purpose of this research is to investigate the care needs of individuals who have undergone amputation and to identify the difficulties they experience using a descriptive phenomenological design. The research was conducted between November 2023 and January 2024 with patients who underwent amputation surgery at the Selçuk University Faculty of Medicine Hospital Orthopedics and Traumatology clinic and were followed up in the outpatient clinic, met the inclusion criteria, and agreed to participate in the study.

Participants

While the purpose of sampling in quantitative research is to make generalizations about the universe and to fully represent the universe, in qualitative research the aim is to understand and clarify the phenomenon in depth. Since the quality of the sample, not the quantity, is important in qualitative research, it is recommended to determine samples that meet the objectives of the research and can provide detailed data, instead of large groups as in quantitative research (11). Purposeful sampling method was used in this research, and the data collection process continued until data saturation was reached, that is, until the data started to be repeated. Although sample size calculation is not recommended due to the nature of qualitative research, it is reported that in purposeful sampling it would be appropriate to have the number of participants between 5 and 25 and that it is important to reach data saturation (10). In this research, transcripts were made day by day and data saturation was checked. Since the research data began to repeat, the data collection process was stopped after the 13th patient.

When similar studies were examined, it was seen that the sample size varied between 12-20 (12-15). In addition, 43 (65.5%) of the total 66 amputations performed in the previous year in the clinic where the research was conducted were lower extremity amputations. In this regard, 13 individuals who applied to the polyclinic at the time of the study and underwent lower extremity amputation and met the acceptance criteria for the study formed the sample group.

Inclusion Criteria:

- (a) Being 18 years of age or older,
- (b) Agreeing to participate in the research,

- (c) Having undergone lower extremity amputation surgery,
- (d) Having at least 6 months elapsed since the surgery.

Exclusion Criteria:

- (a) Having cognitive impairments,
- (b) Having communication barriers.

Data Collection Instruments

Data were collected using a patient identification form and a semi-structured interview form.

Patient Identification Form: This form consisted of 6 questions aimed at determining the participants' general characteristics. It was prepared by the researchers based on the literature (5,6).

Semi-Structured Interview Form: The semi-structured interview form included 7 questions. The opinions of two expert researchers in the field were obtained for the questions, and after suggested revisions were made, the data collection process was carried out.

Data Collection Technique

Individual in-depth interviews, a qualitative data collection technique, were used in the research, and data were collected using a semi-structured interview form along with a patient identification form. After obtaining written and verbal consent from patients who agreed to participate in the interviews, individual face-to-face interviews were conducted in a private room at the outpatient clinic at a suitable date and time chosen by the patients. In-depth individual interviews were conducted by the same female researcher (PhD) and lasted between 20-45 minutes. After obtaining consent from the patients, recording and note-taking techniques were used.

Data Analysis

The researchers have received qualitative research training and have qualitative research experience. The audio recordings were transcribed verbatim by the researchers on the same day, and the participants were asked to check them when they were available. Thematic analysis was used to analyze the data (Figure 1) (16).

The identified themes were also examined and coded by two experienced experts in qualitative research besides the researchers. To assess the reliability of the obtained data, coding was performed by two experts who were unaware of the research, and consistency analysis was conducted (Kappa value 0.91 [p=0.00]). This result was interpreted as indicating a high level of internal reliability, meaning there was significant agreement among the coders (17).

Study Trustworthiness

For validity in the research, credibility and transferability methods were used. To ensure credibility; The interviews were held at a time convenient for the participants, the researcher acted meticulously not to affect the participants' feelings and thoughts, and their statements were repeated in an understandable manner during the interview and confirmed with feedback (18). For reliability, each stage of the study was explained and written in detail, and confirmability was ensured by presenting the data completely in the method section of the research (19). To ensure consistency, a Semi-Structured Interview Form was created to be used in in-depth individual interviews, and this form was used as a guide in each interview (18).

Ethical Aspect of the Research

Written permission was obtained from the Selçuk University Faculty of Nursing Non-Interventional Ethics Commit-

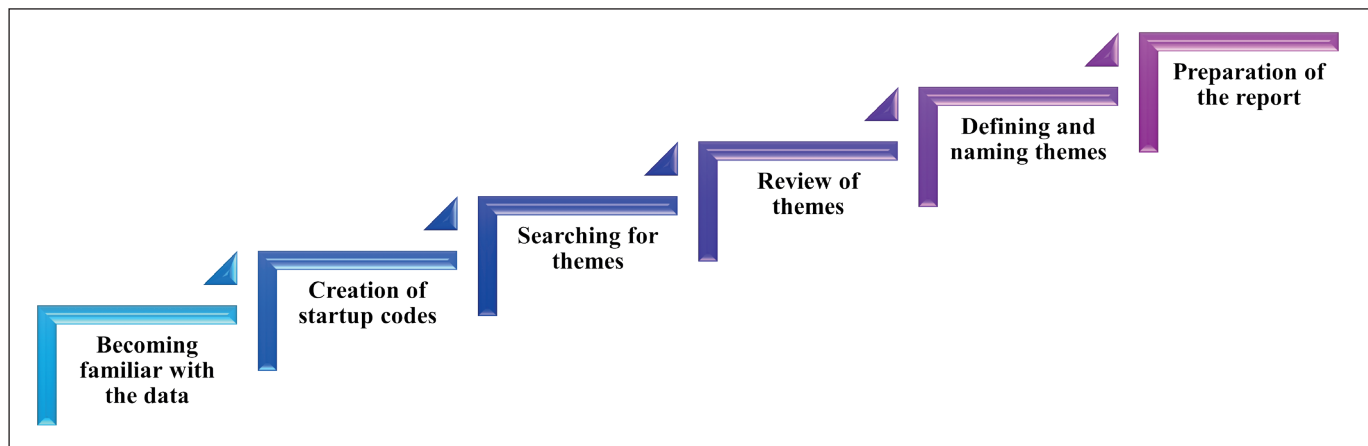


Figure 1: Braun and Clark's thematic analysis steps.

tee to conduct the research, institutional permission was obtained from the institution where the study was conducted, and written consent was obtained from the patients who agreed to participate in the study after explaining the purpose of the research. The Consolidated Criteria for Reporting Qualitative Research (COREQ) guidelines were used for reporting.

RESULTS

In this study, 76.9% of the participants were male, 69.2% were married, 69.2% were retired, 46.1% were amputated due to diabetic foot, 30.8% had below-knee amputation, 84.6% of them did not use a prosthesis and the average age was 54.4 years (Table 1).

Thematic analysis yielded six themes: “Physical effects,” “Socioeconomic effects,” “Adaptation and coping,” “Emotional effects,” “Perception of amputation,” and “Perception of prosthetics” (Table 2).

Theme 1: Physical Effects

The theme of physical effects comprised subthemes of “dependency,” “fear of falling,” “lack of physical impact,” and

“phantom pain.” The majority of participants expressed the need for assistance in almost all daily life activities, including mobility, eating, drinking, and elimination. While some participants described themselves as dependent, others referred to this condition as being needy. One participant expressed this dependency as follows: “Now let me ask you, your hands and feet are tied. What would you do if you needed to use the bathroom? Even if I want a simple drink of water, I have to ask for it... 90% of my needs are seen to by others. They carry me to the bathroom, wash me, and bring me back. I’m dependent, you see.” (P1). On the other hand, three participants stated that they were not physically affected and performed all activities independently. Two of these participants were individuals with toe amputations. The participant who reported being physically independent explained: “I do everything by myself. I drive my car, I go everywhere. I don’t have a prosthesis right now, but I haven’t been affected.” (P6).

Some participants mentioned struggling to maintain balance and having a fear of falling. Two participants reported experiencing phantom pain. One participant described this experience as follows: “I started experiencing imaginary pains, phantom pains, we started treatment but it feels strange. You know your leg is not there, but it hurts... It lasted for a month.” (P12).

Theme 2: Socioeconomic Effects

The theme of socioeconomic effects comprised subthemes of “social isolation,” “restriction of freedom,” “economic difficulties,” and “social reactions.” The prominent subtheme in the social impact of amputation was social isolation. The majority of participants reported that they could not maintain their previous social lives due to mobility limitations, felt their freedom was restricted, depended on another person to leave the house, and some participants felt imprisoned. One participant expressed their experience of social isolation as follows: “I can’t go out because I don’t have a car. I can’t go anywhere. I’m always dependent on someone. I’m stuck at home. I can’t even meet my friends. If someone takes me, I go, otherwise I can’t go.” (P2). Another participant expressed feeling their freedom was restricted, saying, “Before the surgery, I was a person who didn’t stay at home, worked for 10 hours a day. If you confine someone who used to roam around in the fields and mountains at home, think about what happens... (crying) It’s like prison, between four walls. I feel like I’m in jail.” (P1).

Theme 3: Adaptation and Coping

This theme comprised subthemes of “support systems,” “religious coping,” “internal motivation,” “denial and suppression.” Many participants explained that support systems

Table 1: Participant Demographic Information (n=13).

Variables	Findings
Age average	54.4±21.81
Gender*	
Female	3 (23.1)
Male	10 (76.9)
Marital Status*	
Single	4(30.8)
Married	9(69.2)
Occupation*	
Retired	9 (69.2)
Unemployed	2 (15.4)
Employee	1 (7.7)
Student	1 (7.7)
Reason for Amputation*	
Diabetic foot	6 (46.1)
Trauma	5 (38.5)
Infection	2 (15.4)
Amputated Limb *	
Both legs below the knee	3 (23.1)
Above the knee	2 (15.4)
Below the knee	4 (30.8)
Ankle	1 (7.7)
Foot toes	3 (23.1)
Prosthesis *	
Yes	2 (15.4)
None	11 (84.6)

*Data are shown as n(%).

Table 2: Participants' care needs and difficulties experienced after amputation (n=13).

Theme	Sub-theme*	n (%)	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12	P13
Physical Effects	Dependency	8 (61.5)	√	√	√	√	√				√	√	√		
	Fear of falling	2 (15.3)					√			√					
	Lack of physical impact	3 (23.0)						√	√						√
	Phantom pain	2 (15.3)								√				√	
Socioeconomic Effects	Social isolation	5 (38.4)		√	√					√		√	√		
	Restriction of freedom	3 (23.0)				√	√			√					
	Economic difficulties	1 (7.6)												√	
	Social reactions	1 (7.6)												√	
Adaptation and Coping	Support systems	10 (76.9)		√	√	√		√		√	√	√	√	√	√
	Religious coping	3 (23.0)		√	√					√					
	Internal motivation	3 (23.0)						√						√	√
	Denial and suppression	3 (23.0)			√		√					√			
		1 (7.6)									√				
Emotional Effects	Body image disturbance	6 (46.1)				√	√			√	√		√		√
	Loss	6 (46.1)	√		√	√	√					√	√		
	Helplessness	5 (38.4)	√	√		√			√		√				
	Psychological distress	2 (15.3)											√		√
	Mood changes	1 (7.6)				√									
Perception of Amputation	Negative perceptions	9 (69.2)	√			√	√	√		√	√	√	√		√
	Positive perceptions	1 (7.6)												√	
Perception of Prosthesis	Positive effect of the prosthesis	2 (15.3)									√			√	
	Expectations from prosthesis	2 (15.3)		√										√	
	Hope/empowerment	2 (15.3)	√	√											
	Completion	1 (7.6)								√					

* Participants gave more than one answer

such as family support and support from healthcare professionals facilitated the adaptation process. One participant expressed the support they received from family and healthcare professionals as follows: *“Healthcare professionals and my family helped me adapt. Healthcare professionals were honest with me, they always told me what would happen, and it happened as they said. I trusted them, and I adapted more easily... My family has always been there for me. I got married last week.”* (P6).

Some participants expressed the influence of spiritual and religious feelings while adapting to the amputation process. They reported praying, being grateful, and thinking of people in worse situations. One participant explained their coping mechanism: *“It didn't emotionally affect me at all. Why didn't it affect me? Because (starts crying)... they perform surgeries without anesthesia in Palestine right now, how could this (my situation) affect me. We need to be grateful for our*

situation, we have all kinds of opportunities. I accepted them with gratitude, with my belief in God (Crying)...” (P8).

During the interviews, some participants mentioned trying to maintain high levels of internal motivation and self-encouragement while coping with the amputation process. One participant described their acceptance process: *“I wasn't affected psychologically at all. I knew my leg wouldn't heal, even if it was amputated, I'd be relieved. Does anyone want their leg to be amputated, I did. I had prepared myself because I had made the decision myself. I encourage myself a lot.”* (P12).

One of the three participants who could not accept being an amputee mentioned contemplating suicide and expressed their helplessness: *“I couldn't accept it, nurse, I even thought of drinking poison, I want to die. There were times I even thought of dying, I wanted to. You're helpless, what can you do?”* (P1).

Theme 4: Emotional Effects

The theme of emotional effects of amputation comprised subthemes of “body image disturbance,” “loss,” “psychological distress,” “helplessness,” and “mood changes.”

Body image disturbance was among the prominent expressions. Participants explained that regardless of the amputated organ, their body image was affected. They described feeling discomfort with their appearance, tendencies to conceal the amputation, and feeling incomplete. One participant with toe amputation expressed their view of the amputated leg and how they felt incomplete despite their body being intact: *“It’s as if I’m afraid of my foot now. I’m cautious as if something’s going to happen, when I wear my shoes, when I walk... (seeing the amputated limb as vulnerable)... I look complete from the outside. But I feel incomplete inside. Even in a closed place at home, even when you’re with your child, you feel the need to hide your incompleteness.”* (P13). Another participant with knee-level amputation described their body perception: *“Of course, we’re not whole anymore. When you wear pants, when you wear pajamas, it feels strange to see yourself like that.”* (P8).

Amputation resulted in various losses for many participants. They described how amputation changed their familial roles, transitioning from independence to dependence, and the emotional losses caused by physical losses. A participant who became a father after amputation expressed their inability to fulfill the roles of a father and a spouse: *“Psychological support is needed for everyone; it’s a very difficult surgery. There’s a child at home, for example, my child asks me for help, and I can’t help, he cries, I can’t even go to him and take him in my arms. My activity with my wife is zero, in every way. I can’t help her in any way. I can’t be there for her. My wife ends up taking care of two children. In fact, my care is even more difficult.”* (P11).

Some participants described the feeling of helplessness caused by their physical dependency. One participant expressed their loneliness, helplessness, and desire to die: *“As if the surgery wasn’t enough, my wife passed away a month after my first surgery. I’m all alone... I’m in a terrible state (crying)... My sons and daughters-in-law take care of me. There were times I even thought of dying, I wanted to. You’re helpless, what can you do?”* (P1).

Another participant described how their psychology was affected, leading to changes in emotions and behaviors: *“This illness has really messed up my psychology. They say you’ve become like a child to me, but I want them to show interest in me too. The boy and my wife get angry with me, saying you’re expecting attention like a child. They say I’m always aggressive...”* (P4).

Theme 5: Perception of Amputation

When participants were asked to liken amputation to something, most of them mentioned their negative perceptions. Prominent themes in their expressions included non-existence, being incomplete or half, dependence, worthlessness, and being like a broken glass. One participant expressed their experience as follows: *“When I think of amputation, I think of my disabled foot and the problems it will cause from now on. Consider me a robot, not even a robot, consider me a skeleton. I mean, I’m like an inanimate thing - a creature. Motionless, I’m a living dead.”* (P1). In this statement, they explained their constraints and losses, the lack of future expectations, and the decrease in self-esteem, likening amputation to death. Another participant, who had experienced recurrent health issues before amputation and had an active role in the decision-making process, described amputation as salvation.

Theme 6: Perception of Prosthesis

Many participants did not use a prosthesis. Those who did expressed the positive effects of the prosthesis in their lives, both cosmetically and in facilitating movement. Some participants who did not use a prosthesis expressed willingness to use one, hoping it would reduce their deficiencies, facilitate their strength, and make walking easier. One participant stated: *“If I had a prosthesis, I could adapt better. It’s very difficult with crutches.”* (P11), expressing that the prosthesis would have a positive impact on their adaptation.

DISCUSSION

In this study, the care needs and difficulties experienced by individuals who underwent amputation were examined in depth. In line with the findings obtained from the interviews, the themes of physical effects, socioeconomic effects, adaptation and coping, emotional effects, amputation perception and prosthesis perception were determined.

This research reveals that the majority of participants need assistance in almost all daily living activities, especially movement, eating, drinking, bathing and excretion. Regarding their need for help, some participants define themselves as dependent, while some participants define this situation as neediness. In one study, participants reported that they needed more effort and time for personal care tasks, household chores, hobbies, and social activities after amputation (13). The result obtained from this study is consistent with other studies reporting that mobility, physical function, and daily living activities are negatively affected in individuals after amputation (20,21). Additionally, some participants mentioned that they had difficulty balancing and had a fear of falling. Similarly, in one study, participants most com-

monly reported decreased movement due to loss of balance, pain, loss of strength, and medical directives to lift or isolate the affected area (14). In another study, participants talked about the fear of falling and emphasized that this situation caused them to avoid challenging activities that they had previously enjoyed (13). In addition, movement limitation is very concerning due to the high risk of cardiovascular events and death, especially in individuals with lower extremity amputations (22), and maintaining physical activity is important for improving long-term health outcomes (23). These results reveal the importance of guiding the individual from the first mobilization to include the rehabilitation process in restructuring both movement and balance systems in order to reduce the risk of falling as well as the negative physiological effects of inactivity.

In the study, two participants stated that they experienced phantom pain. In the literature, phantom pain is associated with insomnia and poor quality of life (24). Phantom pain can occur with various physical and psychological factors and can also be exacerbated by these factors (25). It is envisaged that raising participants' awareness about phantom pain and explaining the relevant treatment-care protocols in pre-operative education can positively affect the quality of life by supporting individuals' adaptation and coping.

In this study, most participants reported that they could not maintain their former social lives due to limited mobility, their freedom was restricted, they were dependent on another person to go out of the house, and some participants reported that they felt like they were in prison. A study stated that loss of mobility also affects family and social relationships and, in some cases, causes deep isolation (14). MacKay et al. study examined social support, accessibility and socioeconomic factors, and stated that the main factors shaping individuals' life experiences are "physical limitations" and "loss of valuable activities" and "change in functional mobility" (21). Results supporting the research findings (14,21) emphasize the importance of adaptation to the use of prosthesis and rehabilitation in order to regulate the movement system and restore balance after amputation. It is also thought that it would be useful to create, use and disseminate programs to identify individuals at risk of social isolation. In addition, it is emphasized that advanced technologies and artistic activities that support interaction between individuals are very promising in reducing social isolation (26).

In this research, based on the participants' statements about adaptation and coping, the subthemes "Support systems", "Religious coping", "Internal motivation", "Inacceptance" and "Denial/Suppression" were obtained. Many of the participants in the study explained that support systems, such

as support from family and health professionals, facilitated the adaptation process. It is known that family support is of critical importance on the recovery process (14). In a qualitative study, it was reported that hopelessness and depression, body image interference, religious attitudes, family and community support were effective in shaping the general patient experience, including the biopsychosocial adaptation of individuals (15). Keeves et al. emphasized the value of peer support networks and supportive community groups during the transition to family, work and social roles before amputation (27). A study revealed that social support, especially from family and friends, was an important factor affecting the participants' journey with limb loss (21). Another study showed that lack of social support brought additional obstacles to the patient's recovery (28). According to these results, it can be said that providing family support from the pre-operative period and including the family in the care process can facilitate the adaptation of individuals as well as positively affecting intra-family processes. On the other hand, as in this research, it shows that the therapeutic approach and support of health professionals can be considered as an important part of the adaptation process.

In the study, a participant explained that meeting other individuals with amputations during the post-operative hospitalization period negatively affected him as follows; "I had a harder time in the hospital environment in the first few weeks. I am impressed. *"There were patients like me in my room at the hospital, they were always talking about their problems, but it doesn't feel good if you tell them."* (K6) There are great differences between individuals in their responses to amputation and their coping methods (29). It is very important to support individuals in setting realistic goals and adopting positive coping strategies. Taking into account physical, cognitive, psychological and socioeconomic conditions as well as social support systems before and after amputation can make positive contributions to the adaptation process.

In this study, participants' statements about the emotional effects of amputation revealed the sub-themes of body image impact, loss, psychological distress, helplessness and mood change. Participants explained the impact of the amputated organ on their body image, regardless of the region, as their body integrity was disrupted, they felt uncomfortable with their appearance, they tended to hide the amputation, and they felt incomplete. In one study, some participants who had undergone minor amputations described body image disturbances, including shame and embarrassment, related to the unique experience of limb loss (30). In the same study, it was reported that a participant who lost several toes described feeling that his foot was no longer "complete" and

tried to avoid others' comments or questions (20). This result is similar to the research of Şimsek et al. (31). It has been reported that body image changes, in addition to causing functional and social adaptation problems, are also an important predictor of quality of life and psychosocial adaptation to amputation (32). These results point out that the use of a prosthesis that will ensure body image integrity as early as possible, before body image disorder occurs, will positively affect body perception.

Physical dependency caused by amputation may cause loss of freedom, as well as increased dependence on caregivers, restructuring of family relationships, and changes in responsibilities (18). In this study, many participants explained that amputation changed their roles within the family, that they moved from independence to dependence, and about the emotional losses caused by their physical losses. One participant expressed the loss of role she experienced with the statement, *"I used to be the mother of the house, now they look after me. It is difficult, very difficult..."* (P 5). Similarly, in some studies, participants stated that there were changes in their roles within the family, that these changes could affect the lives of family members (e.g., taking on more housework) and could constitute a loss for family members (e.g., not being able to do sports or activities with their grandchildren) (21), and that their caregiving roles. They reported that they had difficulties in reversing the situation and that they felt disappointed and even powerless because they could not maintain their parenting or care roles (14). It is known that the incidence of depression, anxiety and body image disorders is high after amputation (4). It has been reported that the mental health of individuals who cannot fulfill their previous roles in the family, society and work environment may be affected due to the loss of roles experienced, and this may contribute to depression (33). In this context, it can be said that, in addition to physical adaptation, the support of health professionals with a multidisciplinary approach will play a key role in the adaptation process in ensuring the psychosocial adaptation of individuals and structuring and acquiring family and social roles.

In this study, almost all of the participants reflected negative perceptions such as being nothing, being incomplete, being in need, being useless and a broken glass. In one study, it was stated that participants described amputation as a life-changing, devastating event and emphasized the significant impact of limb loss on their emotional health and self-perception (21). In a systematic meta-analysis conducted by Behera and Dash, it was reported that amputation was defined as the feeling of exclusion from life, the embodiment of a new self-identity, and the identity made possible by the prosthesis (6). In addition to negative perceptions, a remarkable result in our research is that a participant who

had repeated health problems before amputation and took an active role in the decision-making process defined amputation as salvation and expressed that he accepted his situation, revealing his individual experiences and its positive impact on the process. It can be said that negative health experiences leading to amputation may facilitate the acceptance process. Involving individuals in the process during the preparation phase and an open and honest approach strengthens individuals' sense of trust in healthcare professionals, as well as supporting our previous findings in terms of the support of healthcare professionals in their support systems during the coping process.

The use of prosthesis is an important factor to increase the quality of life after amputation (34). In this study, participants with prostheses expressed the positive effects of the prosthesis on their lives, both cosmetically and in terms of facilitating mobility. Some of the individuals who do not use prostheses expressed their willingness to use prostheses and stated that they hoped that it would reduce the deficiencies in their lives, make them stronger and make it easier for them to walk.

In this study, the care needs and difficulties experienced by amputated patients were examined in depth. However, due to the nature of qualitative research, the data belong to a limited population and cannot be generalized. Additionally, face-to-face interviews were conducted by only one person. While this may have contributed to ensuring consistency in the interviews, it may have caused limitations in the transfer of body language into writing.

Many participants in the study stated that they had difficulty in performing daily living activities after amputation and experienced varying degrees of physical dependence. There are many individuals who have difficulty meeting their basic needs such as toileting, bathing and dressing. Emotional difficulties, social isolation and feelings of dependency after amputation have affected many people. Participants frequently emphasized the importance of support systems such as family and healthcare professionals. In particular, receiving support from family members played an important role in the adaptation process of individuals after amputation.

The psychological effects experienced after amputation varied. While some participants had difficulty in the acceptance process, others approached their situation from a positive perspective. Experiences regarding individuals' place in society and the way they are perceived became evident in the narratives of many participants. The desire to be involved despite necessarily being isolated from social life is an important issue expressed by many participants.

Almost all of the participants perceived amputation negatively. However, it was noted that participants using prosthesis used more positive expressions. Many of the participants talked about their desire to use a prosthesis and their hope that the prosthesis would have a positive impact on their lives.

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Author's Contributions

Study Design: **Emine Selda Gündüz, Melike Durmaz, Bahattin Kerem Aydın**, Data Collection: **Emine Selda Gündüz, Melike Durmaz, Bahattin Kerem Aydın**, Data Analysis: **Emine Selda Gündüz, Melike Durmaz, Bahattin Kerem Aydın**, Study supervision: **Emine Selda Gündüz, Melike Durmaz, Bahattin Kerem Aydın**, Manuscript Writing: **Emine Selda Gündüz, Melike Durmaz, Bahattin Kerem Aydın**, Critical revisions for important intellectual content: **Emine Selda Gündüz, Melike Durmaz, Bahattin Kerem Aydın**.

Conflict of Interest

The authors declare they have no conflict of interest.

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Ethical Approve

The authors state that this research has been carried out in accordance with The Code of Ethics of the World Medical Association (Declaration of Helsinki) for experiments involving humans.

Peer Review Process

Extremely and externally peer-reviewed.

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VII. ZONGULDAK ENDOKRİN *Günleri*

IV. ENDOKRİNOLOJİK HASTALIKLARA MULTİDİSİPLİNER GÜNCEL YAKLAŞIM KONGRESİ

29 - 30 Kasım 2024

ZONGULDAK BÜLENT ECEVİT ÜNİVERSİTESİ

Türkiye Diyabet ve Obezite Dergisi

Batı Karadeniz Tıp Dergisi

Yükseköğretim ve Bilim Dergisi

Değerli Bilim İnsanlarımız,

Zonguldak Endokrin Günleri kapsamında bu yıl planladığımız

“VII. Zonguldak Endokrin Günleri, Endokrinolojik Hastalıklara Multidisipliner Güncel Yaklaşım Kongresi,

IV. Klinisyenler İçin Boyun Ultrasonografisi Kursu,

III. Obezite Okulu,

III. Diabetes Mellitus Okulu,

II. Ayak Değerlendirme-Podoloji Kursu

I. Hipertansiyon ve Hiperlipidemi Kursu”

29-30 Kasım 2024 tarihlerinde Zonguldak Bülent Ecevit Üniversitesi Sezai Karakoç Kültür Merkezi’nde gerçekleşecektir.

Endokrin hastalıkların tanı, tedavisi ve takiplerinin disiplinler arası iyi bir koordinasyonla gerçekleştirilmesi kaçınılmazdır. Preklinik, klinik ve deneysel araştırmaların sonuçlarının güncel rehberler eşliğinde uygun platformlarda multidisipliner bilim insanlarıyla paylaşılmasını hedeflemekteyiz.

Zonguldak Endokrin Günleri kapsamında I., II., III., IV., V. ve VI. Zonguldak Endokrin Günleri toplantılarını gerçekleştirdik. 2024 yılında planladığımız VII. Zonguldak Endokrin Günlerini Zonguldak Bülent Ecevit Üniversitesi, Tıp Fakültesi, Türkiye Obezite Araştırmaları Derneği, ZBEÜ Obezite ve Diyabet Uygulama ve Araştırma Merkezi, Türkiye Diyabet ve Obezite Dergisi, Batı Karadeniz Tıp Dergisi, Yükseköğretim ve Bilim Dergisi, endüstrinin destekleriyle ve sizlerin de değerli katkılarıyla bir kongre formatında gerçekleşmesini sağlayacağız.

Zonguldak Bülent Ecevit Üniversitesi Tıp Fakültemiz bünyesinde neredeyse tüm anabilim dallarıyla gerçekleştirdiğimiz bilimsel faaliyetleri, hasta tanı ve tedavi sürecinde elde ettiğimiz tecrübeleri, güncel rehberler ışığında Zonguldak Endokrin Günleri oturumları içerisinde paylaşacağız. Toplantılarımızı ülkemizin değerli öğretim üyeleri - bilim adamlarının katkıları ile gerçekleştireceğiz.

Kongremizde klinisyenlerin giderek artan boyun ultrasonografisi kullanımını ihtiyacına uygun olarak rutin pratiklerinde uygun kullanımı, tiroid, paratiroid ve lenf nodlarının tanımlanması, ince iğne aspirasyon biyopsileri ile örneklem işlemlerine yönelik “Klinisyenler İçin Boyun Ultrasonografi Kursu” gerçekleştirilecektir. Ayrıca sağlık profesyonellerinin ve herkesin katılabileceği “Obezite Okulu, Diabetes Mellitus Okulu, Ayak Değerlendirme-Podoloji Kursu, Hipertansiyon ve Hiperlipidemi Kursu” planlanmıştır.

VII. Zonguldak Endokrin Günleri kapsamında tiroid, hipofiz, pankreas/nöroendokrin tümörler, paratiroid hastalıkları, obezite, diabetes mellitus ile akademik yayıncılık başlıklarından oluşan altı oturum gerçekleştirilecektir. Bu oturumlarda tanı, tedavi ve takip süresini tamamlamış olgular sunulacaktır. Oturuma katılan bilim dalları panelistlerince değerlendirilme, güncel rehberler eşliğinde bilgi aktarımı, hastalık konseyi benzeri ve karşılıklı interaktif oturumlar şeklinde gerçekleşecektir.

Kongremize sözlü ve poster bildirilerle katılım mümkündür. 30 Ekim 2024 tarihine kadar iletilecek ve değerlendirme sonrası kabul edilen Kongredeki sunumlar “Türkiye Diyabet ve Obezite Dergisi”nde yayınlanacaktır. Ayrıca bildiriler derecelendirilecek ve başarılı bulunanlara belge verilecektir. Araştırmacıları deneysel, preklinik ve klinik araştırma sonuçlarını sunmaya kongremize davet ediyoruz.

Bilim İnsanlarımızı ve meslektaşlarımızı Batı Karadeniz’in incisi, madenin ve emeğin başkenti, yeşil ve mavinin kaynaştığı noktada Zonguldak iline bekliyoruz. Zonguldak Bülent Ecevit Üniversitesi Tıp Fakültesi adına “VII. Zonguldak Endokrin Günleri, Endokrinolojik Hastalıklara Multidisipliner Güncel Yaklaşım Kongresi, IV. Klinisyenler İçin Boyun Ultrasonografisi Kursu, III. Obezite Okulu, III. Diyabet Okulu, II. Ayak Değerlendirme-Podoloji Kursu, I. Hipertansiyon ve Hiperlipidemi Kursu” muza davet etmekten ve ağırlamaktan büyük kıvanç duymaktayız.

Katılımcılar ve destek verenlerin katkıları ile verimli ve geleneksel bir bilimsel aktiviteyi başarılı bir şekilde gerçekleştirme inancındayız.

Onursal Başkan	Kongre Başkanları	Kongre Genel Sekreterleri	
Rektör Prof. Dr. İsmail Hakkı Özölçer	Prof. Dr. Taner Bayraktaroğlu Prof. Dr. Güldeniz Karadeniz Çakmak	Doç. Dr. Ömercan Topaloğlu Doç. Dr. Duygu Erdem	Doç. Dr. Emrah Keskin Dr. Öğr. Üyesi Ufuk Tali
Düzenleyenler			
Zonguldak Bülent Ecevit Üniversitesi ZBEÜ Tıp Fakültesi Türkiye Obezite Araştırmaları Derneği	ZBEÜ Obezite ve Diyabet Uygulama ve Araştırma Merkezi (OBİM EASO COM) Türkiye Diyabet ve Obezite Dergisi	Batı Karadeniz Tıp Dergisi Yükseköğretim ve Bilim Dergisi Organizasyon: D-Event	
Düzenleme Kurulu			
Prof. Dr. Hande Aydemir (Dekan)	Doç. Dr. Duygu Erdem	Dr. Öğr. Üyesi Hakan Balbaloğlu	Arş. Grv. Dr. Ünzile İşıl Yüce
Prof. Dr. Taner Bayraktaroğlu	Doç. Dr. Emrah Keskin	Dr. Öğr. Üyesi İlhan Taşdöven	Arş. Grv. Dr. Hatice Tekin
Prof. Dr. Güldeniz Karadeniz Çakmak	Doç. Dr. Rabiye Uslu Erdemir	Dr. Öğr. Üyesi Ufuk Tali	Arş. Grv. Dr. Didem Güney
Prof. Dr. Bekir Hakan Bakkal	Doç. Dr. Bengü Gülhan Köksal İncegül	Dr. Öğr. Üyesi Güray Ceylan	Arş. Grv. Dr. İpek Yorgancıoğlu
Prof. Dr. Volkan Demirhan Yumuk	Doç. Dr. Deniz Baklacı	Öğrt. Gr. Salih Erdem	Arş. Grv. Dr. Yiğit Özaydın
Prof. Dr. Mustafa Cömert	Doç. Dr. Güneş Çakmak	Uzm. Dr. Kemal Karagözoğlu	Arş. Grv. Dr. Mina Arık
Doç. Dr. Ömercan Topaloğlu	Dr. Öğr. Üyesi Burçin Acuner	Uzm. Dr. Kübra Kocatepe	Öğrenci (Dönem-6) Senanur Kucaklı
Doç. Dr. Muammer Bilici	Dr. Öğr. Üyesi Sakin Tekin	Uzm. Dr. Elif Yivli	

Teknik Destek

Öğrt. Gr. Salih Erdem	Uzm. Dr. Kübra Kocatepe	Mustafa Pür	Asiye Uzun	Nuray Kani
Uzm. Dr. Kemal Karagözoğlu	Uzm. Dr. Elif Yivli	Onur Genç	Serhat Bilge	Yusuf Kral

VII. ZONGULDAK ENDOKRİN *Günleri*

IV. ENDOKRİNOLOJİK HASTALIKLARA MULTİDİSİPLİNER GÜNCEL YAKLAŞIM KONGRESİ

29 - 30 Kasım 2024

ZONGULDAK BÜLENT ECEVİT ÜNİVERSİTESİ

Türkiye Diyabet ve Obezite Dergisi

Batı Karadeniz Tıp Dergisi

Yükseköğretim ve Bilim Dergisi

“SÖZLÜ VE POSTER BİLDİRİLERDE EN BAŞARILI BİLDİRİLER SEÇİLECEKTİR”

Zonguldak Endokrin Günleri kapsamında bu yıl yedincisini planladığımız **Endokrin Hastalıklara Multidisipliner Güncel Yaklaşım Kongresi**, 29 -30 Kasım 2024 tarihlerinde **Zonguldak Bülent Ecevit Üniversitesi Merkez Farabi Kampüsü Sezai Karakoç Kültür Merkezi**’nde gerçekleşecektir.

Kongremize (<https://zeg.beun.edu.tr/>) sözlü ve yazılı bildiri gönderimi devam etmektedir (<https://zeg.beun.edu.tr/bildiri-gonderimi/2/bildiri-ozet-kurallari.html>).

Bildiri son gönderim tarihi: 30 Ekim 2024 tarihidir.

Kongrede “Sözlü ve Poster Bildirilerde En Başarılı Bildiriler” seçilecektir.

Gönderilen bildiriler “Türkiye Diyabet ve Obezite Dergisi”nde yayınlanacaktır.

Araştırmacıların “<http://turkjod.beun.edu.tr/?journal=TURKJOD&page=index>” adresinden kayıt ve giriş sonrası, profilinizde mutlaka “yazar” rolünüzü işaretlemeniz gerekiyor. Sonrasında bildirinize ait aşağıdaki bilgileri ve metni Kongre Sekreteriyasına göndermeniz gerekmektedir.

Gönderilen bildirinin;

- Başlığı TR/ENG
- Yazarları, yazarların ORCID araştırmacı numaraları (orcid.org adresinden kayıt yaptırıp öğrenildikten sonra) (Sorumlu Yazar işaretlenmelidir)
- İletişim ve Kurum Adresleri
- Türkçe Öz, Anahtar Kelimeler
- İngilizce “Abstract”, “Keywords”
- Bildiriyi sunacak yazarın mutlaka kayıt yaptırması gerekmektedir.
- Bildiri sunum şekline (sözel sunum veya poster) değerlendirme kurulu tarafından karar verilir. Ancak bildiriyi gönderen yazarın sunum tercihini (sözel veya poster olarak) e-posta içeriğinde belirtmesi gerekmektedir.
- Bildiri özeti Türkçe olarak gönderilmelidir.
- Çalışmanın amacını, yöntemini, bulguları ve sonuçlarını içermelidir. Bu başlıklar özet içinde koyu (bold) olarak yazılmalıdır (Bildiri örnekleri ektedir).
- Bildiri özeti 350 kelime ile sınırlandırılmıştır.
- Bildiri özeti göndermekte kullanacağınız yazı karakteri Times New Roman ve 12 Punto olmalıdır.
- Bir adet resim ve bir adet tablo
- Standart kısaltmalar kabul edilir. Özel kısaltma varsa, ilk kullanıldığı yerde ardından bir parantez açarak kısaltmanın tam açılımı yazılmalıdır.
- Bildiri özetleri yazarların ve sunumu yapacak kişinin ad, soyadı ve kurumlarını içermelidir.
- Kongre kayıtları tek isme yapıldığından, bildiri özetinde yer alan diğer isimleri kapsamamaktadır.

Bildiri Son Gönderim Tarihi: 30 Ekim 2024

Bildiri Gönderim Adresi: drhomercan@hotmail.com Doç. Dr. Ömercan TOPALOĞLU (Kongre Genel Sekreteri)

Bildiri özetlerinin kabul edilip edilmediği ile ilgili bilgilendirme e-posta ile yapılacaktır. Meslektaşlarımızı Batı Karadeniz’in incisi, taşkömürü madeninin ve emeğin başkenti, yeşil ve mavinin kaynaştığı noktada Zonguldak’ta, Zonguldak Bülent Ecevit Üniversitesi olarak ağırlamak adına “VII. Zonguldak Endokrin Günleri Endokrinolojik Hastalıklara Multidisipliner Güncel Yaklaşım Kongresi”ne davet etmekten büyük kıvanç duymaktayız.

Katkı ve katılımınız ile verimli ve geleneksel bir bilimsel aktiviteyi gerçekleştirmiş olacağız.

Düzenleme Kurulu

VII. ZONGULDAK ENDOKRİN *Günleri*

IV. ENDOKRİNOLOJİK HASTALIKLARA MULTİDİSİPLİNER GÜNCEL YAKLAŞIM KONGRESİ

29 - 30 Kasım 2024

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VII. ZONGULDAK ENDOKRİN GÜNLERİ

IV. ENDOKRİNOLOJİK HASTALIKLARA MULTİDİSİPLİNER GÜNCEL YAKLAŞIM KONGRESİ, 29 -30 Kasım 2024

BİLİMSEL PROGRAM

29 Kasım 2024, Cuma

Sezai Karakoç Kültür Merkezi Merkez Farabi Kampüsü

10.00 - 13.00 Kayıt

13.00 - 13.15 Açılış ZEG 1/2/3/4/5/6/7

Güldeniz KARADENİZ ÇAKMAK, Taner BAYRAKTAROĞLU

13.15 - 14.00 Açılış

Oturum Başkanı: Hande AYDEMİR, Emrah KESKİN

Savaş CEYLAN

Büyüme Hormonu Yüksekliğinde Tedavi Yaklaşımları ve Cerrahi Tedavi Sonuçları

14.00 - 15.00 Tiroid Oturumu

Oturum Başkanları: Günay GÜRLEYİK, Taner BAYRAKTAROĞLU

Olgu Sunumu: Kemal KARAGÖZOĞLU

Panelistler:

Sakin TEKİN (Endokrinoloji ve Metabolizma Hastalıkları)

Ufuk TALİ (Genel Cerrahi)

Hakan BALBALOĞLU (Genel Cerrahi)

Duygu ERDEM (KBB)

Duygu BAYIR GARBİOĞLU (Tıbbi Onkoloji)

Özcan PİŞKİN (Anesteziyoloji ve Reanimasyon)

Rabia USLU ERDEMİR (Nükleer Tıp)

Bilgin Kadri ARIBAŞ (Radyoloji)

Figen BARUT (Patoloji)

Özlem ELMAS (Radyasyon Onkolojisi)

15.00 - 15.20 Kahve Molası

16.00 - 17.00 Hipofiz Oturumu Akromegali Olgusu ve Güncel Yaklaşım

Oturum Başkanları: Savaş CEYLAN, Berrin ÇETİNARSLAN ARSLAN

Olgu Sunumu: Kübra KOCATEPE

Panelistler:

Ömercan TOPALOĞLU (Endokrinoloji ve Metabolizma Hastalıkları)

Emrah KESKİN (Nöroşirurji)

Deniz BAKLACI (KBB)

Banu ALICIOĞLU (Radyoloji)

Bekir Hakan BAKKAL (Radyasyon Onkolojisi)

Banu DOĞAN GÜN (Patoloji)

17.00 - 18.00 Sözlü Sunumlar

Oturum Başkanları: Muammer BİLİCİ, Birsen SAHİP YESİRALIOĞLU

18.00 - 18.30 Akılcı İlaç Sunumu

Oturum Başkanları: Güray CEYLAN, Dilek AYVAZ MALKOÇ

Konuşmacılar: Elif YİVLİ

Diabetes Mellitus Tedavisinde Güncel ve Kanıta Dayalı Medikal Tedavi

30 Kasım 2024, Cumartesi

Sezai Karakoç Kültür Merkezi Merkez Farabi Kampüsü

08.30 - 09.00 Sözlü Sunumlar

Oturum Başkanları: Sakin TEKİN, Müzeyyen AK

09.00 - 10.15 Paratiroid Hastalıkları

Oturum Başkanları: Nurdan GÜL, Emin GÜRLEYİK

Olgu Sunumu: Kübra KOCATEPE

Panelistler:

Ömercan TOPALOĞLU (Endokrinoloji ve Metabolizma Hastalıkları)

Ufuk TALİ (Genel Cerrahi)

Rabia USLU ERDEMİR (Nükleer Tıp)

Banu ALICIOĞLU (Radyoloji)

Burak BAHADIR (Patoloji)

10.15 - 10.30 Kahve Molası

10.30 - 12.00 Nöroendokrin Tümörler

Oturum Başkanları: N. Zafer CANTÜRK, ZEYNEP CANTÜRK

Olgu Sunumu: ELİF YİVLİ

Panelistler:

Sakin TEKİN (Endokrinoloji ve Metabolizma Hastalıkları)

Mustafa CÖMERT (Genel Cerrahi)

Duygu Bayır GARBİOĞLU (Onkoloji)

Selim AYDEMİR (Gastroenteroloji)

Bilgin Kadri ARIBAŞ (Radyoloji)

Rabia USLU ERDEMİR (Nükleer Tıp)

Bekir Hakan BAKKAL (Radyasyon Onkolojisi)

Bengü Gülhan KÖKSAL İNCEGÜL (Anesteziyoloji ve Reanimasyon)

Figen BARUT (Tıbbi Patoloji)

12.00 - 12.30 Uydu Sempozyumu

12.30 - 13.45 Öğle Yemeği

13.45 - 15.00 Obezite

Oturum Başkanları: Ayşe Kubat ÜZÜM, Mustafa CÖMERT

13.45-14.00 Obezite Epidemiyolojisi, Tanı ve Tedavisinde Güncel Durum

Volkan Demirhan YUMUK

14.00-15.00 Olgu Sunumu: Kemal KARAGÖZOĞLU

Panelistler:

Taner BAYRAKTAROĞLU (Endokrinoloji ve Metabolizma Hastalıkları)

Sertaç Ata GÜLER (Genel Cerrahi)

Vildan ÇAKIR KARDEŞ (Psikiyatri)

Funda KASAPOĞLU (Diyetisyen)

Selda SARIKAYA (FTR)

VII. ZONGULDAK ENDOKRİN *Günleri*

IV. ENDOKRİNOLOJİK HASTALIKLARA MULTİDİSİPLİNER GÜNCEL YAKLAŞIM KONGRESİ

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Batı Karadeniz Tıp Dergisi

Yükseköğretim ve Bilim Dergisi

Mustafa OZAN ÇAKIR (Kardiyoloji)
Ayşegül TOMRUK ERDEM (Göğüs Hastalıkları)
Gökçe KAAAN ATAÇ (Radyoloji)
Merve Sena BAYTAR (Anesteziyoloji ve Reanimasyon)
İlhan TAŞDÖVEN (Genel Cerrahi)
15.00 - 15.15 Kahve Arası
15.15 - 16.30 Diabetes Mellitus
Oturum Başkanları: Taner BAYRAKTAROĞLU, Ahmet AVCI
Olgu Sunumu: Elif YİVLİ
Ömercan TOPALOĞLU (Endokrinoloji ve Metabolizma Hastalıkları)
Atilla ALPAY (Göz Hastalıkları), Naile ERİŞ GÜDÜL (Kardiyoloji)
Esra ACIMAN DEMİREL (Nöroloji)

16.30 - 17.00 Akademik Yayıncılık Paneli
**Oturum Başkanları: Güldeniz KARADENİZ ÇAKMAK,
Hale SAYAN ÖZAÇMAK**
Panelistler
Zehra SAFİ ÖZ
Taner BAYRAKTAROĞLU
Türkiye Diyabet ve Obezite Dergisi,
Batı Karadeniz Tıp Dergisi,
Yükseköğretim ve Bilim Dergisi,
Frontiers in Endocrinology-Frontiers in Diabetes
17.00 - 17.30 Kapanış Töreni

III. OBEZİTE OKULU

25 Kasım 2024 Pazartesi 13.00-15.30
ZBEÜ Obezite ve Diyabet Uygulama ve Araştırma Merkezi 2. Kat
Toplantı Salonu
Oturum Başkanları: Taner BAYRAKTAROĞLU, Selda SARIKAYA
13.00- 13.30 Taner BAYRAKTAROĞLU
Obezite Tanısı Sıklığı, Nedenleri, Kliniği
13.30-14.00 Funda KASAPOĞLU, Ahu DARICI

Obezitede Besin Grupları, Popüler Diyetler ve Tıbbi Beslenme Tedavisi
14.00-14.10 Ara: Bağlama Dinletisi, Ömer ÇİÇEKDAĞ
14.10-14.40 Tuğçe KÖKSAL
Obezitede Egzersiz ve Fiziksel Aktivite Tedavisi
14.40-15.10 Sakin TEKİN, İlhan TAŞDÖVEN, Ufuk TALİ
Obezitede Medikal ve Cerrahi Tedavi (Teknikler), Uzun Dönem
Sonuçları
15.10-15.30 Soru-Cevap ve Bitiş

III. DIABETES MELLITUS OKULU

26 Kasım 2024 Salı
Oturum Başkanları: Taner BAYRAKTAROĞLU
13.00- 13.30 Taner BAYRAKTAROĞLU
Diabetes Mellitus Tanısı, Sıklığı, Tipleri ve Nedenleri
Ömercan TOPALOĞLU
Diabetes Mellitus Kliniği
Sakin TEKİN

Takip ve tedavisi
13.30-14.00 Gizem TATAROĞLU
Diyabette Besinlerin Glisemik İndeksi, Karbonhidrat Sayımı ve Tıbbi
Beslenme Tedavisi
14.00-14.10 Ara
14.10-14.40 Safiye ÇATALÇAM, Ebru Boz UZALDI
Diyabetle Yaşam ve Bilinmesi gerekenler
14.40-15.00 Soru-Cevap ve Bitiş

II. PODOLOJİ/AYAK SAĞLIĞI KURSU

27 Kasım 2024 Çarşamba
Tarih ve Saat: 20 Kasım 2024 Çarşamba 13.00-14.30
ZBEÜ Obezite ve Diyabet Uygulama ve Araştırma Merkezi 2. Kat
Toplantı Salonu
13.00 -14.30 Oturum Başkanları: Taner BAYRAKTAROĞLU,
Tuğçe KÖKSAL
13.30-13.45 Tuba ESER
**Diyabetik Ayak Fizyopatolojisi, Diyabetik Ayağı Engellemek, Riski
Azaltma Yöntemleri**

13.45-14.00 Banu KURBAN
Diyabetik Hastada Ayak Değerlendirmesi
14.00-14.20 Tuba ESER, Ömer ÇİÇEKDAĞ, Seval SARUHAN ALDOĞAN
**Podoloji Polikliniği Vaka örnekleri (Batık tırnak, tırnak teli, nasır,
hipertrofik tırnak, tabanlık)**
14.20-14.30 Tartışma ve Kapanış

VII. ZONGULDAK ENDOKRİN *Günleri*

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I. HİPERTANSİYON VE HİPERLİPİDEMİ KURSU

Tarih ve Saat: 28 Kasım 2024 Perşembe 13.00-15.30

Yer: ZBEÜ Obezite ve Diyabet Uygulama ve Araştırma Merkezi 2.Kat Toplantı Salonu

Oturum Başkanları: Taner BAYRAKTAROĞLU, Ahmet AVCI

13.00- 13.30 Ömercan Topaloğlu

Hipertansiyon Tanısı ve Kliniği

13.30-14.00 Mustafa Ozan ÇAKIR, Sakin TEKİN

Olgularla Hipertansiyon Tedavisi ve Takibi

14.00-14.10 Ara

14.10-14.40 Kemal KARAGÖZOĞLU

Hiperlipidemi Tanısı ve Klinik Yaklaşım

14.40-15.10 Naile Eriş GÜDÜL, Kübra KOCATEPE

Hipertansiyon Hastasına Endokrinolojik ve Kardiyolojik Yaklaşım, Tedavi ve Takip

15.10-15.30 Soru-Cevap ve Bitiş

IV. ZONGULDAK KLİNİSYENLER İÇİN BOYUN ULTRASONOGRAFİ KURSU

29 Kasım 2024 Cuma Sabah

Zonguldak Bülent Ecevit Üniversitesi Tıp Fakültesi, İç Hastalıkları, Endokrinoloji ve Metabolizma Hastalıkları Bilim Dalı/ Genel Cerrahi Anabilim Dalı

Kurs Düzenleme Kurulu

Prof. Dr. Taner BAYRAKTAROĞLU,

Prof. Dr. Güldeniz KARADENİZ ÇAKMAK

Doç. Dr. Ömercan TOPALOĞLU

Dr. Öğrt. Üyesi Sakin TEKİN

Dr. Öğrt. Üyesi Hakan BALBALOĞLU

Dr. Öğrt. Üyesi İlhan TAŞDÖVEN

Dr. Öğrt. Üyesi Ufuk TALİ

Sağlık Uygulama ve Araştırma Merkezi, Obezite ve Diyabet Uygulama Merkezi, Genel Cerrahi ve Endokrinoloji ve Metabolizma Hastalıkları

ZBEÜ İbni Sina Sağlık Kampüsü, Esenköy, Zonguldak

1. Oturum

Başkanlar: Taner BAYRAKTAROĞLU,

Güldeniz Karadeniz ÇAKMAK

09.00 - 10.15

Öndeğerlendirme, Tiroid, Paratiroid Ultrasonografisi Raporlaması
İlhan TAŞDÖVEN

Görüntüleme Eşliğinde Biyopsi Endikasyonları

Sakin TEKİN

Tiroglobulin, Kalsitonin ve Parathormon Örneklemesi Endikasyonları

Ömercan TOPALOĞLU

10.15-10.30 Ara

2. Oturum

Başkanlar: Taner BAYRAKTAROĞLU

Güldeniz Karadeniz ÇAKMAK

Ömercan TOPALOĞLU

Sakin TEKİN

10.30 - 12.00 Klinikte Tiroid ve Paratiroidsonografileri, Görüntüleme Eşliğinde Biyopsi Uygulamaları

Olgu 1: Tiroid

Endokrinoloji ve Metabolizma Hastalıkları Bilim Dalı, Tiroid US ve Biyopsi Laboratuvarı

Taner BAYRAKTAROĞLU, Ömercan TOPALOĞLU, Sakin TEKİN

Genel Cerrahi Anabilim Dalı, Endokrin Cerrahi Polikliniği, Ultrasonografi Birimi

Güldeniz KARADENİZ ÇAKMAK, Hakan BALBALOĞLU, İlhan TAŞDÖVEN

Olgu 2: Paratiroid adenomu

Endokrinoloji ve Metabolizma Hastalıkları Bilim Dalı, Tiroid US ve Biyopsi Laboratuvarı

Taner BAYRAKTAROĞLU, Ömercan TOPALOĞLU, Sakin TEKİN

Genel Cerrahi Anabilim Dalı, Endokrin Cerrahi Polikliniği, Ultrasonografi Birimi

Güldeniz KARADENİZ ÇAKMAK, Hakan BALBALOĞLU, İlhan TAŞDÖVEN

Olgu 3: Görüntüleme Eşliğinde Biyopsi ve Örneklemesi İşlemleri

Endokrinoloji ve Metabolizma Hastalıkları Bilim Dalı, Tiroid US ve Biyopsi Laboratuvarı

Taner BAYRAKTAROĞLU, Ömercan TOPALOĞLU, Sakin TEKİN

Genel Cerrahi Anabilim Dalı, Endokrin Cerrahi Polikliniği, Ultrasonografi Birimi

Güldeniz KARADENİZ ÇAKMAK, Hakan BALBALOĞLU, İlhan TAŞDÖVEN

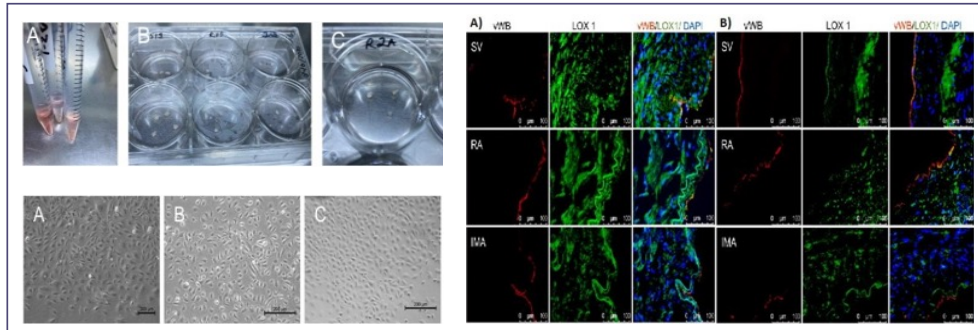
12.00-12.30 Değerlendirme ve Bitiş



Cilt/Volume 8
Sayı / Number 2
Ağustos / August
2024

Medical Journal of Western Black Sea

Batı Karadeniz Tıp Dergisi



Unraveling the Mystery: How High Density Lipoprotein 'Good' Cholesterol Goes 'Bad'?

- Current Status and New Treatment Approaches in Idiopathic Pulmonary Fibrosis
- Histological Scoring Systems for the Assessment of the Degree of Lung Injury in Rats
- The Relationship Between Platelet Indices, Hormonal Status, and Insulin Resistance in Adolescents with Polycystic Ovary Syndrome: A Retrospective Case-Control Study
- Evaluation of Effects of Inhaled Corticosteroid (Budesonide) on Cystatin C, Angiotensin Converting Enzyme, α -1-Antitrypsin, Interleukin-8 and Clinical Status in Mild to Moderate Persistent Asthmatic Children
- Evaluation of the Risk of Malignant Arrhythmia Through Electrocardiography Parameters in Patients with Urinary Stone Disease
- A Novel Index for Survival in Acute Heart Failure: Diuretic Efficiency Score
- Retrospective Investigation of Alcohol Intoxications Followed in Intensive Care Unit
- Surgical Outcomes of Adrenal Mass Management: A Retrospective Analysis
- Manual Dexterity, Balance, and Trunk Control in Patients with Alzheimer's Disease: A Cross-Sectional Study
- Radioprotective Effects of Annona Muricata Leaf Extract in the Spinal Cord
- Unraveling the Mystery: How High Density Lipoprotein 'Good' Cholesterol Goes 'Bad'?
- Psychiatric Evaluation of Forensic Cases in the Context of Criminal Law; Sociodemographic Characteristics, Clinical Diagnoses, and Crime Relations: A Retrospective Study
- Amyand's Hernia: A Case Report
- Adult Tracheobronchomalacia that Progressed Following Radiotherapy in an Advanced-stage Lung Cancer Patient: A Rare Case Report
- Editor's Letter to the Article "Our Clinical Experience in Patients with Appendiceal Mucinous Neoplasia"



<https://dergipark.org.tr/tr/pub/mjwbs>
<https://dergipark.org.tr/en/pub/mjwbs>

Özgün Araştırma / Original Research

Association of Insulin Resistance and Ectopic Fat Accumulation with HOMA Indices: A Single-Centre Observational Study
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