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SOBİAD

OTJHS
Online Turkish Journal of Health Sciences

e-ISSN: 2459-1467

OTSBD
Online Türk Sağlık Bilimleri Dergisi

Online Turkish Journal of Health Sciences 2025;10(1):1-7 *Online Türk Sağlık Bilimleri Dergisi 2025;10(1):1-7*

Evaluation of Moral Courage in Nurses According to Individual Characteristics

Hemşirelerde Ahlaki Cesaretin Bireysel Özelliklerine Göre Değerlendirilmesi

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ABSTRACT

Objective: The study aimed to evaluate the moral courage of the nurses according to their socio-demographic characteristics.

Materials and Methods: This study was cross-sectional and descriptive. A total of 214 volunteer nurses working in a private hospital were included in this study. 'Individual Characteristics Form' and 'Nurses' Moral Courage Scale' are the data collection tools of this study.

Results: The median value of the participants' "Moral Courage Scale in Nurses" was 86.0.

In the study, statistical significance was found between the mean ranks of moral courage and nurses' level of education, years of experience in the profession, whether they worked as a clinical or manager nurse, the department they worked in, and whether they received ethics training ($p<0.05$).

Conclusions: In this study, it was determined that nurses were moderately morally courageous. The fact that moral courage was found to be at a higher level among nurses who had been working for less than a year showed that nurses who were new to the profession possessed a heightened awareness of moral courage. It is thought that it would be useful to evaluate moral courage in nurses and student nurses through prospective and qualitative studies in future studies.

Keywords: Ethics, moral courage, nurses

ÖZ

Amaç: Araştırmanın amacı hemşirelerin sosyodemografik özelliklerine göre ahlaki cesaretini değerlendirmektir.

Materyal ve Metot: Bu çalışma kesitsel ve tanımlayıcı niteliktedir. Çalışmaya özel bir hastanede görev yapan toplam 214 gönüllü hemşire dahil edilmiştir. 'Bireysel Özellikler Formu' ve 'Hemşirelerde Ahlaki Cesaret Ölçeği' bu çalışmanın veri toplama araçlarıdır.

Bulgular: Araştırmada "Hemşirelerde Ahlaki Cesaret Ölçeği" median değerinin 86.0 olduğu belirlendi. Hemşirelerin eğitim düzeyi, meslekte çalışma yılı, servis ya da yönetici hemşire olarak çalışma durumu, çalıştıkları klinik türü ve etik-ahlak konularında eğitim alma durumu ile ahlaki cesaret sıra ortalamaları arasında istatistiksel açıdan anlamlı farklılık olduğu belirlendi ($p<0,05$).

Sonuç: Bu çalışmadan elde edilen veriler doğrultusunda hemşirelerin orta düzeyde ahlaki açıdan cesaretli olduğu belirlendi. Özellikle bir yıl altında çalışan hemşirelerde ahlaki cesaretin daha yüksek düzeyde saptanmış olması mesleğe yeni başlayan hemşirelerin bu kavramın farkında olduklarını ortaya koydu. Bu sonuç hasta bakım kalitesi, hasta savunuculuğu ve hemşirelik mesleği açısından sevindiricidir. Gelecek çalışmalarda hemşirelerde ve öğrenci hemşirelerde ahlaki cesaretin prospektif ve kalitatif çalışmalar ile değerlendirilmesinin yararlı olacağı düşünülmektedir.

Anahtar Kelimeler: Etik, ahlaki cesaret, hemşireler

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Yayın Bilgisi / Article Info:
Gönderi Tarihi/ Received: 26/05/2024
Kabul Tarihi/ Accepted: 06/11/2024
Online Yayın Tarihi/ Published: 17/03/2025

Atıf / Cited: Tanrıkulu F and et al. Evaluation of Moral Courage in Nurses According to Individual Characteristics. *Online Türk Sağlık Bilimleri Dergisi* 2025;10(1):1-7. doi: 10.26453/otjhs.1490234

INTRODUCTION

Morality, which is an indispensable part of human life, constitutes the whole of certain attitudes and behaviours shown under certain conditions. As complex beings influenced by biology, psychology, society, and culture, humans gain certain values and attitudes about what is right and wrong by continuing their moral development within their conditions.[1] In professions that deal with human beings, it is important for individuals to have knowledge about ethics and morality and to adopt their fundamental principles in their professional practices.[2,3]

Nurses provide continuous care to healthy and ill individuals and frequently face situations requiring moral judgment in their professional practice. In overcoming this process, nurses are guided by legal and ethical regulations such as ethical theories, professional ethical codes and patient rights guides. [2-4] Currently, it is very important for nurses to show moral courage when faced with moral dilemmas so that they can actively participate in the decision-making process.[5]

When nurses are faced with ethical and moral problems, their ability to decide and implement what is professionally right depends on their moral courage. [3,7,8] Nurses who adopt morally courageous behaviours may occasionally experience harsh reactions from colleagues or managers, be exposed to psychological and/or physical violence, and face the risk of losing their jobs.[4] Studies have shown that many nurses encounter threats to their own and their patients' well-being in terms of moral courage but are reluctant to talk about these risks and fail to take action.[3-5,9]

For nurses, having moral courage is essential to delivering quality care and effectively fulfilling their roles as patient advocates.[10] The failure of a nurse to demonstrate moral courage leads to indifference to ethical principles, reluctance to provide care, and failure to defend the rights of patients over time. On the contrary, it has been reported that moral courage positively affects moral sensitivity, improves communication within the medical team, and increases the quality of life, quality of care of patients and patient safety.[11-18] When we analyse the literature, it is seen that the concept of moral courage, which is closely related to moral sensitivity and moral distress, has not been a common topic of research in Türkiye.[19,20]

Therefore, the study aimed to evaluate the moral courage of nurses according to their sociodemographic characteristics.

MATERIALS AND METHODS

Ethics Committee Approval: The study was approved by the Non-Interventional Clinical Research Ethics Committee from Istanbul Medipol University. (Date: 26/07/2022, decision no: 648). The necessary permissions for the measurement instruments to be used in the study were obtained from the authors by email. The study was conducted in accordance with the Declaration of Helsinki.

Sample and Study Design: This study was cross-sectional and descriptive. The population of the study consisted of 450 nurses working in a private hospital in Istanbul. The sample of the study was determined as 208 with a 95% confidence interval and 5% margin of error, calculated by the sampling method with a known population. All 208 nurses were the minimum sample number to be included in the study. The data collection process was completed between August 1 and October 10, 2022, with 214 nurses who volunteered to participate in the study.

Data Collection Tools: 'Individual Characteristics Form' and 'Nurses' Moral Courage Scale' were used to collect data.

Individual Characteristics Form: The form was developed as a result of the literature review of the researchers.[7,11,14] The form includes questions affecting moral courage as well as the sociodemographic characteristics of nurses. There are a total of eight questions in this form.

Nurses' Moral Courage Scale (NMCS): The scale was developed by Numminen et al. to determine the level of moral courage of nurses; it was adapted into Turkish by Ayaz and Akkuş, and its validity and reliability were established.[21,22] It has 21 items and 4 sub-dimensions. These dimensions are compassion and true presence, moral responsibility, moral integrity, and commitment to good care. The scale has five options. Scores between 21 and 105 points are obtained from the scale. As the scale score increases, the nurses' moral courage increases positively. The Cronbach's alpha was reported to be 0.93. In our study, Cronbach's alpha value was 0.91.

Data Collection: The data were collected by sending the online forms prepared by the researchers to the nurses via social media tools between August and October 2022. On the first page of the online form, the purpose of the study for informed consent, the method and how the confidentiality of the data will be ensured are stated. In this form, nurses were asked whether they were willing to participate in the study. Those who gave consent to participate in this study proceeded to the stage with the research questions, while the study was terminated for those who did not give consent.

Statistical Analysis: The IBM SPSS 25 program was used for data analysis. The data were analysed by Kolmogorov-Smirnov test to determine whether the data were normally distributed. Since the data did

not show normal distribution, nonparametric tests were used. Mann-Whitney U test was used in cases with two variables, and Kruskal-Wallis H test analysis was used in cases with more than two variables. The statistical significance level of 0.05 was accepted.

RESULTS

The sociodemographic data of the nurses participating in the study are given in Table 1. It was determined that 52.8% of the nurses participating in the study were in the 21-27 age group, 74.8% were female, 63.1% were single, and 80.8% had a bachelor's degree. It was found that 54.2% of the nurses had worked as nurses for 1-5 years, the majority (91.6%) worked as clinical nurses, 56.5% worked in internal clinics, and 89.3% had previously received training on ethics and morality (Table 1).

When the median values of the NMCS and all sub-dimensions of the nurses were examined, NMCS was 86.0, compassion and true presence was 20.0, moral integrity was 30.0, moral responsibility was 16.0 and commitment to good care was observed to be 21.0. (Table 2).

Within the scope of the study, the mean ranks of the NMCS and its sub-dimensions were compared according to the sociodemographic characteristics of the nurses. Accordingly, it was discovered that the difference between the mean ranks of compassion and true presence, moral responsibility, commitment to good care and NMCS total score according to the educational level of the nurses was statistically significant; nurses with master's and doctoral degrees had higher levels of moral courage ($p<0.05$). The difference between the mean ranks of the total scores of the NMCS and all sub-dimensions according to years working in the profession was statistically significant; it was determined that nurses who worked for one year or less had higher levels of moral courage ($p<0.05$). It was found that the moral courage levels of nurses working as nurse managers were higher than other nurses; there was a statistically significant difference between the mean ranks of the total scores of NMCS, compassion and true presence and moral responsibility according to the nurses' job description ($p<0.05$). Among the nurses who participated in the study, nurses working in clinics in the departments of obstetrics and gynaecology were found to have significantly higher ranks in the total mean scores of NMCS and all sub-dimensions than nurses working in internal clinics. It was found that the mean ranks of NMCS, moral integrity, compas-

Table 1. Distribution of individual characteristics of nurses.

Variables		n (%)
Age Group	21-27 age	113 (52.8)
	28 age and above	101 (47.2)
Gender	Female	160 (74.8)
	Male	54 (25.2)
Marital Status	Married	79 (36.9)
	Single	135 (63.1)
Education Degree	Bachelor's Degree	173 (80.8)
	Master's and PhD	41 (19.2)
Duration of Employment	1 year or less	29 (13.6)
	Between 1-5 years	116 (54.2)
	Between 6-10 years	45 (21.0)
	10 years or more	24 (11.2)
Formal Position	Clinical Nurse	196 (91.6)
	Responsible Nurse	18 (8.4)
Department	Internal Clinics	121 (56.5)
	Surgery Clinics	53 (24.8)
	Department of Obstetrics and Gynaecology	31 (14.5)
	Mental and Public Health Clinics	9 (4.2)
Previous Training in Ethics and Morality	Yes	191 (89.3)
	No	23 (10.7)

Table 2. Distribution of nurses' scores from the NMCS and its sub-dimensions.

	NMCS	Compassion and true presence	Moral integrity	Moral responsibility	Commitment to good care
Median	86.0	20.0	30.0	16.0	21.0
Minimum	43.0	8.0	15.0	7.0	9.0
Maximum	105.0	25.0	35.0	20.0	25.0

NMCS: Nurses' Moral Courage Scale.

sion and true presence, and commitment to good care total scores of the nurses who had previously received training on ethics and morality were significantly higher than those who had not received such training ($p<0.05$) (Table 3).

DISCUSSION AND CONCLUSION

Moral courage is an important concept that requires nurses to possess ethical sensitivity and to put the welfare and dignity of their patients above all else in the face of opposition or a challenge. Within the complex and dynamic structure of health services, events that challenge the moral integrity of nurses occur from time to time. In this case, nurses may exhibit morally courageous behaviour by risking dismissal, social exclusion or endangering their well -being.

In this study, in which the level of moral courage of nurses and the factors affecting it were determined, the median value of the moral courage scale of nurses was found to be 86.0. Considering that the lowest score that can be obtained from the moral courage

Table 3. Comparison of NMCS rank means according to socio-demographic data of nurses.

Variables		NMCS				
		Total Score	**Compassion and true presence**	**Moral integrity**	**Moral responsibility**	**Commitment to good care**
		Mean Rank	Mean Rank	Mean Rank	Mean Rank	Mean Rank
Age	21-27 age	100.10	100.89	101.28	107.99	99.11
	28 age and above	115.78	114.90	114.46	106.96	116.89
	Test and p-value	Z: -1.851 p:0.06	Z: -1.660 p: 0.09	Z: -1.560 p: 0.11	Z: -0.123 p: 0.90	**Z: -2.111 p: 0.03**
Gender	Female	108.80	108.46	108.82	110.0	108.27
	Male	103.65	104.66	103.60	100.09	105.22
	Test and p-value	Z:-0.529 p:0.59	Z:-0.392 p:0.69	Z:-0.537 p:0.59	Z:-1.027 p:0.304	Z:-0.315 p:0.753
Marital Status	Married	113.37	112.80	108.04	111.55	115.44
	Singe	104.06	104.40	107.19	105.13	102.85
	Test and p-value	Z:-1.062 p:0.28	Z:-0.963 p:0.33	Z:-0.098 p:0.92	Z:-0.740 p:0.45	Z:-1.445 p:0.14
Education Degree	Bachelor's Degree	103.55	103.14	106.91	103.38	103.49
	Master's and PhD	124.16	125.89	109.98	124.87	124.41
	Test and p-value	**Z:-1.917 p: 0.05**	**Z:-2.125 p:0.03**	Z:-0.286 p:0.77	**Z:-2.018 p: 0.04**	**Z:-1.958 p:0.05**
Duration of Employment	1 year or less[1]	142.43	132.52	141.16	142.26	141.64
	Between 1-5 years[2]	92.72	96.13	91.91	98.38	92.55
	Between 6-10 years[3]	117.03	107.61	121.24	115.97	115.51
	10 years or more[4]	118.83	132.02	116.44	93.71	123.50
	Test and p-value	**KW:17.73 p:0.001** 1>2	**KW: 12.53 p:0.006** 1>2	**KW: 18.77 p:0.001** 1>2 1>3	**KW: 13.97 p:0.003** 1>2 1>4	**KW: 18.17 p:0.001** 1>2
Formal position	Clinical nurse	104.32	104.44	105.40	104.10	105.23
	Nurse manager	142.17	140.86	130.33	144.47	132.22
	Test and p-value	**Z:-2.48 p:0.013**	**Z:-2.40 p:0.016**	Z:-1.641 p:0.101	**Z:-2.675 p:0.007**	Z:-1.78 p:0.075
Department	Internal Clinics[1]	92.28	92.92	95.39	95.43	93.92
	Surgery Clinics[2]	121.19	119.19	117.69	117.49	119.34
	Mental and Public Health Clinics[3]	126.11	134.72	116.61	114.67	126.78
	Department of Obstetrics and Gynaecology[4]	138.10	136.52	134.69	135.44	134.66
	Test and p-value	**KW:18.31 p: 0.001 4>1**	**KW: 17.30 p: 0.001 4>1**	**KW: 12.32 p: 0.001 4>1**	**KW: 12.66 p: 0.005 4>1**	**KW: 14.79 p: 0.002 4>1**
Previous Training in Ethics and Morality	Yes	112.58	113.21	111.95	109.82	111.97
	No	65.30	60.11	70.54	88.22	70.41
	Test and p-value	**Z:-3.46 p: 0.001**	**Z:-3.90 p: 0.001**	**Z:-3.04 p: 0.002**	Z:-1.59 p: 0.11	**Z:-3.06 p:0.002**

P-values <0.05 are highlighted in bold; NMCS: Nurses' Moral Courage Scale; Z: Mann-Whitney U test; KW: Kruskal Wallis test; the numbers (^{1,2,3,4}) are used to indicate which groups the statistical difference comes from.

scale is 21 and the highest score is 105, it can be said that the moral courage of the nurses in this study is above average. This result is an indication that nurses are professionally committed to ethical principles. In addition, total scores on the moral courage scale sub-dimensions of compassion and true presence, moral integrity, moral responsibility and commitment to good care were revealed to be above average in our study.

It was determined that there is a limited number of studies in Türkiye in which the moral courage levels of nurses were examined.[20,23,24] In these studies, similar to our study, it was found that the scores on the moral courage scale of the nurses were above the averages observed in the literature.[20,23] It was seen that many studies have been carried out internationally with nurses and nursing students regarding behaviour related to moral courage.[11,25-27] In a study conducted in China, it was found that the level of moral courage of nurses was moderate.[27] The results of the studies in the literature and our results were similar. These results indicate that nurses tend to prioritize the well-being of their patients, demonstrating a strong sense of responsibility and commitment to quality care.

In the study, the educational level of nurses was determined as a factor that affects moral courage. Participants with master's and doctoral degrees had significantly higher moral courage scores. However, it was determined that there was no statistically significant difference between only the moral integrity -dimension scores of the participants and the level of education. When the results of the studies comparing the moral courage status of nurses with the level of education were analysed, it was seen that there were different results. The results of a few studies were similar to our study. [11,25] However, in a study conducted by Elmaoğlu and Eriş with 227 nurses in Türkiye, it was observed that educational status did not affect moral courage scores. [20] In two different studies conducted in Iran and China, it was found that there was no difference between the moral courage scores of graduate and undergraduate nurses. [18,27] The higher levels of moral courage among Masters and PhD nurses may be due to nurses' knowledge regarding moral courage. In addition, it can be said that nurses with higher education levels are more sensitive to the subject of moral courage.

In this study, it was found that the moral courage and sub-dimension scores of participants with one year or less of employment were significantly higher than those with one to five years of employment. It is noticeable that results differ in the studies in the literature.[11,25,28,29] Hauhio et al. determined that there was no significant relationship between nurses' moral courage and working time.[28] On the contrary, some studies found a significant positive correlation between nurses' working hours and moral courage. [11,25,28,29]

Notably, the results of this study showed that nurses who had worked for one year or less had the highest moral courage. This result showed that nurses who were new to the profession were sensitive to ethical issues. The ethical knowledge of newly graduated nurses may be effective in their moral courage.

In the study, it was determined that the moral courage scores of nurse managers were significantly higher than those of clinical nurses. Similar to our study, Konings et al. found that nurses working as head nurses had higher levels of moral courage than other nurses.[25]

However, according to another study, it was discovered that the moral courage scores of nurses did not vary according to their formal positions.[11] It is thought that the significant result of our study is related to the fact that nurse managers have characteristics that can positively affect moral courage, such as having had postgraduate education, having developed leadership skills, and being self-confident and decisive.

In this study, it was found that the level of moral courage of the nurses varied according to the department in which they were working. Post-hoc analyses showed that nurses working in obstetrics and gynaecology units had significantly higher moral courage scores and sub-dimension scores than nurses working in internal medicine clinics. The results of the limited study in which moral courage was compared with the departments in which nurses worked showed that moral courage did not change according to the departments in which the nurses worked.[20,27] This study suggests that nurses working in obstetrics and gynecology are more sensitive to moral issues and prioritise moral courage because they care for patients with more sensitive characteristics, such as women and children.

It was observed that the participants' education on ethics and morality was another factor affecting moral courage. The moral courage scores of the nurses who received training on ethics and morality were statistically significantly higher. In a study of 583 nurses, Huang et al. found that nurses who received ethics training were more likely to demonstrate moral courage.[27] The outcomes of this study were similar to the findings of the other study. It is thought that this situation may be due to the fact that the competence in the level of knowledge of nurses on ethics and morality may be reflected in their moral courage scores.

In conclusion, the study found that the level of moral courage among nurses was above average. In this study, it was seen that nurses' level of education, years working in the profession, formal position, the department in which they worked, and having re-

ceived training on ethics and morality were effective in determining their moral courage. The fact that moral courage was found to be at a higher level among nurses who had been working for less than a year showed that nurses who were new to the profession possessed a heightened awareness of moral courage. This result is encouraging in terms of the quality of patient care, patient advocacy and the nursing profession. However, it would be useful to determine via prospective and qualitative studies whether there is a decline in moral courage scores of nurses as a result of increasing working years. However, in order to develop and strengthen moral courage in nurses, it is important to provide information and training on moral sensitivity and moral distress. In order to foster moral courage among nurses in their professional lives, it may be useful to organize activities such as training and workshops focused on raising awareness and gaining skills at the individual level. Finally, there is a need for studies to evaluate the effectiveness of interventions to improve moral courage in nurses.

Ethics Committee Approval: The study was approved by the Istanbul Medipol University Non-Interventional Clinical Research Ethics Committee. (Date: 26/07/2022, decision no: 648). Permission for the measurement tools used in the study was obtained from the authors by e-mail. The study was conducted in accordance with the Declaration of Helsinki.

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

Author Contributions: Concept – FT; Supervision– FT, RD; Materials – FT, RD, MD; Data Collection and Processing – RD, MD; Analysis and Interpretation – FT, RD; Writing – FT, RD, MD.

Peer-review: Externally peer-reviewed.

Other Information: This study was presented as an oral presentation at the 3rd International 6th National Health Services Congress.

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OTJHS
Online Turkish Journal of Health Sciences

e-ISSN: 2459-1467

OTSBD
Online Türk Sağlık Bilimleri Dergisi

Online Turkish Journal of Health Sciences 2025;10(1):8-14 *Online Türk Sağlık Bilimleri Dergisi 2025;10(1):8-14*

Reliability and Validity of the Turkish Version of the COVID-19 Anxiety Syndrome Scale among Health Professionals

Sağlık Çalışanlarında COVID-19 Anksiyete Sendromu Ölçeği'nin Geçerlik ve Güvenirlik Çalışması

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ABSTRACT

Objective: This study aimed to adapt the COVID-19 Anxiety Syndrome Scale (C-19ASS), used as a reference to take measures against anxiety, worry, perceived threats and stressors, into Turkish and to test its reliability and validity on healthcare workers.

Materials and Methods: The sample of the methodological-descriptive-cross-sectional study consisted of 223 healthcare workers aged 18 years and above. "Sociodemographic Data Collection Form" and "C-19ASS were used to obtain the data. Healthcare workers working in different cities and hospitals answered the questionnaires online using a link.

Results: The scale explained 55.013% of the total variance. In EFA, the factor loadings for the two sub-dimensions were distributed between 0.487-0.909 and 0.580-0.806, respectively. The fit indices in CFA were determined as RMSEA 0.063, GFI 0.956, CFI 0.977, IFI 0.977, TLI 0.968 and NFI 0.952. Cronbach alpha values for the total scale and the two sub-dimensions were 0.891, 0.851 and 0.776, respectively.

Conclusions: These findings support by showing that the Anxiety Syndrome Scale will be useful with mental status assessment and mental health services planning.

Keywords: Anxiety, COVID-19, health professional, reliability, validity

ÖZ

Amaç: Bu çalışmanın amacı kaygı, anksiyete, algılanan tehdit ve stresörlere karşı önlemler almak için kullanılan COVID-19 Anksiyete Sendromu Ölçeği (C-19ASS)"ni Türkçeye uyarlamak ve geçerlilik güvenilirliğini sağlık çalışanlarında test etmektir.

Materyal ve Metot: Metodolojik-tanımlayıcı-kesitsel tipteki çalışmanın örneklemini 18 yaş üstü 223 sağlık çalışanı oluşturdu. Verilerin elde edilmesinde "Sosyodemografik Veri Toplama Formu" ve "C-19ASS kullanıldı. Farklı şehirlerde ve hastanelerde görev yapan sağlık çalışanları anketleri bağlantı linki ile web tabanlı olarak yanıtladı.

Bulgular: Ölçek toplam varyansın %55,013 açıklamıştır. Faktör yükleri iki alt boyut için sırasıyla 0,487-0,909 ve 0,580-0,806 arasında dağılmıştır. CFA'da uyum indeksleri RMSEA 0,063, GFI 0,956, CFI 0,977, IFI 0,977, TLI 0,968 ve NFI 0,952 olarak saptanmıştır. Ölçek toplam ve iki alt boyut için cronbach alfa değerleri sırasıyla 0,891, 0,851 ve 0,776'dır.

Sonuç: Anksiyete Sendromu Ölçeği'nin ruhsal durum değerlendirmesi ve ruh sağlığı hizmetleri planlamalarında yararlı olacağı düşünülmektedir.

Anahtar Kelimeler: Anksiyete, COVID-19, geçerlilik, güvenilirlik, sağlık profesyoneli

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Yayın Bilgisi / Article Info:
Gönderi Tarihi/ Received: 12/06/2024
Kabul Tarihi/ Accepted: 05/03/2025
Online Yayın Tarihi/ Published: 17/03/2025

Atıf / Cited: Arkan B and et al. Have Reliability and Validity of the Turkish Version of the COVID-19 Anxiety Syndrome Scale among Health Professionals. *Online Türk Sağlık Bilimleri Dergisi* 2025;10(1):8-14. doi: 10.26453/otjhs.1500265

INTRODUCTION

In late 2019, the coronavirus outbreak in Wuhan, China, negatively affected people's lives in many ways. The COVID-19 pandemic became a major global crisis that posed a threat worldwide. The virus caused confusion, uncertainty, unpredictability, and lack of control. Due to similar effects of past outbreaks, radical changes are being discussed.[1,2] The negative socioeconomic impact of quarantine, forced isolation, and temporary confinement is considered a risk factor that negatively affects mental health, especially among low-income families.[3]

In studies mentioning the psychological effects of the pandemic, anxiety levels were found to be high. Limcaco et al. reported that the pandemic increased anxiety in a general population sample between March 17 and April 1.[4] This study involved 1091 participants from 41 countries answering web-based questionnaires in Spanish and English. Emphasizing the link between anxiety and the pandemic, Yin et al. conducted a cross-sectional study (February 2019 –February 2020) with approximately 30,000 adults across seven Chinese provinces, reporting a 15% rise in anxiety during the COVID-19 outbreak, which was higher in places with increased transmission risk.[5] They also surveyed 1210 adults in various Chinese cities, finding severe stress, anxiety, and depression.[5] Odriozola-González et al. conducted a web-based study on 3550 adults in Spain, similarly noting elevated stress, anxiety, and depression. Responses from 18,147 adults in an Italian web-based study confirmed high levels of posttraumatic stress disorder, adjustment and sleep disorders, anxiety, depression, and stress.6,7

It is crucial to identify COVID-19 anxiety syndrome, as related mental problems may lead to ineffective coping.8 The COVID-19 Anxiety Syndrome Scale (C-19ASS) assesses maladaptive coping methods, including avoidance, threat monitoring, anxiety, and control, offering a valid, reliable tool for measuring anxiety, perceived threats, and stressors.9

Healthcare professionals' frontline role during the pandemic exposed them to higher levels of COVID-19-related anxiety, stress, and perceived threats than other groups. They faced increased infection risks for themselves and their families, making the effects of COVID-19 Anxiety Syndrome more pronounced.[10] Measuring and evaluating anxiety in this group is essential for understanding its impact on healthcare systems and for designing targeted interventions.[11]

For the reasons stated above, this study was conducted to determine the validity and reliability of the Turkish version of the C-19ASS.

MATERIALS AND METHODS

Ethics Committee Approval: The approval of Bursa Uludag University – Health Sciences Research and Publication Ethics Committee (Date: 23.02.2022, decision no: 10) was obtained. The study adhered to the ethical guidelines of the Declaration of Helsinki. Informed consent was obtained from participants via email. In order to adapt the C-19ASS into Turkish, permission was obtained by e-mail from Nikčević and Spada, who developed the scale.

Study Design and Participants: This study was a methodical, descriptive, cross-sectional study to adapt to Turkish C-19ASS. The study sample consisted of 223 healthcare workers over the age of 18 years. When determining the number of samples to determine validity and reliability, three rules are mentioned in the literature, namely the 5, 10 and 100 rules.[12] To determine the validity and reliability of the Anxiety Syndrome Scale, consisting of nine items, the sample was determined to be 100 healthcare workers, choosing 10 workers per item. A total of 223 health workers who met the research criteria were included in the sample.

Data Collection: We used the "Sociodemographic Data Collection Form" and the "C-19ASS" developed by researchers to obtain study data. The questionnaires were available online via a link sent to healthcare professionals working in different cities and hospitals. Participants answered the questionnaires online.

Sociodemographic Data Collection Form: This form was developed by researchers and consisted of 13 questions to determine the sociodemographic characteristics of nursing students (grade, age, gender, number of siblings, employment status, income level, education level).

COVID-19 Anxiety Syndrome Scale (C-19ASS): It is a 9-question form developed by Nikčević and Spada and published in 2020[9]. It is reported to be a valid and reliable tool, applied to 426 participants over the age of 18 living in the USA. The scale consists of 9 items, and each item is scored on a five-point Likert scale (1=never, 2=rarely (less than 1 or 2 days), 3=several days, 4=more than 7 days, 5=almost every day). The scale assesses a series of statements by participants on how they cope with the threat of COVID-19 and the extent to which these statements have applied to participants in the last two weeks. Two factors are taken into account in the evaluation of the items on the scale. The first one is the persistence factor of items 2, 4, 6, 7, 8, and 9, and the other is the avoidance factor of items 1, 3, and 5. The Cronbach's alpha coefficient of the 6 items indicating continuity was 0.86, and the Cronbach's alpha coefficient of the 3 items indicating avoidance was 0.77. The scores obtained from the scale varied be-

tween 9 and 45, and the higher the score, the higher the level of anxiety syndrome. There was no reverse scoring in the scale. In the original study, as a result of explanatory factor analysis, it was determined that the scale consisted of two sub-dimensions; it was determined that the factor loadings varied between 0.63-0.85 for the first sub-dimension and between 0.78-0.84 for the second sub-dimension. As a result of the confirmatory factor analysis, it was determined that the fit indices were CFI of 0.99, TLI of 0.99, SRMR of 0.026 and RMSEA of 0.020.

Validity and Reliability Analysis

1. Language Validity: The scale was translated from English to Turkish by two native speakers, merged into a single text, and then back-translated and compared with the original. Revisions were made as necessary.

2. Content Validity: Ten psychiatric nursing experts reviewed the items for language and content using a four-point rating scale. Content validity indices were calculated based on the proportion of experts marking "appropriate" or "needs revision."

3. Implementation Phase: The draft was tested on a group outside the main sample to evaluate clarity and feasibility.

4. Construct Validity: Exploratory and confirmatory factor analyses were performed.

5. Reliability Determination: Cronbach-Alpha reliability coefficient, split-half and item-total score analyses were performed.

Statistical Analysis: Cronbach's alpha and McDonald's omega were used for internal consistency, while Pearson correlation, inter-item correlation, and split-half reliability analyses evaluated item-based total scores. Tukey's additivity analysis assessed scale additivity, and Hotelling's T-square test checked response bias. Exploratory factor analysis (principal axis factoring, Promax rotation) and confirmatory factor analysis (covariance matrix) were conducted. No multicollinearity was found. The significance level was p=0.05, and SPSS 24.0, AMOS 25.0, and JAMOVI 2.2 were used.

RESULTS

A total of 79.4% (n=177) of the participants were female, with mean weekly working hours of 43. 99+12.10 (min=7-max=100), and 74.4% (n=166) were married. Based on the opinions received from ten experts, I-CVI was found to be between 0.98-1.00, and S-CVI was found to be 0.99 (Table 1).

Tablo 1. Characteristics of the participant.

Descriptive characteristics		**M±SD**	**Min–Max**
Age		39.74 ± 9.37	22 – 72
Year of Employment		17.25 ± 9.39	1 – 47
Weekly Working Hours		43.99 ± 12.10	7 – 100
		n (%)	
Gender	Female	177 (79.4)	
	Male	46 (20.6)	
Income	Income less than expenses	58 (26.0)	
	Income equals expenses	118 (52.9)	
	Income is more than expenses	47 (21.1)	
Education Level	High Vocational School	4 (1.8)	
	Associate's degree	22 (9.9)	
	Bachelor degree	102 (45.7)	
	Postgraduate	95 (42.6)	
Family Type	Nuclear family	196 (87.9)	
	Extended family	15 (6.7)	
	Broken family	12 (5.4)	
Marital Status	Married	166 (74.4)	
	Single	57 (25.6)	
Members of a professional association	Yes	120 (53.8)	
	No	103 (46.2)	
Do the emotions of the people around you in the hospital rub off on you?	Yes	93 (41.7)	
	No	26 (11.7)	
	Partial	104 (46.6)	
I-CVI		0.98-1.00	
S-CVI		0.99	

M: Mean; SD: Standard Deviation; I-CVI: Item Content Validity Index; S-CVI: Scale Content Validity Index.

Kaiser-Meyer Olkin (KMO) coefficient was 0.915. Bartlett's test X^2 value was 1002,203 and p=0.000. The EFA found that the scale consisted of two sub-dimensions. The two sub-dimensions accounted for 55.013% of the total variance. The factor loadings of the sub-dimension ranged between 0.487-0.909 and ranged between 0.580-0.806, respectively (Table 2).
The chi-square value of the ten-factor model was 48,753, the degree of freedom was 26 and p=0.000. The ^{2}/SD was 1.875. The fit indices were RMSEA 0.063, GFI 0.956, CFI 0.977, IFI 0.977, TLI 0.968 and NFI 0.952 (Table 3).
The confirmatory factor analysis determined that the factor loadings of the first sub-dimension of the scale ranged between 0.46-0.84, and the factor loadings of the second sub-dimension ranged between 0.59-0.85 (Figure 1).

Table 2. Explanatory Factor Analysis Results (n= 223).

	Factor Loadings	
Items	**1st Sub Dimension**	**2nd Sub-dimension**
I1		0.580
I2	0.609	
I3		0.806
I4	0.487	
I5		0.649
I6	0.652	
I7	0.909	
I8	0.655	
I9	0.710	
Variance Explained (%)	50.971	4.043
Total Variance Explained (%)	55.013	
KMO	0.915	
Bartlett X^2	1002.203	
p	0.000	

I=Item; KMO: Kaiser-Meyer Olkin; X^2: Chi-Square Value.

Table 3. Confirmatory Factor Analysis Model Fit Indices (n= 223).

	X^2	DF	X^2/DF	p	RMSEA	GFI	CFI	IFI	TLI	NFI
Two-Factor Model	48.753	26	1.875	0.000	0.063	0.956	0.977	0.977	0.968	0.952

X^2: Chi-Square Value; DF: Degree of Freedom; GFI: Goodness of Fit Index; CFI: Comparative Fit Index; IFI: Incremental Fit Index; NFI: Normed Fit Index; TLI: Trucker-Lewis Index; RMSEA: Root Mean Square Error of Approximation.

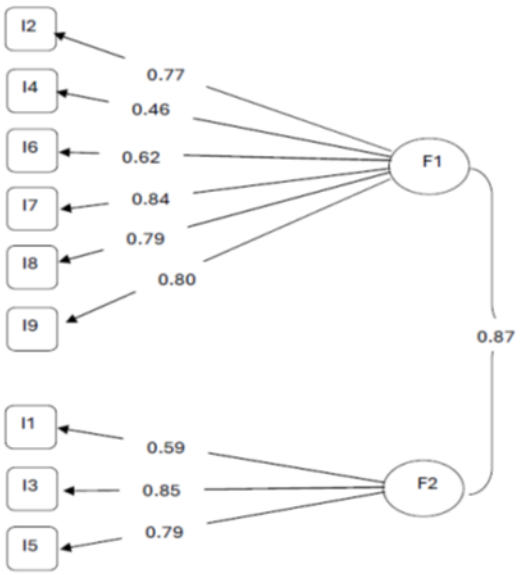

Figure 1. Confirmatory Factor Analysis.

The Cronbach's alpha coefficient for the whole scale and sub-scales were 0.891, 0.851 and 0.776, respectively. McDonald's Omega coefficient of the whole scale and sub-scales were 0.899, 0.865 and 0.792, respectively (Table 4). Other reliability analysis results are given in Table 4.

DISCUSSION AND CONCLUSION

In this study, the opinions of 10 experts were obtained to ensure language and content validity. The I -CVI and S-CVI values of the study were found to be greater than 0.80. The results of the content validity analysis showed that both content and linguistic validity of the scale for the Turkish sample were achieved and that it measured the subject matter as adequately as the original version with respect to the Turkish sample.[9,12-18]

As per the EFA, we found that the scale accounted for more than 50% of the total variance, and the EFA factor loadings were greater than 0.40. In the literature, it should be able to account for at least half of the variance and factor loadings should be above 0.40.[13-17] In order for a scale to have a strong structure. The EFA results from this present study showed that the structure determined by the original scale and the structure in the Turkish sample were similar, and the scale was able to measure anxiety levels towards COVID-19 in the Turkish sample in a similar way to the original scale.[9,13-18]

While the CFA analysis showed that the factor loadings were greater than 0.40, the RMSEA value was below 0.08, and the other fit indices were greater than 0.95. These results showed that EFA and CFA were compatible.[9-15] With EFA and CFA being compatible, this study reported results similar to those of the original scale and confirmed the structure of the original scale with respect to the Turkish sample, proving that the scale can adequately and accurately measure anxiety about COVID-19 for the Turkish sample.[9, 13-17] The validity analysis results showed that the scale can meaningfully and accurately measure the resistance of healthcare workers towards COVID-19 and the fear of avoidance that they may experience in the event of infection or a family member contracting COVID-19 and the fear of infection themselves. Although there is no measurement tool in our country that measures the anxiety of healthcare workers towards COVID-19, there is a

Table 4. Scale Reliability Analysis Results (n=223).

			Split Half Analysis					
	Cronbach's Alpha	**McDonald's Omega**	**First half Cronbach's Alpha**	**Second half Cronbach's Alpha**	**Spearman-Brown**	**Guttman split-half**	**Correlation between the two halves**	**Mean ± Standard Deviation (Min-Max)**
Scale Total	0.891	0.899	0.847	0.730	0.894	0.864	0.808	23.11±8.63 (0-36)
First sub-dimension	0.851	0.865						15.52±5.59 (0-24)
Second sub-dimension	0.776	0.792						7.59±3.63
Cronbach's Alpha When Item Deleted					0.871-0.895			
Corrected Item-Total Score Correlation, *(r)**					0.467-0.756			
Corrected Item-Subscale Total Score correlation, *(r)**					0.407-0.766			
Tukey additivity Test	F				0.453			
	p				0.501			
Hotelling's T-square test	T-square				208.243			
	F				25.210			
	p				0.000			

F: Test of Anova; r= Correlation coefficient.

scale that evaluates the fear of COVID-19 in the general population. The fact that the scale in this study gives similar results to both the original scale and the scale used in the general population shows that the scale is a suitable measurement tool that can be used in our country.

The study also found that Cronbach's alpha and McDonald's omega coefficients of the scale were above 0.70 for both the whole scale and its subdimensions and showed high reliability. The literature emphasizes that high Cronbach's alpha and McDonald's omega coefficients indicate that the items are compatible with each other and measure only the intended structure.[14-18] The results of this study and the high-reliability coefficients showed that the scale could measure the intended concept with respect to the Turkish sample by maintaining its original structure and that the items were compatible with each other.[13-18]

For this study, an additivity analysis was performed, which showed that a total score could be obtained from the scale, and interpretations could be made based on the total score as per the additivity analysis. Since an additivity analysis had not been performed for the original scale, the results could not be compared.[9,13-18]

Response bias is when people fill in the scale items in line with the expectations of society or researchers rather than according to their own opinions. This negatively affects both the reliability and validity of the results.[13-17] We found that all participants filled out the scale based on their own opinions and that there was no response bias.[9, 18] It has been shown that item-total score and sub-dimension total score correlations are high, and the items can measure the same concept.[9,13-18]

Despite all its strengths, the scale has several limitations. First, the study was conducted only with healthcare professionals, and the convenience sampling method was used. These limitations may affect the extent to which the results from the study can be generalized.

In conclusion, the results of this present study revealed that the scale was a valid and reliable measurement tool for the Turkish sample. This study makes a noteworthy contribution to the existing literature by assessing the validity and reliability of the C-19ASS among healthcare workers. The pandemic has led to elevated levels of stress, anxiety, and perceived threat among healthcare professionals, negatively impacting their psychological well-being. This has heightened the demand for reliable assessment tools tailored to this population. Our research addresses this gap by evaluating the applicability of the C-19ASS for healthcare workers, providing empirical evidence of its psychometric properties, and establishing a foundation for future research on anxiety measurement in this high-risk group during pandemics and similar crises. In this regard, our study not only adapts psychological assessment tools for the healthcare sector but also contributes to the development of strategies aimed at safeguarding the mental health of healthcare professionals.

Ethics Committee Approval: This study was approved by the Health Sciences Research and Publication Ethics Committee of Bursa Uludag University (Date: 23.02.2022, decision no: 10).

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

Author Contributions: Concept – BA, AB, MB; Supervision – BA, AB, MB; Materials – BA, AB, MB; Data Collection and/or Processing – BA, AB; Analysis and/or Interpretation – BA, AB, MB; Writing – BA, AB, MB.

Peer-review: Externally peer-reviewed.

Financial Support: This research has not received any specific support.

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OTJHS
Online Turkish Journal of Health Sciences

e-ISSN: 2459-1467

OTSBD
Online Türk Sağlık Bilimleri Dergisi

Online Turkish Journal of Health Sciences 2025;10(1):15-21 *Online Türk Sağlık Bilimleri Dergisi 2025;10(1):15-21*

A Strong Association Between COVID-19 and Single Nucleotide Polymorphisms in Nuclear Factor Kappa B genes

COVID-19 ile Nükleer Faktör Kappa B Genlerindeki Tek Nükleotid Polimorfizmleri Arasındaki Güçlü Bir İlişki

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ABSTRACT

Objectives: SARS-CoV-2 is an enveloped, positive-sense, single-stranded RNA virus belonging to the Betacoronavirus genus. This study aimed to investigate the relationship between COVID-19 severity and NF-κB1 -94 ins/del (rs28362491), NF-κB1A 3'UTR A/G (rs696), -826 C/T (rs2233406) polymorphisms.

Materials and Methods: We investigated the frequencies of these gene polymorphisms in 150 patients with COVID -19 and 171 healthy controls. Total DNA was isolated from the blood samples, and then the PCR-RFLP study was used for genotyping. All statistical analyses were calculated using the chi-square method using SPSS.

Results: A statistically significant differences were determined in the D allele frequency, WD and DD genotype frequencies for the rs28362491 polymorphism. For rs696 polymorphism, there was a statistically significant difference in the frequency of the *G* allele of patients with COVID-19. Additionally, for this polymorphism, CT and TT genotype frequencies were shown to be statistically significant. It was also found that the T allele, CT, and TT genotype frequencies for the rs2233406 have a statistically significant difference.

Conclusion: A significant association was found between COVID-19 disease and NF-κB genes, but further studies, such as investigating promoter activity or gene expression levels, are needed.

Keywords: COVID-19, NF-κB1-94 Ins/Del ATTG, NF-κB1A 3'UTR A/G, NF-κB1A -826 C/T, polymorphism

ÖZ

Amaç: SARS-CoV-2, Betacoronavirus cinsine ait zarflı, pozitif polariteli, tek sarmallı bir RNA virüsüdür. Bu çalışmada COVID-19 hastalığının şiddeti ve NF-κB1 -94 ins/del (rs28362491), NF-κB1A 3'UTR A/G (rs696), NFk-B1A -826 C/T (rs2233406) polimorfizmleri arasındaki ilişkinin araştırılması amaçlanmıştır.

Materyal ve Metot: COVID-19'lu 150 hastada ve kontrol olarak 171 sağlıklı bireyde bu genlerin polimorfizm sıklıklarını araştırdık. Kan örneklerinden total DNA izole edildi ve ardından genotipleme için PCR-RFLP çalışması kullanıldı. Tüm istatistiki analizler SPSS kullanılarak ki-kare yöntemi ile hesaplanmıştır.

Bulgular: Rs28362491 polimorfizmi için D alel frekansı, WD ve DD genotip frekanslarında istatistiksel olarak anlamlı farklılıklar tespit edilmiştir. Rs696 polimorfizmi için, COVID-19'lu hastaların G aleli sıklığında istatistiksel olarak anlamlı bir fark vardı. Ayrıca, bu polimorfizm için CT ve TT genotip frekanslarının istatistiksel olarak anlamlı olduğu gösterilmiştir. Ayrıca, rs2233406 için T aleli, CT ve TT genotip frekanslarının istatistiksel olarak anlamlı bir farka sahip olduğu bulunmuştur.

Sonuç: COVID-19 hastalığı ile NF-κB genleri arasında anlamlı bir ilişki bulunmuştur, ancak promotör aktivitesinin veya gen ekspresyon seviyelerinin araştırılması gibi daha ileri çalışmalara ihtiyaç vardır.

Anahtar Kelimeler: COVID-19, NF-κB1-94 Ins/Del ATTG, NF-κB1A 3'UTR A/G, NF-κB1A -826 C/T, polimorifzm

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Yayın Bilgisi / Article Info:
Gönderi Tarihi/ Received: 27/06/2024
Kabul Tarihi/ Accepted: 18/12/2024
Online Yayın Tarihi/ Published: 17/03/2025

Atıf / Cited: Özbilum Şahin N and et al. A strong association between COVID-19 and Single Nucleotide Polymorphisms in Nuclear Factor Kappa B genes. *Online Türk Sağlık Bilimleri Dergisi* 2025;10(1):15-21. doi: 10.26453/otjhs.1505688

INTRODUCTION

Coronavirus Disease (COVID-19) is an infectious disease caused by the *SARS-CoV-2* coronavirus that emerged in China, firstly in Wuhan, and spread all over Asia.[1] The virus is a positive-polarity, enveloped and single-stranded RNA virus of the genus Betacoronavirus and family coronavirus.[2] Although *SARS-CoV-2* is mainly characteristic of animals, they can infect other species, including humans.[3] Immune response developed against COVID-19 infection is quite similar to other viruses. Immunity is associated with inflammation, and an appropriate and integrated functioning of both processes is essential. Viral particles are defined as foreign elements to the body, as in every infection.[4] This results in the production of proinflammatory factors, including cytokines.[5] Impaired modulation of genes directly involved in inflammation-related processes, including genes encoding cytokines and chemokines, has been shown due to abnormal activation of Nuclear Factor kappa B (NF-κB).[6] NF-κB is also an important regulator of innate immune cells such as T or B cells. Therefore, a dysregulation in NF-κB can lead to an uncontrolled and pathogenic inflammatory response. Interestingly, upregulation of NF-κB has been observed to play a role in the development of *SARS-CoV-2* infection.[6]

The NF-κB1 gene is positioned on chromosome 4q21. The -94 Ins/Del ATTG (rs28362491) polymorphism is a functional polymorphism located in the promoter of this gene. One of the protein families that can manage many inflammatory events is NF-κB. IκBα, encoded by NF-κB1A, is an important inhibitor of NF-κB activity.[7] NF-κB1A genes located on chromosome 14q13 have been associated with the development of many cancers.[8] In addition, -826 C/T polymorphism was associated with hepatitis B virus.[9] Many polymorphisms have been shown in the NF-κBIA gene, but the A/G polymorphism in the 3'UTR region, which is potentially functionally prominent, is thought to regulate gene expression effectively.[10] The 3'UTR A/G polymorphism identified by Glavac et al.[10] and Gao et al.[11] was associated with various cancer types. It is thought that the variation most likely affects the expression of NF-κBIA, which in turn alters the structure and function of the protein, leading to its weak binding to the NF-κB complex and consequently leading to NF-κB activation.

We hypothesize that NF-κB1-94 Ins/Del ATTG, NF-κB1A 3'UTR A/G, and NF-κB1A -826 C/T polymorphisms may act as risk factors for COVID-19 disease. This study aimed to investigate whether functional polymorphisms in NF-κBI and NF-κBIA are associated with COVID-19 disease and its severity.

MATERIALS AND METHODS

Ethics Committee Approval: Approval was obtained from the Sivas Cumhuriyet University Clinical Research Ethics Committee (Decision No: 2021-02/07). The control group consisted of 171 healthy individuals whose blood was drawn during the period when there was no COVID-19 outbreak (Decision No: 2009-02/5). Informed consent forms were obtained from all volunteers.

Collection and storage of the samples: We investigated the genotype and allele frequencies of NF-κB1 -94 Ins/Del ATTG, NF-κB1A 3'UTR A/G, and NF-κB1A -826 C/T polymorphisms in this study. Blood samples of patients diagnosed with COVID-19 were used in this study. The patient group consisted of 150 individuals with a definitive diagnosis of COVID-19 disease by the Sivas Cumhuriyet University Faculty of Medicine Research Hospital Infectious Diseases Department. Individuals who have not been diagnosed with COVID-19 or have any chronic or infectious disease will not be included in the patient group. First, DNA was extracted from blood samples of COVID-19 patients. Polymerase chain reaction- Restriction Fragment Length Polymorphism (PCR-RFLP) was performed for rs28362491, rs696, and rs2233406 genotyping. According to hematologic, biochemical, and serologic laboratory findings, the patients had no other infection or chronic disease. Patients were categorized as severe and non-severe in terms of disease severity. COVID-19 patients hospitalized in the intensive care unit and asymptomatic ones were classified as severe and non-severe, respectively. Healthy volunteers had no disease complaints in their medical history, and their examinations were normal.

Determination of Gene Polymorphisms: Blood samples were stored at -20^0 C until the time of the study. Total genomic DNA isolation was performed using the standard phenol-chloroform protocol.[12] The concentration of DNA was determined in ultraviolet-visible spectroscopy (UV–VIS) nanodrop (Maestro, NANO). PCR-RFLP method was used to determine the genotypes of the individuals. Within the scope of the study, the appropriate primer pairs and annealing temperatures for the relevant gene regions of the genomic DNA isolated from blood samples were determined as in our previous studies.[13,14] PCR products of the relevant gene regions were cut with appropriate restriction enzymes. The digested products were run on a 3% agarose gel, photographed in a gel imaging system, and the genotypes of the individuals were determined (Figure 1). In order to eliminate errors such as partial digestion that may arise from restriction digestion, samples from the patient and control group (15%) with different genotypes were selected, and the genotypes of

the individuals were confirmed by DNA sequence analysis.

Statistical Analysis: Statistical analysis was formed by comparing patients with COVID-19 in intensive care with individuals with moderate and mild disease severity. Data were uploaded to the SPSS (Ver: 23.0) program, and Pearson's chi-squared test calculated the NF-κB genes alleles and genotype frequencies between case and control groups. Descriptive statics are presented as percentages and frequencies for categorical variables and as medians for continuous variables. Analysis of haplotype frequencies was performed using SHEsis online software (http://analysis.bio-x.cn/myAnalysis.php) and this software was used for possible haplotypes. Difference haplotype frequencies were calculated with Pearson's chi-squared test between case and control groups. $P \leq 0.05$ was considered statistically significant in all cases, and the error level was taken as 0.05.

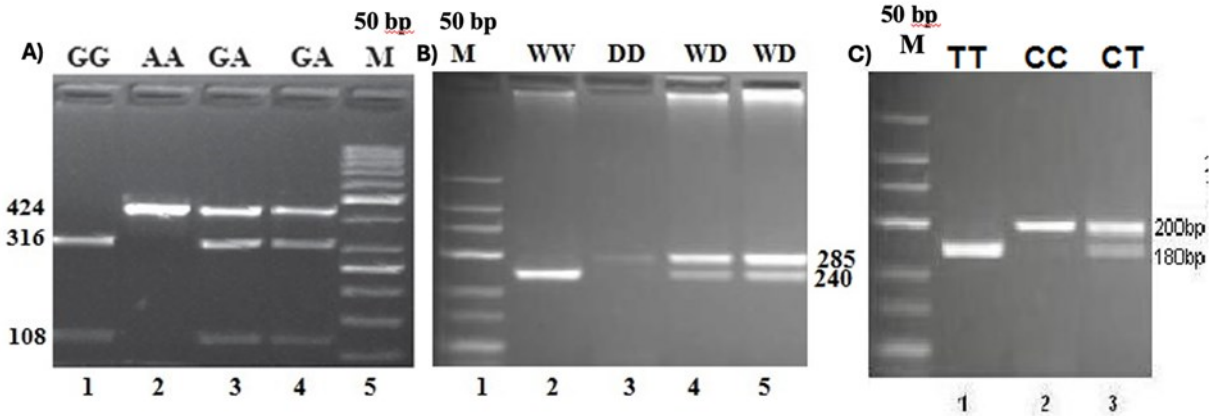

Figure 1: PCR-RFLP and sequence analysis of NF-κB1 W/D and NF-κB1A 3'UTR A→G and -826C/T polymorphisms. **A)** NF-κB1A 3'UTR A → G polymorphism, AA genotype: 424 bp number 2, GA genotype: 424, 316 and 108 bp; numbers 3 and 4, GG genotype: 316 and 108 bp; number 1. Marker: 50 bp; **B)** NF-κB1 -94W/D polymorphism, WW (ins/ins) genotype: 240 and 45 bp; number 2, WD (ins/del) genotype 285, 240 and 45 bp; numbers 4 and 5, DD (del/del) genotype 285 bp; number 3). M: 50 bp; **C)** NF-κB1A -826C/T polymorphism genotypes formed after cutting with Bfa I enzyme. Sample number 1 is TT genotype (20 bp + 180 bp). Sample number 2 is the CC genotype (200bp). Sample number 3 CT genotype (20bp+180bp+200bp). Marker: 50 bp.

RESULTS

In this study, we investigated the effect of 3 NF-κB gene polymorphism, which is a strong player in the immune response to COVID-19 disease. We compared allele and genotype frequencies of the study population regarding case-control, sex and severity (Table 1, Table 2, and Table 3, respectively). In this study, allele and genotype frequencies of the study group were compared. For the NF-κB1 -94 ins/del polymorphism, between case and control groups, we showed a statistically significant difference in the WD and DD genotype distribution ($p<0.001$, $p=0.038$, respectively). For the NF-κB1A 3'UTR A/G polymorphism, the G allele frequency had a 2.5-fold higher risk than the A allele ($p<0.001$; OR=2.52). For NF-κB1A -826 C/T polymorphism, the T allele frequency has a statistically significant difference ($p<0.001$) (Table 1). Haplotype analyses were also examined for all possible haplotypes. The data for all comparisons are also summarised in Table 1.

Table 1. Risk estimates and frequencies of haplotypes, alleles and genotypes for NF-κB (-94 ins/del, 3'UTR A/G, -826 C/T) polymorphisms in COVID-19 patients and healthy controls.

NF-κB1/B1A polymorphism		Case, n (%)	Control, n (%)	p-value	OR (95%CI)
-94ins/del	W allele	167 (55.96)	266 (66.17)	**0.005**	1.56 (1.14-
(rs28362491)	D allele	133 (44.04)	136 (33.83)		2.12)
	WW	35(23.33)	85 (42.29)		
Genotype	WD	97(64.67)	96 (47.76)	**0.001**	2.45(1.51-3.98)
	DD	18(12.00	20 (9.95)	**0.038**	2.19(1.03-4.62)
3'UTR A/G	A allele	111(37.00)	204(50.75)		
(rs696)	G allele	189(63.00)	138(49.25)	**0.001**	2.52(1.83-3.46)
	AA	21(14.00)	90(44.78)		
Genotype	AG	69(46.00)	84(41.79)	**0.001**	3.52(1.98-6.23)
	GG	60(40.00)	27(13.43)	**0.001**	9.52(4.93-18.37)
-826 C/T	C allele	154(51.33)	321(79.85)		
(rs2233406)	T allele	146(48.67)	81(20.15)	**0.001**	3.76(2.69-5.24)

Table 1. Continue.

Genotype	CC	42(28.00)	125(62.19)		
	CT	70(46.67)	71(35.32)	**0.001**	2.94(1.81-4.75)
	TT	38(25.33)	5 (2.49)	**0.001**	22.62(8.36-61.22)
Haplotypes	W A C	15(0.050)	24(0.133)		
	W A T	20(0.065)	8(0.045)	0.080	4.00(1.41-11.35)
	W G C	108(0.359)	57(0.314)	**0.002**	3.03(1.47-62.3)
	W G T	14(0.048)	20(0.111)	0.813	1.12(0.44-2.87)
	D A C	31(0.102)	16(0.087)	**0.011**	3.10(1.29-7.50)
	D A T	0(0.000)	13(0.080)	**0.011**	0.64(0.51-0.82)
	D G C	62(0.206)	34(0.187)	**0.005**	2.92(1.35-6.29)
	D G T	50(0.169)	8(0.043)	**0.001**	10.00(3.73-26.82)

Our study group consisted of 84 women and 132 men with COVID-19. We calculated genotype and allele frequencies between these groups and analyzed the statistical difference between them. However, we did not find a statistical difference due to gender for allele and genotype frequencies (Table 2)

One of the aims of this study was to compare the allele and genotype frequencies of these three SNPs in terms of COVID-19 severity. However, no statistically significant difference was observed between patients having severe COVID-19 in intensive care and outpatients (Table 3).

Table 2. Association between genotype and sex of the COVID-19 patients.

NF-κB1/B1A polymorphism		Female, n (%) (84)	Male, n (%) (132)	p-value	OR (95%CI)
-94ins/del	W allele	89(52.98)	78(59.10)		
(rs28362491)	D allele	79(47.02)	54(40.90)	0.290	1.28(0.81-2.03)
	WW	16(19.04)	19(28.79)		
Genotype	WD	57(67.86)	40(60.61)	0.183	1.70(0.78-3.68)
	DD	11(13.10)	7(10.60)	0.288	1.87(0.58-5.94)
3'UTR A/G	A allele	62(36.99	48(36.36)		0.98(0.80-1.59)
(rs696)	G allele	106(63.01)	84(63.64)	0.923	
	AA	10(11.90)	10(15.15)		
Genotype	AG	42(50.00)	28(42.42)	0.425	1.50(0.55-4.07)
	GG	32(38.10)	28(42.43)	0.796	1.14(0.41-3.15)
-826 C/T	C allele	83(50.00)	69(52.27)		
(rs2233406)	T allele	85(50.00)	63(47.73)	0.622	1.12(0.71-1.77)
Genotype	CC	25(29.77)	16(24.24)		
	CT	33(39.28)	37(56.06)	0.159	0.57(0.26-1.25)
	TT	26(30.95)	13(19.70)	0.597	1.28(0.50-3.19)

Table 3. Association between severe and mild COVID-19 patients.

NF-κB1/B1A polymorphism		Severe (%)	Mild (%)	p-value	OR (95%CI)
-94ins/del	WW genotype	5(33.33)	32(23.70)		
(rs28362491)	WD genotype	8(53.33)	88(63.18)	0.367	0.58(1.77-1.96)
	DD genotype	2(13.34)	15(11.11)	0.859	0.85(0.14-4.91)
3'UTR A/G	AA genotype	2(13.33)	19(14.07)		
(rs696)	AG genotype	5(33.33)	64(47.41)	0.733	0.74(0.13-4.31)
	GG genotype	8(53.34)	52(38.52)	0.648	1.46(0.28-7.50)
-826 C/T	CC genotype	4(26.67)	33(24.44)		
(rs2233406)	CT genotype	7(46.67)	76(56.30)	0.677	0.76(0.21-2.77)
	TT genotype	4(26.66)	26(19.26)	0.750	1.27(0.29-5.65)

DISCUSSION AND CONCLUSION

The COVID-19 pandemic is a viral infection that has become a public health problem in a short time and consists of various clinical stages. Patients may develop serious complications if a balanced immune response to viral infection is not established in the early stages. Acute Respiratory Distress Syndrome caused by the cytokine storm in COVID-19 has been shown to be an important cause of death. Therefore, suppressing the cytokine storm is critical to reduce mortality in COVID-19 patients. Activated transcription factors, including NF-κB, are activated to stimulate cytokine genes. Thus, released cytokines limit viral spread through paracrine effects as well as IFN-mediated gene stimulation.[15] Since NF-κB triggers the production of acute inflammatory mediators in various cells, it has been used in many in vivo and in vitro studies to elucidate the pathogenesis of respiratory viral infections and lung-related diseases.[16] NF-κB is an important regulator of differentiating

and activating T cells and other innate immune cells. Therefore, dysregulation of NF-κB can lead to an uncontrolled and pathogenic inflammatory response. Interestingly, upregulation of NF-κB was observed to be involved in developing *SARS-CoV-2* infection.[17] *SARS-CoV-2* can trigger an uncontrolled inflammatory response. Since NF-κB is involved in the inflammatory process, it is especially important to find compounds that will prevent the activation of this pathway. Therefore, this study aimed to discuss the role of a variant of NF-κB genes in the pathogenesis and treatment of COVID-19.

In this study, we examined the association between the severity of COVID-19 disease and NF-κBI -94 ins/del, NF-κBIA 3'UTR A→G, NF-κBIA -826 C/T polymorphisms. With this study, allele and genotype frequencies of NF-κBI -94 ins/del, NF-κBIA 3'UTR A→G, and NF-κBIA -826 C/T were determined for the first time in a Turkish population. In addition, it was determined whether there was a statistical difference between male and female individuals in terms of genotype and allele distributions. In addition, haplotype distributions and whether there is a statistical difference for these SNPs in COVID-19 disease were also determined.

The distribution of the mutant D allele in the NF-κBI -94 ins/del polymorphism was studied in different populations, and it was found that the frequency of this allele varied from 32% to 60%, and this frequency was 33.83% in our study.[8,18] Considering whether there was a statistically significant difference, our findings showed that the allele frequency of the D allele was significantly higher in the case group (44.04%), and the D allele may be a risk allele for COVID-19 (Table 1). There was also no significant difference in the disease severity between males and females (Table 2 and Table 3). Looking at some studies conducted in recent years, it was found that the D allele frequency was 38.5% in the Polish population,[19] 48.6% in the Indian population,[20] and 60% in the Western Chinese population.[21] We found a significant difference in WD and DD genotypes between COVID-19 patients and controls ($p<0.001$, $p=0.038$, respectively) (Table 1). We also found that individuals with WD and DD genotypes had approximately 2.5 higher risk for COVID-19 than individuals with WW genotype (odds ratio=2.45, odds ratio=2.19, respectively) (Table 1). A study found that the DD genotype significantly increased the risk of HCV infection compared to the WW genotype in rs28362491 polymorphism.[22] In another study conducted in line with our study, the DD genotype increased the risk in individuals with persistent HCV infection.[23] In a study conducted by Arslan et al.,[13] a comparison of WW genotypes with both WD and DD genotypes revealed that the difference between Crimean Congo Hemorrhagic Fever patients and controls was statistically significant.[13]

Regarding the NF-κB1A 3'UTR A/G polymorphism, mutant G allele distributions have been studied in different populations to date, and the frequency of this allele has been found between 38% and 52%. The mutant G allele frequency was found to be 38.7% in Alzahra,[24] 51.9% in Morocco, and [23] and 45% in Northern Spain.[25] Regarding NF-κB1A 3'UTR A/G polymorphism, both alleles and genotypes were found to be significant in COVID-19 patients compared to reference alleles and genotypes. The mutant G allele was statistically significant between patients and controls, and individuals carrying the G allele were found to be 2.5 times more at risk than individuals carrying the A allele ($p<0.001$, OR=2.52) (Table 1). We found a statistically significant difference in AG and GG genotypes between COVID-19 patients and controls ($p<0.001$; $p<0.001$) (Table 1). We also found that individuals with AG and GG genotypes had a 3.5-fold and 9.5-fold higher risk compared to individuals with AA genotype (OR=3.52; OR=9.52; respectively) (Table 1). Recently, a study conducted by Camblor and colleagues found that the NF-κBIA rs696 GG genotype was statistically significantly increased in the patient group compared to healthy population controls.[24] Remarkably, bronchoalveolar lavage samples from patients with critical COVID-19 compared with non-COVID-19 pneumonia and normal lung identified NF-κBIA as an upregulated gene in this disease.[26] The NF-κBIA gene encodes IκBa, a key inhibitor of NF-κB signalling that acts by blocking the translocation of RelA/p50 active dimers to the nucleus.[7] The G allele has been associated with decreased NF-κBIA mRNA stability and lower inhibitory activity in vitro.[27,28] Less inhibition of rs696 G allele, NF-κB may promote proinflammatory signalling of the pathway, thereby increasing the risk of COVID-19 complications and intensive care unit admission. Another viral disease study observed a positive correlation between NF-κBIA polymorphisms and disease progression, impaired liver function, and elevated serum levels of the cytokines TNF -α and IL-6 in patients with chronic HBV.[29] Based on our findings, together with those of previous studies, mutations in some NF-κBIA polymorphisms may lead to decreased NF-κBIA activity and subsequent overexpression of NF-κB, followed by activation of NF-κB, which further intensifies liver injury by inducing secretion of multiple cytokines.

In studies, the mutant T allele in NF-κB1A -826C/T polymorphism was found at different frequencies. This allele distribution was 6.2% in Romania.[29] In the Turkish population, this allele was 20.15%. Statistically significant differences were found in NF-κB1A -826C/T polymorphism in terms of both allele and genotype distribution. In the patient group, the T

allele was found to be statistically significant compared to the control group, and individuals with the T allele were found to be approximately four times more risky than individuals with the C allele (Table 1). Regarding genotype distributions, individuals with CT and TT genotypes were statistically significant compared to individuals with CC genotypes. Individuals with CT and TT genotypes were approximately 3-fold and 23-fold at risk for COVID-19 disease compared to individuals with CC genotype (Table 1, respectively). Lin et al.[8] proposed that mutations in some NF-κBIA polymorphisms may lead to reduced NF-κBIA activity and subsequent overexpression of NF-κB. Subsequent activation of NF-κB would further intensify liver damage by inducing the secretion of multiple cytokines. A study showed that rs2233406 increased the risk of developing autoimmune or inflammatory diseases 2.11-fold.[30] In our study, in line with these data, it was shown that individuals with TT genotype in rs2233406 polymorphism had a 23-fold higher risk of developing COVID-19 disease compared to individuals with CC genotype, and this risk was statistically significant (Table 1). Our haplotype analysis also showed that WGC, DAC, DAT, DGC, and DGT haplotypes were important in the risk of developing COVID-19 (Table 1). Individuals with the DGT haplotype have a 10-fold higher risk of developing COVID-19 (Table 1; $p<0.001$, OR=10.00).

In our study, we also compared COVID-19 on the basis of gender and severity of the disease, but we did not find a statistical relationship between the disease and gender. Likewise, we did not find any relationship in the comparison made according to severity.

In conclusion, allele and genotype frequencies of NF-κB1-94ins/del, NF-κB1A 3'UTR A/G, and NF-κB1A -826 C/T polymorphisms were higher in COVID-19 patients compared to healthy controls. NF-κB1-94ins/del, NF-κB1A 3'UTR A/G and NF-κB1A -826 C/T mutant genotypes may increase susceptibility to COVID-19 disease. However, more comprehensive studies are needed for these polymorphisms, especially in terms of protein levels or gene expression levels.

Ethics Committee Approval: This study was performed in line with the principles of the Declaration of Helsinki. Approval was granted by the Ethics Committee of Sivas Cumhuriyet University (Decision No: 2021-02/07).

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

Author Contributions: Concept NÖŞ, BB; Supervision NÖŞ, SA, MB; Materials SB, MB; Data Collection and/or Processing – NÖŞ, BB, SB; Analysis and/or Interpretation –NÖŞ, BB, SB; Writing –NÖŞ, BB, SB, SA, MB.

Peer-review: Externally peer-reviewed.

Financial Support: This study was supported by the Scientific Research Council of Sivas Cumhuriyet University (Grant number: F-2021-635), Sivas, Türkiye.

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OTJHS
Online Turkish Journal of Health Sciences

e-ISSN: 2459-1467

OTSBD
Online Türk Sağlık Bilimleri Dergisi

Online Turkish Journal of Health Sciences 2025;10(1):22-28 *Online Türk Sağlık Bilimleri Dergisi 2025;10(1):22-28*

Evaluation of Turkish Medical Researchers' Affecting Factors for Journal Selection Decisions

Türk Tıp Araştırmacılarının Dergi Seçim Kararlarını Etkileyen Faktörlerin Değerlendirilmesi

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ABSTRACT

Objective: This study aimed to investigate the factors affecting Turkish medical researchers' choice of journals for publication.

Materials and Methods: This study is an online cross-sectional survey study. The participants with at least one Pubmed/MEDLINE indexed published paper were recruited non-random from the Turkish Medical Network Telegram group. The questionnaire consisted of 18 questions and three sections; the first part included open-ended questions, the second part included questions about the factors affecting journal selection, and the third part included participants who were asked if they had paid for publication for any reason.

Results: The study included 353 Turkish medical researchers, with a median age of 38 and 50.9% female. Bibliometric scores, publication fees, and overall prestige/reputation were the most influential factors affecting journal selection. The availability of a suitable manuscript, turnaround times, international contributions, previous experiences with the journal, and ease of submission were also significant factors.

Conclusions: This study demonstrates that the participants consider the publication objectives, relevance, and important selection criteria before they make a clear decision.

Keywords: Citation index, impact factor, journal selection, Turkish medical researchers

ÖZ

Amaç: Bu çalışma, Türk tıp araştırmacılarının makalelerini yayımlamak için dergi seçimini etkileyen faktörleri araştırmayı amaçlamıştır.

Materyal ve Metot: Bu çalışma, çevrimiçi kesitsel bir anket çalışmasıdır. En az bir PubMed/MEDLINE dizinli yayımlanmış makalesi bulunan katılımcılar, Türk Medikal Ağı Telegram grubundan rastgele olmayan yöntemle seçilmiştir. Anket, üç bölümden ve 18 sorudan oluşmuştur; birinci bölüm açık uçlu soruları, ikinci bölüm dergi seçiminde etkili olan faktörlere ilişkin soruları, üçüncü bölüm ise katılımcıların herhangi bir nedenle yayımlama ücreti ödeyip ödemediklerini içermektedir.

Bulgular: Çalışmaya medyan yaşı 38 olan ve %50.9'u kadın olan 353 Türk tıp araştırmacısı katılmıştır. Dergi seçiminde bibliyometrik skorlar, yayımlama ücretleri ve genel prestij/itibar en etkili faktörler arasında yer almıştır. Ayrıca, uygun bir makale bulunabilirliği, geri dönüş süreleri, uluslararası katkılar, dergiyle önceki deneyimler ve başvuru kolaylığı da önemli faktörler arasında yer almıştır.

Sonuç: Bu çalışma, katılımcıların dergi seçimi yapmadan önce yayımlama hedeflerini, konuya uygunluğunu ve önemli seçim kriterlerini dikkate aldıklarını ortaya koymaktadır.

Anahtar Kelimeler: Atıf indeksi, dergi seçimi, etki faktörü, Türk tıp araştırmacıları

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Yayın Bilgisi / Article Info:
Gönderi Tarihi/ Received: 23/08/2024
Kabul Tarihi/ Accepted: 26/12/2024
Online Yayın Tarihi/ Published: 17/03/2025

Atıf / Cited: Etçioğlu E and et al. Evaluation of Turkish Medical Researchers' Affecting Factors for Journal Selection Decisions. *Online Türk Sağlık Bilimleri Dergisi* 2025;10(1):22-28. doi: 10.26453/otjhs.1536214

INTRODUCTION

The production and transfer of academic information are for the benefit of both society and researchers. Moreover, academic publication serves many purposes, including increasing peer recognition and providing career opportunities.[1,2]

Preparing an article and getting it published in a journal is a complex process. Authors must complete all required phases of the publication process, including execution, writing, editing, drafting, formatting, and identifying the peer-reviewed journals they are targeting to publish an article that results in a successful publication goal.[3] Choosing the best journal for a written work can be challenging, even for experienced authors. Selecting a journal involves considering a variety of factors (such as the peer review process, the target audience of the journal, the type of articles accepted, the publishing model used, etc.). Therefore, choosing the right journal can save time for both authors and publishers.[4,5]

The following criteria must be met to write and publish a journal article successfully: choosing an appropriate topic, understanding the publication's audience, framing the article in the appropriate style, cooperating with the journal editor to produce an acceptable manuscript, including positively responding to the editor's criticisms and suggestions; and adhering to all submission guidelines and deadlines. Journal writing can be an exacting, demanding, frustrating, and incredibly satisfying professional activity for someone who sees it through to its successful conclusion.[6] Preparing, submitting, and properly revising a manuscript can be challenging. Any deficiencies in these procedures may result in the rejection of a manuscript or dissatisfaction of the author.[3] Considering all these factors, choosing the ideal journal is difficult. Although there are various articles on this subject, the criteria have not yet been clarified.[7-9]

In this study, we aimed to evaluate the journal selection decisions of Turkish researchers in the medical field and the factors affecting these decisions. By identifying these elements, the research aims to aid both novice and experienced authors in making informed choices. Additionally, the findings can guide journal editors and publishers in improving their services to meet researchers' needs better, enhancing the publication process.

MATERIALS AND METHODS

Ethics Committee Approval: Our study was approved by the Sakarya University Faculty of Medicine Ethics Committee (Date: 16.04.2021, decision no: E-71522473-050.01.04-25241-247). This study was conducted with ethical principles for medical research described in the Declaration of Helsinki. Participants were informed of the purpose of the survey online, and consent was obtained online as well. All personal identifiers regarding participant data were removed during analysis to preclude personal identification.

Study design: This study is an online cross-sectional survey study.

Participant recruitment and sampling: Participants with at least one Pubmed/MEDLINE-indexed published paper were recruited non-random from the Turkish Medical Network Telegram app group, which includes more than 3.000 confirmed academic members. The members who showed interest received a written description of the project and were subsequently contacted with a link for the survey. Surveys were conducted via an online questionnaire between March 1st and April 30th, 2022, due to COVID-19 precautions. The questionnaire was piloted for face validity within a small representative sample of 14 medical professionals, and the final version was further tested online among several non-participating medical professionals.

Study tool: After reviewing relevant surveys, editorials, and review papers on the factors that influence the selection of a journal for publication, the authors prepared a questionnaire consisting of 18 questions and three sections, with an estimated time to complete of less than 5 minutes.

The first section included questions for age, sex, academic title, major field of study, years of practice, years as a lecturer, years since the first publication, and number of publications (papers indexed in Pubmed/MEDLINE, all published articles, books, or book chapters), which were gathered by open-ended questions.

The second section included questions regarding factors that affect journal choice. For factors associated with journal choice, participants were asked to choose from a pre-determined list including overall prestige/reputation of the journal, journal editors and editorial board, citation indexes, international contribution, scientometric data, publishing fees, previous experience with the journal, having a study which has a good fit with the journal, the turnaround time, and ease of submission. Participants were further asked to choose their citation index(es) that influenced their journal choice, including Science Citation Index (SCI)-Expanded (SCIE), Social Sciences Citation Index (SSCI), Arts and Humanities Citation Index (AHCI), ESCI (Emerging Sources Citation Index), EBSCO, Scopus, DOAJ (Directory of Open Access Journals) and TRIndex (Turkish Citation Index), developed by The Scientific and Technological Research Council of Türkiye (TÜBİTAK)/ Turkish Academic Network and Information Center (ULAKBİM), is a bibliographic / full-text database

containing articles and journals in the main subjects of Dentistry, Pharmacy, Engineering, Basic Sciences, Health Sciences, Veterinary, Social and Human Sciences. Participants chose the scientometric data that influenced their journal choice from a list that included Journal Impact Factor (JIF), Hirsch (H)-Index, Scientific Journal Ranking (SJR), Eigenfactor, Source Normalized Impact per Paper (SNIP), and Altmetrics. All pre-defined lists for answers also included an "other" choice, in which participants could also write their answers.

In the third section, participants were asked if they had paid for publication for any reason. Responses were categorized as “Yes, for open access,” “Yes, for other reasons (such as publication and page charges),” “The fee was waived,” and “I specifically avoid paid journals”.

Statistics: Analyses were performed using IBM SPSS (Statistic Program for Social Sciences) Statistics for Windows version 23 (IBM Corp., Armonk, NY, USA). Data were presented as median and range or in number and percentage values. Mann Whitney-U tests were used for the comparison of continuous data. A p-value of less than 0.05 was considered statistically significant.

RESULTS

A total of 353 Turkish medical researchers with at least one Pubmed/MEDLINE-indexed paper were included in the study. The median age was 38 years, and women and men approximately equally participated in the survey. The majority of participants (n=220, 62.3%) held the title of specialist, while one -third held the title of professor. Only 13 (3.7%) of the participants were residents. More than half of the participants (n=237, 67.2%) were from clinical sciences. Participants practiced medicine for a median of 11 years and were teaching medicine for a median of 5 years. The median year from the first publication was five years, with a median of four publications indexed in Pubmed/MEDLINE and eight publications overall (Table 1).

Table 1. Characteristics of participants.

Characteristics		Data
Gender, n (%)	Female	180 (50.9)
	Male	173 (49.1)
Academic title, n (%)	Resident	13 (3.7)
	Specialist	220 (62.3)
	Assistant Professor	93 (26.4)
	Associate Professor and Professor	27 (7.6)
Field of practice, n (%)	Basic sciences	28 (7.9)
	Clinical sciences	237 (67.2)
	Surgical sciences	88 (24.9)
Years of practice: Median (min-max) years		11 (1-33)
Years as a lecturer: Median (min-max) years		5 (0-25)
Years since first publication: median (min-max) years		5 (1-20)
Number of publications: Median (min-max) values	Papers indexed in Pubmed/MEDLINE	4 (1-95)
	All papers	8 (1-207)
	Books or book chapters	2 (0-42)

Data were presented as frequency (percentage) for categorical variables and median (minimum-maximum) for continuous variables.

Three hundred thirty-five participants (94.9%) considered citation indexing as a factor in their journal selection. Other highest-ranking factors were scientometric scores, publishing fees, the overall prestige/ reputation of the journal and having a study that fits the journal well. Less than twenty percent of the participants reported that turnaround time, international contribution, previous experiences with the journal, ease of submission, and the editors and editorial board affected their journal choice (Table 2).

When participants were asked which citation indexes affect their journal choice, all participants unanimously chose SCIE as the primary index. Only 126 (35.7%) participants used the TR Index as a citation index to choose journals, with other indexes used to a lesser extent. When choosing a journal, three hundred and twenty-three (91.5%) participants relied on JIF as the primary scientometric data. The second most influential scientometric data was the H-index, with 166 (47%) of the participants reporting it as a factor that influenced their decision and others to a lesser extent (Table 3).

Table 2. Factors influencing the journal selection of participants.

Factors	n (%)
Citation indexing	335 (94.9)
Scientometric data	156 (44.2)
Publishing fees	153 (43.3)
Overall prestige/reputation	136 (38.5)
Study with a good fit to the journal	99 (28)
Turnaround time	59 (16.7)
International contribution	54 (15.3)
Previous experience with the journal	36 (10.2)
Ease of submission	21 (5.9)
Editors and editorial board	9 (2.5)

Data were presented as frequency (percentage) for categorical variables.

Table 3. Citation indexes and scientometric data influencing the journal selection of participants.

Index Status		n (%)
Citation index	SCIE	353 (100)
	TR Index	126 (35.7)
	ESCI	88 (24.9)
	SSCI & AHCI	64 (18.1)
	Scopus	48 (13.6)
	Others*	16 (4.5)
Scientometric data	JIF	323 (91.5)
	H-index	166 (47)
	SJR	27 (7.6)
	Others**	11 (3.1)

Data were presented as frequency (percentage) for categorical variables. SCIE; Science Citation Index-Expanded, TRIndex; Turkish Citation Index, ESCI; Emerging Sources Citation Index, SSCI; Social Sciences Citation Index, AHCI; Arts and Humanities Citation Index. Others* include the Directory of Open Access Journals (DOAJ) and EBSCO. JIF; Journal Impact Factor, H-index; Hirsch index, SJR; Scientific Journal Ranking. Others** include the Eigenfactor, Altmetrics, and 5-year impact factor.

Participants who preferred using scientometric data were practicing medicine for 2.5 years longer than those who did not (12 years vs. 9.5 years, Mann-Whitney U test, p=0.006). Moreover, they had four more publications (10 publications vs. 6 publications, Mann-Whitney U test, p=0.004). Similar differences were also observed in participants who used "having a study that fit the journal well" as a factor for journal choice; these participants were practicing medicine for three years longer (13 years vs. 10 years, Mann-Whitney U test, p=0.003), and had three more publications (11 publications vs. 8 publications, Mann-Whitney U test, p=0.044) (Table 4). Nearly half of the participants (n=164, 46.5%) reported having previous experiences with paid journals for various reasons: 114 (32.3%) had paid page, figure, or submission charges, and 50 (14.2%) paid Open Access (OA) article publishing charges. None of the participants reported a fee waiver; the remaining 189 (53.5%) expressed that they avoid journals requiring authors to pay any fees for article publishing (Table 5).

Table 4. Association between participants' characteristics and journal selection factors.

Factor	Group	Median years of practice	p-value	Median number of publications	p-value
Preferred using scientometric data	Practicing participants	12	p=0.006	10	p=0.004
	Non-practicing participants	9.5		6	
Journal choice: fit to journal	Considered important	13	p=0.003	11	p=0.044
	Not considered important	10		8	

Mann-Whitney U test

Table 5. Payment practices and preferences of participants regarding journal publication fees.

Category	n (%)
Previously paid journals for publication	164 (46.5)
- Paid page, figure, or submission charges	114 (32.3)
- Paid only OA article publishing charges	50 (14.2)
Fee waivers reported	0 (0)
Avoid journals requiring fees	189 (53.5)

Data were presented as frequency (percentage) for categorical variables; OA: Open Access.

DISCUSSION AND CONCLUSION

Choosing the right journal for an article is a crucial decision that affects the pre-publishing process and the article's success post-publication. It impacts the article's visibility, the effectiveness of the research findings in the literature, and the likelihood of receiving citations. This study aims to evaluate the factors that Turkish researchers in the medical field consider when choosing a journal to submit their papers. Herein, we demonstrated that among the factors affecting journal selection, participants were mainly influenced by the citation index. High-quality and respected journals are usually well-indexed; this broader extent in their bibliographic database makes the journal more available.[10] In this context, the researchers participating in our study prefer to have their articles published in a high-quality and respected journal. SCIE, an index that hosts the most respected and high-impact factor journals in today's academic world, was uniformly defined as the index that affected the participants' journal selection.[11] While our results demonstrate that citation indexes seem to play a pivotal role in journal selection for researchers seeking high-quality publication opportunities, it is essential to recognize that not all well-indexed journals maintain the same level of academic rigor, highlighting the need for careful evaluation beyond indexing alone, noting that Turkish researchers may need to be informed on the topic.[10]

Journal ranking via scientometric indexes is a quantitative approach mainly based on paper and citation counts that aims to inform researchers and help guide academic institutions. Herein, we demonstrated that Turkish researchers value scientometric data after the citation index for journal selection. Scientometric data, used as a measure to evaluate and rank the prestige of a journal, was also noted as an important criterion for journal selection in other countries as well.[12] In our study, the participants stated that JIF affected the journal selection the most among the scientometric data. JIF reflects the average annual number of citations of articles published in the journal over the past two years and is reported annually by the Journal Citation Reports (JCR).[13] While journals with high JIF are often perceived as more prestigious, there is considerable misusage associated with this metric.[14] In light of these concerns, the San Francisco Declaration on Research Assessment (DORA) has advocated reducing reliance on JIF as an incentive factor.[15] Rather than using JIF alone, using multiple scientometric data during the journal selection process can provide a more robust evaluation of journal quality.[16] While we demonstrate that JIF remains a significant influence in journal selection among Turkish researchers, educating researchers to incorporate various data to ensure a more comprehensive and accurate assessment of journal quality is crucial.

Some journals may request a fee during article submission or publication. The journals that employ a pay-to-publish mandatory open-access model and the costs of open-access publishing are increasing yearly.[17] While previous studies have shown that publishing open access increases the number of citations, the findings remain inconclusive and depend on the research area.[18,19] In our study, participants had negative opinions about journals that charge authors for open-access publishing. High fees, paying in different currencies, exchange differences, and other expenses (laboratory kit, transportation, etc.) made until the publication stage are inevitable causes of this result.

Once an article is submitted to a journal, it enters into a phase where it cannot be submitted to another journal's evaluation until a reply is received. Therefore, the turnaround time of a journal becomes a crucial factor in journal selection.[20] The literature suggests that authors should control the average number of days for editorial review, the average time for peer review, and the average time from acceptance of the article to publication, which is included in the journal information prior to submitting a paper.[20] In line with these suggestions, our study participants noted that the turnaround time is among the important criteria for journal selection.

As journals are usually published by international academic societies with different missions and visions for shaping the literature, editorial policies regarding journal purpose and aims play a crucial role in defining 'the goodness of fit' of an article for journal selection.[20] Therefore, when submitting a paper to a journal, the paper should be relevant to the subject and should be compatible with the journal's purpose and aims, as having a bad fit is one of the most common reasons for rapid rejection in the medical field.[21] Only a quarter of our participants reported that they consider "good fit to the journal" as a criterion in selecting journals. Despite the significance, it is concerning that only a minority of participants recognizes it as a criterion, which highlights the need for greater awareness and education among researchers regarding the importance of understanding editorial policies and journal alignment.

In our study, participants who stated that they preferred scientometric data of journals as a criterion had been practicing medicine for a longer period than those who did not, and these participants had a higher number of publications. The professional experience of participants who were considered a 'good fit for the journal' as one of the criteria for journal selection was also significantly higher, and they had a greater number of publications. Similarly, the literature suggests that the level of experience

plays a significant role in the journal selection process and the factors influencing it.[22]

In conclusion, our study offers a unique perspective on the journal selection process of Turkish researchers in the medical field. Understanding the reasons and methods behind their choice of publication platform is crucial in the ever-expanding information landscape. Choosing a journal for publication is a complex decision influenced by various factors. Our study underscores the significant roles of citation indexes and scientometric data, particularly JIF, in shaping journal preferences. Other factors, such as publication fees and turnaround times, also play a crucial role. Lastly, ensuring that the article aligns well with the journal's scope is revealed as an important factor, as any misalignment can result in swift rejection. It is worth noting that apart from showing the current landscape of journal selection criteria used by Turkish researchers, our study also underlines those educating researchers on the correct use of citation indexes and scientometric data remains a significant challenge, which ultimately will enhance the effectiveness of their publication strategies. There are several limitations in this study. The non-random selection of participants, who were instead recruited voluntarily from the Turkish Medical Network Telegram group, represents a limitation of this study. However, the insights gained from this sampling approach, which inherently includes only researchers active on this specific digital platform, are significant. While the findings may not be generalizable to the broader population of Turkish medical researchers, they provide a valuable perspective. There is a need for studies that include a more significant number of participants and where academic and non-academic authors can be examined in detail.

Ethics Committee Approval: Our study was approved by the Sakarya University Faculty of Medicine Ethics Committee (Date: 16.04.2021, decision no: E-71522473-050.01.04-25241-247).

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

Author Contributions: Concept – EE, CÖ, EE, GT; Supervision – EE, CÖ, EE, GT; Materials – EE, CÖ, EE, GT; Data Collection and/or Processing – EE, CÖ, EE, GT; Analysis and/or Interpretation – EE, CÖ, EE, GT; Writing – EE, CÖ, EE, GT.

Peer-review: Externally peer-reviewed.

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OTJHS
Online Turkish Journal of Health Sciences

e-ISSN: 2459-1467

OTSBD
Online Türk Sağlık Bilimleri Dergisi

Online Turkish Journal of Health Sciences 2025;10(1):29-37 *Online Türk Sağlık Bilimleri Dergisi 2025;10(1):29-37*

Post-Traumatic Stress Disorder, Sleep Problems and Nutritional Status after the 7.8 and 7.5 Magnitude Earthquakes in Kahramanmaraş, Türkiye: A Cross-Sectional Study

Kahramanmaraş, Türkiye'de 7.8 ve 7.5 Büyüklüğündeki Depremler Sonrası Travma Sonrası Stres Bozukluğu, Uyku Sorunları ve Beslenme Durumu: Kesitsel Bir Çalışma

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ABSTRACT

Objective: This study aimed to evaluate post-traumatic stress disorder (PTSD), depression, stress, anxiety levels, sleep problems, and nutritional status among earthquake survivors.

Materials and Methods: This cross-sectional study was conducted nine months after the 2023 Kahramanmaraş earthquakes with 201 adult earthquake survivors, including 87 men and 114 women, with a mean age of 29.46 ± 12.19 years. An online questionnaire including demographic characteristics, the Impact of Event Scale (IES-R), Depression Anxiety Stress Scale, the PTSD Symptom-Self Report Scale (PSS-SR), Insomnia Severity Index (ISI), and food frequency questionnaire was performed. Participants self-reported their height and body weight before and after the earthquake. The scales were correlated and compared with gender.

Results: According to the PSS-SR classification, 58.3% of participants had severe and 11.9% had extremely severe PTSD symptoms. Additionally, 51.2% experienced extremely severe anxiety, and 75.6% had insomnia. There was a moderate positive correlation between IES-R and stress (r: 0.634, p<0.001), anxiety (r: 0.589, p<0.001), depression (r: 0.610, p<0.001), ISI (r: 0.492, p<0.001), and PSS-SR (r: 0.696, p<0.001). Nutrient intake was adequate according to the RDA, but there were significant differences in body weight and body mass index before and after the earthquake (p<0.001).

Conclusions: The earthquakes significantly affected survivors, leading to a high burden of psychiatric disorders. It is essential to strengthen public health services in this area.

Keywords: Earthquakes, insomnia, nutritional status, post-traumatic, stress disorders

ÖZ

Amaç: Bu çalışmada depremzedelerde travma sonrası stres bozukluğu (TSSB), depresyon, stres, anksiyete düzeyleri, uyku sorunları ve beslenme durumunun değerlendirilmesi amaçlanmıştır.

Materyal ve Metot: Bu kesitsel çalışma, 2023 Kahramanmaraş depremlerinden dokuz ay sonra, yaş ortalaması 29,46 ± 12,19 yıl olan 87 erkek ve 114 kadın olmak üzere 201 yetişkin depremzede ile gerçekleştirilmiştir. Demografik özellikler, Olay Etkisi Ölçeği (IES-R), Depresyon Anksiyete Stres Ölçeği, TSSB Belirtileri Ölçeği-Kendini Değerlendirme (TSSBÖ-KD), Uykusuzluk Şiddeti İndeksi (UŞİ) ve besin tüketim sıklığını içeren online bir anket uygulanmıştır. Katılımcıların beyanı ile depremden önce ve sonra boy ve vücut ağırlıkları alınmıştır. Ölçekler ilişkilendirilmiş ve cinsiyetler arası karşılaştırılmıştır.

Sonuçlar: TSSBÖ-KD sınıflandırmasına göre, katılımcıların %58,3'ü şiddetli ve %11,9'u çok şiddetli TSSB semptomlarına sahiptir. Ayrıca, %51,2'si çok şiddetli anksiyete ve %75,6'sı uykusuzluk yaşamaktadır. IES-R ile stres (r: 0,634, p<0,001), anksiyete (r: 0,589, p<0,001), depresyon (r: 0,610, p<0,001), UŞİ (r: 0,492, p<0,001) ve TSSBÖ-KD (r: 0,696, p<0,001) arasında orta düzeyde pozitif bir korelasyon bulunmuştur. Besin alımı RDA'ya göre yeterlidir, ancak deprem öncesi ve sonrasında vücut ağırlığı ve beden kütle indeksinde anlamlı farklılıklar vardır (p<0.001).

Sonuç: Depremler hayatta kalanları önemli ölçüde etkilemiş ve yüksek psikiyatrik bozukluk yüküne yol açmıştır. Bu alanda halk sağlığı hizmetlerinin güçlendirilmesi elzemdir.

Anahtar Kelimeler: Beslenme durumu, depremler, stres bozuklukları, travma sonrası, uykusuzluk

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Yayın Bilgisi / Article Info:
Gönderi Tarihi/ Received: 24/09/2024
Kabul Tarihi/ Accepted: 14/01/2025
Online Yayın Tarihi/ Published: 17/03/2025

Atıf / Cited: Bayram HM and et al. Post-Traumatic Stress Disorder, Sleep Problems and Nutritional Status after the 7.8 and 7.5 Magnitude Earthquakes in Kahramanmaraş, Türkiye: A Cross-Sectional Study. *Online Türk Sağlık Bilimleri Dergisi* 2025;10(1):29-37. doi: 10.26453/otjhs.1555533

INTRODUCTION

Türkiye is a significant earthquake zone due to its location.[1] The country is surrounded by seismically active boundaries and interactions with various crustal types and tectonic styles, which contribute to the seismicity in and around Türkiye.[2,3]

An earthquake is a natural phenomenon characterized by the sudden release of energy in the Earth's crust, resulting in seismic waves.[4] While earthquakes cannot be prevented, their impact can be minimized through adequate precautions.

The effects of an earthquake can include acute stress disorder, which may later develop into post-traumatic stress disorder (PTSD). PTSD is characterized by symptoms of reliving the event, blunting, avoidance, and hyperarousal.[5] Chronic depression, generalized anxiety and PTSD have been reported to affect at least 50% of earthquake survivors.[6] Furthermore, anxiety symptoms, ranging from %9 to 57, have been shown to be the most common psychiatric morbidity.[7] The magnitude of the earthquake, household quality, social support and baseline mental health are generally associated with the variation in these estimates.[7,8]

It has also been shown that changes in eating behaviour related to changes in appetite and food preferences, including avoiding eating certain products and food groups, are more frequent in people suffering from depression.[9] Changes in eating behavior related to depression can lead to nutrient deficiencies, affecting overall health, including the nervous system's proper functioning. Research has shown that earthquakes can have a significant impact on nutritional status, particularly among vulnerable populations such as children.[10,11] However, no other study evaluating the nutritional status after large-scale earthquakes was found in the literature.

Two earthquakes with magnitudes of 7.8 and 7.5 occurred in Türkiye on 6 February 2023, nine hours apart, with epicentres in Pazarcık and Ekinözü districts of Kahramanmaraş, respectively.[1]

The earthquake severely affected 8 neighbouring provinces, particularly Kahramanmaraş and Hatay. For this reason, in order to improve the post-disaster coping of earthquake survivors and to improve their mental health, it is important to determine the relationship between variables related to stress, anxiety, depression and sleep status, as well as to identify emotional problems. This study aimed to evaluate PTSD, stress, depression, anxiety levels, sleep problems and nutritional status among earthquake survivors. While these issues are commonly observed following major natural disasters, there is a lack of integrated research exploring the interplay between these factors and their cumulative impact on the well-being of affected individuals. By focusing on this multifaceted approach, the study aims to contribute to the literature by providing a deeper understanding of the complex relationships between mental health, sleep and nutritional status in the context of disaster recovery, identifying potential intervention areas and holistic support strategies for earthquake survivors.

MATERIALS AND METHODS

Ethical Considerations: The ethics committee of Istanbul Gelisim University Ethics Committee (Date: 20.11.2023, decision no: 2023/09) approved the study. The study was carried out following the principles of the Declaration of Helsinki.

Participants and Study Design: This cross-sectional study was conducted on earthquake survivors (aged 18-64 years) approximately 9 months after the 2023 Kahramanmaraş earthquakes.

The G*Power software was used for sample selection. Based on a correlation analysis with a medium effect size (r=0.3), a significance level (α) of 0.05, and a power (1-β) of 0.80, it was determined that at least 174 participants. A total of 201 earthquake survivors completed the study. An online questionnaire including demographic characteristics, questions about nutritional behaviours, the Impact of Event Scale-revised (IES-R), Depression Anxiety Stress Scale, PTSD Symptom-Self Report Scale (PSS-SR), Insomnia Severity Index (ISI) and food consumption frequency was performed. Additionally, height and body weight (before and after the earthquake) were taken with the participants' declaration.

Impact of Event Scale: The Impact of Event Scale-Revised (IES-R) was developed as a measure of PTSD symptoms and is a brief, easy-to-administer self-report questionnaire. The validity and reliability of the Turkish version of the scale were evaluated by Çorapçıoğlu et al., and Cronbach's alpha was found to be 0.960.[12] This scale includes 22 items in which the severity of symptoms in the last 7 days is scored between 0-4. It is interpreted as an increase in the level of being affected by events as the total score on the scale increases.[12] Cronbach's alpha was found to be 0.949 in this study.

Depression, Anxiety, and Stress Scale: The Depression Anxiety and Stress Scale (DASS-21) assesses depressive, anxiety, and stress symptoms. The validity and reliability of the Turkish version of DASS-21 were confirmed by Sarıçam, and Cronbach's alpha internal consistency reliability coefficient α=0.870 for the depression subscale, α=0.850 for the anxiety subscale and α=0.810 for the stress subscale.[13] The questionnaire was designed to assess levels of depression, anxiety and stress levels and consisted of seven items for each of the three scales. Items 3, 5, 10, 13, 16, 17, and 21 represent the depression

score; and according to the total score, 0 to 4 means normal, between 5 and 6 of mild depression, 7 to 10 of moderate depression, 11 to 13 of severe depression, and >13 of extremely severe depression. Items 2, 4, 7, 9, 15, 19, and 20 represent the anxiety score, and total scores between 0 to 3 mean normal, between 4 and 5 of mild anxiety, between 6 and 7 of moderate anxiety, between 8 and 9 of severe anxiety, and >9 of extremely severe anxiety. Additionally, items 1, 6, 8, 11, 12, 14, and 18 represent the stress score, and the total scores between 0 and 7 mean normal, between 8 and 9 of mild stress, 10 and 12 of moderate stress, 13 and 16 of severe stress, and >16 are indicative of extremely severe stress.[13] Cronbach's alpha was found to be α= 0.809 for depression subscale, α= 0.830 for anxiety subscale and α= 0.807 for stress subscale in this study.

The PTSD Symptom-Self Report Scale (PSS-SR): The scale was developed to determine PTSD symptoms and possible negative situations. The validity and reliability of the Turkish version of the scale were evaluated by Aydın et al., and Cronbach's alpha was found to be 0.660.[14] PTSD consists of 17 items scored between 0-3 and 5 of the items in the scale question the symptoms of re-experiencing, 7 of avoidance and 5 of increased arousal. The arithmetic sum of 1-5 items gives the re-experiencing score, the arithmetic sum of 6-12 items gives the avoidance score, and the arithmetic sum of 13-17 items gives the arousal score. Cronbach's alpha was found to be 0.929 in this study.

Insomnia Severity Index: The Insomnia Severity Index (ISI) was developed to assess the severity of insomnia. The validity and reliability of the Turkish version of the scale were evaluated by Boysan et al., and Cronbach's alpha was found to be 0.820.[15] Scale items consisting of seven questions are scored between 0-4. Scores that can be obtained from the scale vary between 0-28. Eight and above is defined as insomnia. Cronbach's alpha was found to be 0.897 in this study.

Food Frequency Questionnaire: The semi-quantitative FFQ included 130 food and beverage items, covering a wide range of foods typically consumed by adults in Türkiye, categorized into major food groups such as grains, fruits, vegetables, dairy, meat, and beverages. Participants were asked to report their usual consumption frequency over the past month, with options ranging from "never" to "every day". Portion sizes were estimated using standard household measurements such as cups, spoons, or visual aids, allowing for semi-quantitative estimates of intake. The FFQ assessed intakes of energy, macronutrients (carbohydrates, protein, and fats), and micronutrients (vitamins and minerals).

We determined the daily energy and nutrient intake taken from FFQ using the Nutrient Database (BeBİS, EBISpro for Windows, Germany; Turkish Version, BeBiS 9). Energy and macro- and micronutrient intake results were compared with the Turkish recommended dietary allowance (RDA) according to age and gender.[16] Nutrient intakes <67% of the RDA were considered "inadequate".

Statistical Analysis: All statistical analyses were conducted using IBM SPSS Statistics 24.0. The distribution of variables was verified using the Kolmogorov–Smirnov test. Data are expressed as numbers or means (SD). To compare measured variables (age, the number of main meals and snacks, IES-R total score, stress score, anxiety score, depression score, PSS-SR score, and ISI score), the Mann–Whitney U-test was used for these variables. The chi-squared test was used for categorical variables—the Wilcoxon test was used for comparing body mass index (BMI) and body weight before and after the earthquake. Spearman correlation was used for the correlation of IES-R total score, stress score, anxiety score, depression score, PSS-SR score, ISI score, age and BMI. The p-value ≤ 0.05 was considered statistically significant for the statistical test.

RESULTS

Table 1 shows the general characteristics of participants. The mean age was 29.46±12.19 years, and 57.7% of participants were not employees (p<0.001). 47.8% of participants had economic losses after the earthquake. Additionally, most of the participants (83.6%) ate their main meal in their own house (p: 0.007).

The mean height was 176.38±20.28 cm in men and 164.83±6.89 in women (data not shown). There was a statistical difference between body weight and BMI before and after the earthquake in both genders (p< 0.001) (Figure 1).

Based on the anxiety classification, 51.2% of participants had extremely severe anxiety. According to the depression classification, 22.9% of the participants were classified as severe and 24.9% as extremely severe. 58.3% of the participants had severe PTSD symptoms, and 11.9% had extremely severe PTSD symptoms according to the PSS-SR classification. Most participants (75.6%) were classified as insomnia. No significant differences were found between men and women in these scales (Table 2).

Table 1. General characteristics (n: 201).

		Men (n: 87) n (%)	Women (n: 114) n (%)	Total (n: 201) n (%)	p-value
Age (Mean± SD)		31.07±12.87	28.24±11.55	29.46±12.19	0.590
Place of Residence	Own House	52 (59.8)	67 (58.8)	119 (59.2)	
	Container	9 (10.3)	20 (17.5)	29 (14.4)	0.459
	Tent	4 (4.6)	5 (4.4)	9 (4.5)	
	House of a relative	22 (25.3)	22 (19.3)	44 (21.9)	
Education Level	Primary school	2 (2.3)	6 (5.3)	8 (4.0)	
	Secondary school	18 (20.7)	21 (18.4)	39 (19.4)	
	High school	38 (43.7)	37 (32.5)	75 (37.3)	0.368
	University	28 (32.2)	48 (42.1)	76 (37.8)	
	Master's degree/doctorate	1 (1.1)	2 (1.8)	3 (1.5)	
Employment Status	Employee	59 (67.8)	26 (22.8)	85 (42.3)	**<0.001****
	Unemployee	28 (32.2)	88 (77.2)	116 (57.7)	
Presence of a chronic disease	No	65 (74.7)	76 (66.7)	141 (70.1)	0.276
	Yes	22 (25.3)	38 (33.3)	60 (29.9)	
Economic loss after the earthquake	No	44 (50.6)	61 (53.5)	105 (52.2)	
	Yes	43 (49.4)	53 (46.5)	96 (47.8)	0.776
Main meal (Mean± SD)		2.40±0.49	2.28±0.52	2.33±0.51	0.121
Snacks (Mean± SD)		1.76±0.70	1.91±0.83	1.87±0.79	0.406
The place where the main meal is eaten	House	80 (92.0)	88 (77.2)	168 (83.6)	
	Prepared food area	7 (8.0)	26 (22.8)	33 (16.4)	**0.007***
Meal skipping status	No	34 (39.1)	35 (30.7)	69 (34.3)	0.233
	Yes	53 (60.9)	79 (69.3)	132 (65.7)	
Meal skipped	Breakfast	26 (49.1)	24 (30.4)	50 (37.9)	
	Lunch	26 (49.1)	51 (64.6)	77 (58.3)	0.079
	Dinner	1 (1.8)	4 (5.0)	5 (3.8)	

*: p<0.05; **: p<0.001; The chi-squared test was used for categorical data. Mann–Whitney U-test was used for age, the number of main meals, and snacks.

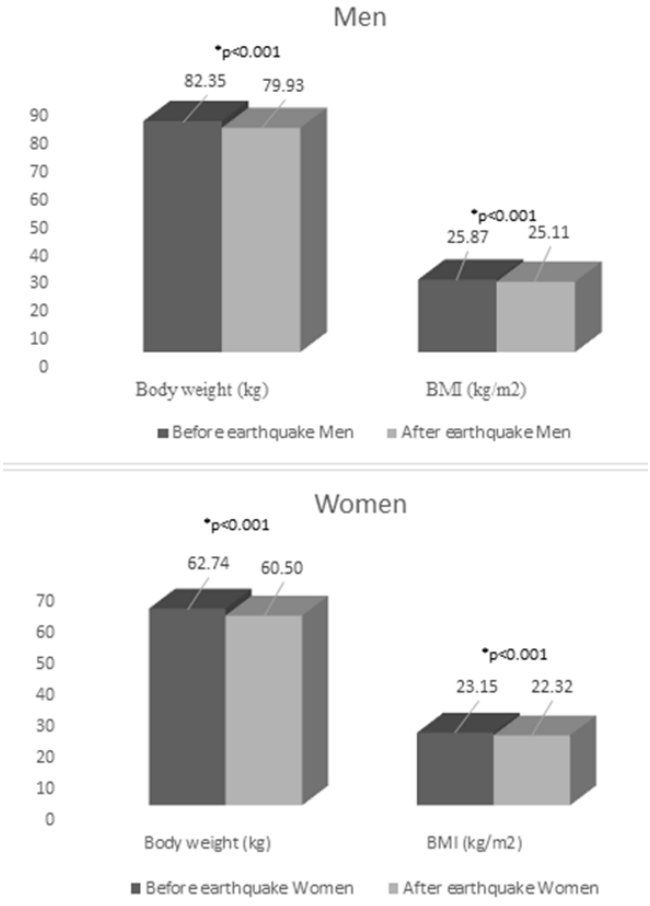

Figure 1. Differences in body weight and BMI before and after earthquake. *: p<0.001; Wilcoxon test.

Table 2. The mean values and classification of IES, DASS-21, PSS-SR, and ISI scales of participants (n: 201).

		Men (n: 87) n (%)	Women (n: 114) n (%)	Total (n: 201) n (%)
IES-R score (Mean ± SD)		43.05±15.59	46.10±16.86	44.78±16.35
Stress score (Mean ± SD)		8.09±3.20	8.29±3.64	8.20±3.45
Stress classification	Normal (0-7 scores)	40 (46.0)	47 (41.2)	87 (43.2)
	Mild (8-9 scores)	21 (24.1)	24 (21.1)	45 (22.4)
	Moderate (10-12 scores)	19 (21.8)	32 (28.0)	51 (25.4)
	Severe (13-16 scores)	7 (8.1)	10 (8.8)	17 (8.5)
	Extremely severe (>16 scores)	-	1 (0.9)	1 (0.5)
Anxiety score (Mean ± SD)		9.29±4.06	9.46±4.45	9.39±4.28
Anxiety classification	Normal (0-3 scores)	8 (9.2)	14 (12.3)	22 (10.9)
	Mild (4-5 scores)	5 (5.7)	7 (6.1)	12 (6.1)
	Moderate (6-7 scores)	18 (20.8)	14 (12.3)	32 (15.9)
	Severe (8-9 scores)	11 (12.6)	21 (18.4)	32 (15.9)
	Extremely severe (>9 scores)	45 (51.7)	58 (50.9)	103 (51.2)
Depression score (Mean ± SD)		10.32±4.25	10.23±4.63	10.27±4.46
Depression classification	Normal (0-4 scores)	5 (5.7)	11 (9.6)	16 (8.0)
	Mild (5-6 scores)	6 (6.9)	9 (7.9)	15 (7.4)
	Moderate (7-10 scores)	37 (42.6)	37 (32.5)	74 (36.8)
	Severe (11-13 scores)	20 (23.0)	26 (22.8)	46 (22.9)
	Extremely severe (>13 scores)	19 (21.8)	31 (27.2)	50 (24.9)
PSS-SR score (Mean ± SD)		24.42±9.15	25.69±11.32	25.14±10.43
PSS-SR classification	Mild PTSD symptoms (<10 scores)	7 (8.0)	14 (12.3)	21 (10.4)
	Moderate PTSD symptoms (11-20 scores)	20 (23.1)	19 (16.6)	39 (19.4)
	Severe PTSD symptoms (21-35 scores)	51 (58.6)	66 (57.9)	117 (58.3)
	Extremely severe PTSD symptoms (>35 scores)	9 (10.3)	15 (13.2)	24 (11.9)
ISI score (Mean ± SD)		11.89±5.51	12.88±5.54	12.45±5.54
ISI classification	Normal	24 (27.6)	25 (21.9)	49 (24.4)
	Insomnia	63 (72.4)	89 (78.1)	152 (75.6)

IES-R: Impact of Event Scale-Revised; PSS-SR: PTSD Symptom-Self Report Scale; ISI: Insomnia Severity Index.

There was a moderate positive correlation between IES-R and stress (r: 0.634, p<0.001), anxiety (r: 0.589, p< 0.001), depression (r: 0.610, p< 0.001), ISI (r: 0.492, p< 0.001) and PSS-SR (r: 0.696, p<0.001). Additionally, PSS-SR showed a strong positive correlation with stress (r: 0.705, p<0.001) for all participants (Table 3).

Table 3. The relationship between age, BMI (after the earthquake), IES-R, stress, anxiety, depression, PTSD, and ISI scores.

		1	2	3	4	5	6	7
Men	1. Age	-						
	2. BMI	**0.480****	-					
	3. IES-R score	0.055	0.043	-				
	4. Stress score	-0.053	-0.075	**0.586****	-			
	5. Anxiety score	-0.056	**0.235***	**0.470****	**0.706****	-		
	6. Depression score	-0.162	**0.282***	**0.534****	**0.617****	**0.605****	-	
	7. ISI score	0.172	-0.054	**0.439****	**0.464****	**0.446****	**0.497****	
	8. PSS-SR score	-0.035	-0.100	**0.618****	**0.576****	**0.522****	**0.587****	**0.499****
Women	1. Age	-						
	2. BMI	**0.281***	-					
	3. IES-R score	0.103	0.013	-				
	4. Stress score	0.053	0.007	**0.570****	-			
	5. Anxiety score	0.153	0.033	**0.602****	**0.760****	-		
	6. Depression score	-0.025	-0.065	**0.583****	**0.801****	**0.707****	-	
	7. ISI score	-0.012	-0.057	**0.483****	**0.527****	**0.467****	**0.522****	-
	8. PSS-SR score	0.049	-0.035	**0.670****	**0.698****	**0.705****	**0.696****	**0.510****
Total	1. Age	-						
	2. BMI	**0.498****	-					
	3. IES-R score	0.017	-0.018	-				
	4. Stress score	-0.023	-0.020	**0.634****	-			
	5. Anxiety score	0.040	-0.057	**0.589****	**0.773****	-		
	6. Depression score	-0.075	-0.104	**0.610****	**0.744****	**0.702****	-	
	7. ISI score	-0.015	-0.098	**0.492****	**0.517****	**0.469****	**0.517****	-
	8. PSS-SR score	-0.018	-0.057	**0.696****	**0.705****	**0.687****	**0.691****	**0.547****

*: p< 0.05; **: p< 0.001; Spearman correlation was used for age, BMI, IESR-R, stress, anxiety, depression, ISI, and PSS-R scores; BMI: Body mass index; IES-R: Impact of Event Scale-Revised; PSS-SR: PTSD Symptom-Self Report Scale; ISI: Insomnia Severity Index.

Table 4 shows the mean daily energy, macro and micronutrient intake of the participants. There were no nutrients below 67% of the RDA for energy and macronutrient (carbohydrate, fat, protein) intake in both men and women. Similarly, fiber, vitamin A, vitamin E, vitamin K, vitamin C, vitamin B_1, vitamin B_2, vitamin B_3, vitamin B_5, vitamin B_6, vitamin B_{12}, biotin, folic acid, potassium, calcium, magnesium, phosphorus, iron and zinc intakes were adequate in both gender compared with the RDA.

Table 4. The mean (minimum-maximum) daily energy, macro- and micronutrient intake of the participants compared to the RDA.

	Men (n: 87)	**RDA (%)**	**<67% of RDA**	**Women (n: 114)**	**RDA (%)**	**<67% of RDA**
Energy (kcal)	2050.61±474.91	79.85±19.85 (115.00-38.73)	No	2066.40±435.26	113.78±26.50 (154.44-61.81)	No
Protein (g)	110.77±27.36	175.56±47.00 (285.91-65.17)	No	104.42±29.93	189.17±56.81 (337.26-58.46)	No
Protein (E %)	20.21±3.48	101.09±20.38 (145.00-60.00)	No	19.25±3.98	96.27±21.78 (155.0-50.00)	No
Fat (g)	86.00±23.37			85.40±25.02		
Fat (E %)	34.08±6.28	97.37±20.66 (140.00-54.29)	No	34.20±6.61	97.72±20.90 (162.86-61.81)	No
Saturated fatty acids (g)	29.08±9.17			28.31±10.20		
MUFA (g)	29.87±9.25			29.72±9.95		
PUFA (g)	19.17±5.51			19.51±5.61		
Omega 3 (g)	2.65±0.76			2.41±0.85		
Omega 6 (g)	16.25±5.14			16.86±5.31		
Cholesterol (mg)	421.23±167.03			402.21±209.46		
Carbohydrate (g)	250.81±62.15	192.93±51.79 (305.05-63.67)	No	249.28±58.86	191.75±48.37 (321.88-109.10)	No
Carbohydrate (% E)	45.68±7.73	76.15±15.17 (108.33-43.33)	No	46.48±7.54	77.47±14.46 (118.33-40.00)	No
Fiber (g)	19.82±6.89	79.32±28.69 (138.32-4.20)	No	21.32±7.84	85.31±32.26 (166.80-21.24)	No
Vitamin A (mcg)	3286.81±1946.74	438.24±262.26 (1047.01-67.41)	No	2935.72±2722.87	451.65±419.18 (1036.15-50.81)	No
Vitamin E (mg)	22.96±5.76	176.65±47.96 (276.69-73.15)	No	23.71±7.36	215.55±69.66 (441.55-35.64)	No
Vitamin K (mcg)	538.94±397.42	449.12±332.74 (457.82-19.40)	No	498.51±414.25	553.91±461.16 (1925.88-30.29)	No
Vitamin C (mg)	220.58±135.98	200.53±124.76 (573.55-18.90)	No	183.95±118.62	193.64±125.62 (508.98-11.89)	No
Vitamin B_1 (mg)	1.72±0.61	143.75±53.60 (350.00-47.50)	No	1.67±0.62	151.99±58.48 (339.09-37.27)	No
Vitamin B_2 (mg)	1.72±0.61	217.26±89.88 (520.77-63.85)	No	1.67±0.62	242.22±110.30 (797.27-50.00)	No
Vitamin B_6 (mg)	2.52±0.84	194.53±68.19 (412.31-56.92)	No	2.42±0.92	186.26±73.26 (353.85-46.15)	No
Vitamin B_{12} (mcg)	5.21±2.73	130.26±69.31 (252.50-27.75)	No	5.30±3.02	134.64±76.38 (550.00-6.00)	No
Vitamin B_3 (mcg)	5.89±1.99	87.54±15.31 (744.19-117.44)	No	5.94±1.98	88.67±16.21 (327.29-97.79)	No
Vitamin B_5 (mcg)	10.70±5.95	81.83±67.72 (226.40-20.53)	No	10.13±5.52	81.81±68.64 (349.07-7.40)	No
Biotin (mcg)	19.08±9.79	102.43±54.56 (617.60-100.33)	No	14.03±7.36	85.43±32.19 (236.27-71.03)	No
Folic acid (mcg)	678.96±308.73	205.75±95.57 (489.63-54.75)	No	649.07±334.42	196.69±102.55 (532.33-46.35)	No
Potassium (mcg)	4563.98±1699.74	101.42±39.08 (197.63-2.32)	No	4358.10±1882.72	92.73±40.81 (245.30-22.57)	No
Calcium (mg)	923.45±317.79	92.35±33.09 (171.73-46.77)	No	902.03±357.62	90.20±36.59 (179.95-24.96)	No

*: Values are presented as mean (minimum-maximum). Comparisons were made against the Turkish Recommended Dietary Allowances (RDA); MUFA: Monounsaturated fatty acids; PUFA: Polyunsaturated fatty acids; RDA: Recommended daily (or dietary) allowance.

Table 4. Continue.

Magnesium (mg)	532.47±162.84	152.14±49.02 (289.88-46.77)	No	521.10±157.04	173.70±54.58 (311.93-67.59)	No
Phosphorus (mg)	666.63±325.65	121.21±60.27 (339.55-47.73)	No	628.08±371.03	114.20±68.00 (335.67-19.89)	No
Iron (mg)	17.29±6.63	157.19±62.28 (384.46-34.42)	No	17.54±6.52	134.93±51.51 (282.46-34.46)	No
Zinc (mg)	16.00±3.90	98.20±26.04 (155.46-34.42)	No	15.62±4.68	123.04±38.48 (201.65-41.42)	No
Alcohol (mL)	0.04 ±0.04	-		0.06 ±0.07	-	

*: Values are presented as mean (minimum-maximum). Comparisons were made against the Turkish Recommended Dietary Allowances (RDA); MUFA: Monounsaturated fatty acids; PUFA: Polyunsaturated fatty acids; RDA: Recommended daily (or dietary) allowance.

DISCUSSION AND CONCLUSION

This study is the first to evaluate PTSD, stress, depression, anxiety levels, sleep problems and nutritional status of earthquake survivors in Türkiye. We found that 51.2% of participants had extremely severe anxiety. 22.9% of the participants were classified as severe depression, and 24.9% as extremely severe depression. 58.3% of the participants had severe PTSD symptoms, and 11.9% had extremely severe PTSD symptoms according to the PSS-SR classification. Most participants (75.6%) were classified as insomnia. There were statistical differences between body weight and BMI before and after the earthquake in both genders. Furthermore, there was a moderate positive correlation between IES-R and stress, anxiety, depression, ISI, and PSS-SR scores. PSS-SR scores showed a strong positive correlation with stress scores. No nutrient intake was below the RDA and was found to be adequate in both genders.

Following catastrophic events or unusual threats, PTSD is the most common type of psychiatric disorder.[17] The severity of exposure has also been found to be positively associated with the risk of subsequent PTSD and other mental disorders.[17,18] In 2017, 3 months after the 7.0 magnitude earthquake that occurred in the Jiuzhaigou region, it was determined that 52.7% of the earthquake victims in the earthquake zone showed symptoms of PTSD, 53.8% of anxiety and 69.6% of depression.[19] The prevalence of PTSD was found to be 20.3% after the 6.1 magnitude earthquake in Piura in 2021.[20] PTSD was found to be 58.3%, depression 16.8% and anxiety 32.1% in adolescents after the 6.5 magnitude earthquake in Indonesia in 2016.[21] We found that 58.3% of the participants had severe, and 11.9% had extremely severe PTSD symptoms. Additionally, 51.2% of participants had extremely severe anxiety. According to depression classification, 22.9% of the participants were classified as severe and 24.9% as extremely severe. Kahramanmaraş is a seismically active area and the whole of the region is subject to frequent earthquakes and tremors. The type of event may influence the association between PTSD and related factors.[22] Two high-magnitude earthquakes nine hours apart may have led to a higher likelihood of triggering PTSD in the local population.

Earthquakes can indeed have a significant impact on sleep quality and overall sleep situation among individuals affected by such natural disasters. For instance, research conducted after earthquakes in Syria-Türkiye revealed higher rates of poor sleep quality and major depressive episodes, particularly among women.[23] It was indicated a decline in sleep quality from before to after an earthquake, with a significant decrease observed even 24 months post-earthquake.[24] In this study, most participants (75.6%) were classified as having insomnia. The psychological impact of earthquakes on sleep may persist over the long term.[25] Therefore, emphasising the importance of recognising and managing disrupted sleep after earthquakes is important to understand the long-term impact of natural disasters on sleep.

Insomnia is estimated that 70-91% of individuals with PTSD have difficulty initiating or maintaining sleep.[26,27] It was observed that a bidirectional relationship was found between insomnia, PTSD and depressive symptoms among adolescents who survived the 2008 Wenchuan earthquake in China.[28] In a study conducted 9 months after the 7.8 magnitude earthquake in Ecuador in 2016, high levels of depression, anxiety and stress were observed in adolescents.[29] We found that there was a moderate positive correlation between IES-R and stress, anxiety, depression, ISI, and PSS-SR scores. The psychological effects of earthquakes on sleep and the bidirectional relationship between insomnia, PTSD, and depression are significant. This suggests that insomnia, PTSD and depression may be linked in the long term.

There are very few studies evaluating the effect of earthquakes on nutritional status. Studies show that earthquakes can have a significant impact on BMI, especially among vulnerable populations such as children, and emphasise the importance of understanding and addressing the effects of such disasters

on nutrition and health.[10,11] Although no nutrient intake was below the RDA, body weight and BMI showed significant decreases after the earthquake in this study. This may be due to the fact that the FFQ asked about food consumption in the last month. If the FFQ had not focused on the last month's food consumption, the results might have indicated greater variability in nutrient intake. This could have included evidence of more pronounced deficiencies or surpluses in specific nutrients over time, reflecting the potential long-term effects of the earthquake on survivors' dietary habits. Additionally, a broader time frame might have captured fluctuations in food availability and access, which are common challenges in post-disaster settings. Such data could have provided a deeper understanding of the nutritional adjustments survivors made during different phases of recovery.

The study has several strengths and limitations. First, the study was cross-sectional and a cause-and-effect relationship cannot be established. Secondly, although the study was conducted on adults, most of the participants were young adult women. Therefore, the results cannot be generalized. Third, participants self-reported their body weight and height, which may have led to errors. Fourth, the FFQ covers only the last month, which may lead to an underestimation of the longer-term effects of the earthquake. The strengths of our study are that it analyzed multiple variables such as PTSD, anxiety, depression, sleep problems and nutritional status in detail and that physical effects such as nutritional status and changes in body weight were also examined along with psychological status.

In conclusion, most of the participants had severe PTSD symptoms and suffered from insomnia. While nutrient intake was adequate, significant decreases in body weight and BMI were observed. These findings emphasize the need to address both mental health and nutritional status in the aftermath of natural disasters. The earthquake affected earthquake survivors in different ways, and the burden of psychiatric disorders can have detrimental consequences in their lives. Therefore, strengthening public health services in this area is crucial.

Ethics Committee Approval: The ethics committee of Istanbul Gelisim University Ethics Committee (Date: 20.11.2023, decision no: 2023/09) approved the study, which followed the principles of the Declaration of Helsinki.

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

Author Contributions: Concept – HMB, Rİ, BNS, MS; Supervision – HMB; Materials – HMB, Rİ, BNS, MS; Data Collection and/or Processing – Rİ, BNS, MS; Analysis and/or Interpretation – HMB, Rİ, BNS, MS; Writing – HMB, Rİ, BNS, MS.

Peer-review: Externally peer-reviewed.

Financial Support: This work was supported by the TUBITAK 2209-A Research Project Support Programme for Undergraduate Students under Project Number 1919B012307489.

Other Information: This study was presented as an oral presentation at the 7th International Health Science and Life Congress.

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OTJHS
Online Turkish Journal of Health Sciences

e-ISSN: 2459-1467

OTSBD
Online Türk Sağlık Bilimleri Dergisi

Online Turkish Journal of Health Sciences 2025;10(1):38-44 *Online Türk Sağlık Bilimleri Dergisi 2025;10(1):38-44*

Resveratrol Reorganizes the Impaired Cellular Functions of ARPE-19 Cells Created in Diabetes Model

Resveratrol Diyabet Modeli Oluşturulmuş ARPE-19 Hücrelerinin Bozulmuş Hücre Fonksiyonlarini Yeniden Düzenler

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ABSTRACT

Objective: It is well known that high blood glucose levels can damage many visual functions. So, the study aimed to investigate the effects of resveratrol on cellular lipid peroxidation (MDA), cytokines, VEGF-A and apoptosis levels in vitro diabetes model-induced ARPE-19 cells.

Materials and Methods: Six experimental groups were conceptualized as follows. 1-Control group: Received no treatment (Standard Growth Medium), 2-Mannitol Group (M): Cells incubated in 19.5 mM Mannitol supplemented medium, 3-High Glucose Group (HG): Cells incubated in high glucose (25 mM Glucose), 4-Resveratrol Group (R): Cells incubated with 100 µM resveratrol Standard Growth Medium, 5-Mannitol + Resveratrol Group (M+R), 6-High Glucose + Resveratrol Group (HG+R). In All groups, cells were incubated for 48 hrs, and MDA, IL-1β, TNF-α, VEGF-A and Apoptosis levels were measured.

Results: High glucose medium increased the MDA, IL-1β, TNF-α and VEGF-A levels while resveratrol caused a significant decrement in MDA, IL-1β, TNF-α and VEGF-A levels in diabetes model-induced ARPE-19 cells. As a result, resveratrol prevented the ARPE-19 cells against diabetes related impaired conditions.

Conclusions: In conclusion, resveratrol can reverse disrupted cellular functions by reducing cellular oxidative stress and supporting cellular viability.

Keywords: Apoptosis, ARPE-19, diabetes, resveratrol, VEGF-A

ÖZ

in vitro diyabet modeli oluşturulan ARPE-19 hücrelerinin hücresel lipid peroksidasyonu (MDA), sitokinler, VEGF-A ve apoptoz seviyeleri üzerindeki etkileri amaçlanmıştır.

Materyal ve Metot: Altı deney grubu aşağıdaki şekilde oluşturulmuştur. 1-Kontrol grubu: Hiçbir tedavi uygulanmadı (Standart Büyütme Medyumu), 2-Mannitol Grubu (M): 19,5 mM mannitol takviyeli ortamda inkübe edilen hücreler, 3-Yüksek Glikoz Grubu (HG): Yüksek glikozda (25 mM Glikoz) inkübe edilen hücreler, 4-Resveratrol Grubu (R): Standart Büyütme Medyumunda ve 100 µM resveratrol ile inkübe edilen hücreler, 5-Mannitol + Resveratrol Grubu (M+R), 6-Yüksek Glikoz + Resveratrol Grubu (HG+R). Tüm gruplar 48 saat inkübasyon sonrasında MDA, IL-1β, TNF-α, VEGF-A ve Apoptozis düzeyleri ölçüldü.

Bulgular: Yüksek glikoz ortamı ARPE-19 hücrelerinde MDA, IL-1β, TNF-α ve VEGF-A seviyelerinde artışa neden olurken resveratrol, diyabet modeli oluşturulmuş hücrelerde MDA, IL-1β, TNF-α ve VEGF-A seviyelerinde önemli bir azalmaya neden olduğu görülmüştür. Sonuç olarak resveratrolün ARPE-19 hücrelerinin diyabet modeline bağlı olarak bozulmuş hücresel fonksiyonların düzeltilmesine yardımcı olduğu belirlenmiştir.

Sonuç: Resveratrol'ün hücresel oksidatif stresi azaltarak ve hücresel canlılığı destekleyerek bozulan hücresel fonksiyonları tersine çevirebileceği sonucuna varılmıştır.

Anahtar Kelimeler: Apoptoz, ARPE-19, diyabet, resveratrol, VEGF-A

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Yayın Bilgisi / Article Info:
Gönderi Tarihi/ Received: 30/10/2024
Kabul Tarihi/ Accepted: 29/12/2024
Online Yayın Tarihi/ Published:17/03/2025

Atıf / Cited: Argun M and Çelik Ö. Resveratrol Reorganizes the Impaired Cellular Functions of ARPE-19 Cells Created in Diabetes Model. *Online Türk Sağlık Bilimleri Dergisi* 2025;10(1):38-44. doi: 10.26453/otjhs.1576093

INTRODUCTION

Diabetes can significantly impact eye health, leading to conditions collectively known as diabetic eye disease. Diabetic retinopathy, the most prevalent condition, arises when increased blood sugar harms the retinal blood vessels, which can lead to vision impairment. Other related conditions include diabetic macular oedema, cataracts, and glaucoma.[1-3]

Oxidative stress is a condition that occurs because of an imbalance between the production of oxidizing compounds and detoxification by antioxidant defence systems, causing increased ROS production and resulting in cell damage. Oxidative stress can provoke many diseases, such as Alzheimer's, Parkinson's, diabetes, age-related macular degeneration, and atherosclerosis.[4-7]

Resveratrol, a type of stilbene phytophenol, is present in over 70 plant species and their derivatives, such as grape seeds, peanuts, blueberries, and cranberries.[8] Resveratrol has anti-inflammatory,[9]antioxidant,[9] and anti-angiogenic[10] properties. Resveratrol is used as a micronutrient in age-related macular degeneration.[11]

Thus, this study was undertaken to assess the effects of resveratrol on cellular lipid peroxidation, cytokines, VEGF-A and apoptosis levels of in vitro diabetes model-induced ARPE-19 cells.

MATERIALS AND METHODS

Ethics Committee Approval: Not applicable. Since ARPE-19 cells were commercially obtained from American Type Cell Culture (ATCC® CRL-2302™, Manassas, VA, USA), the study does not need ethical committee approval. It complies with the international standards of The Committee on Publication Ethics (COPE).

Cell Culture: ARPE-19 cells, purchased from American Type Cell Culture (ATCC, Manassas, VA, USA), harvested in a humidified %5 CO_2 incubator. A culture medium was formulated with 50% Ham's F12 medium and 50% Dulbecco's Modified Eagle Medium (DMEM), enhanced with 10% FBS and 1% Penicillin-Streptomycin mix. The passage number of cells was from 5 to 10 utilized in the study. Subculturing and treatments to the cells were performed as explained and elsewhere.[7,12]

Experimental Groups: The study groups and treatments were as follows:

1-Control Group: Cells were seeded in an incubator without treatment in a standard growth medium (5.5 mM Glucose) for 48 hrs.[12]

2- Mannitol Group (M): The standard growth medium supplemented with extra mannitol (19.5 mM) and cells were seeded for 48 hrs.[12]

3-High Glucose Group (HG): Cells were seeded in High Glucose Medium (25 mM Glucose) for 48 hrs.[12]

4-Resveratrol Group (R): Cells were seeded in standard growth medium (5.5 mM Glucose) supplemented with 100 µM resveratrol for 48 hrs.[10,12]

5- Mannitol + Resveratrol Group (M+R): The standard growth medium supplemented with extra mannitol (19.5 mM) + 100 µM resveratrol cells were seeded for 48 hrs.[10,12]

6-High Glucose + Resveratrol Group (HG+R): Cells were seeded in High Glucose Medium (25 mM Glucose) + 100 µM resveratrol for 48 hrs.[10,12]

Material Preparation: After trypsinization, the cells were collected in a collecting tube with all contents. One part of the content was separated for Apoptosis experiments before homogenization. The remaining contents were homogenized for 2 minutes by an ultrasonic homogenizer for Lipid peroxidation (MDA), cellular cytokines (IL-1β and TNF-α) and VEGF-A experiments.[13]

Lipid Peroxidation: The protein content of ARPE-19 cells was detected by Lowry's method.[14] As an indicator of lipid peroxidation levels of MDA has been assayed by a spectrophotometrically (Shimadzu, Kyoto, Japan) method, which was defined previously by Placer et al.[15] MDA levels of ARPE-19 cell homogenates were expressed as µmol/g protein.

Measurement of Cellular Cytokines (*IL-1β and TNF-α*), VEGF-A and Apoptosis: IL-1β, TNF-α and VEGF-A levels were quantified by using a multi-well reader (Infinite pro200) at 450 nm wavelength according to the ELISA kit Manufacturer's instructions. Levels of IL-1β, TNF-α and VEGF-A in groups were expressed in ng/ml, pg/ml and pg/ml, respectively, percentages of control after standard curves were calculated.[16]

Non-homogenized cells were used for the detection of apoptosis levels. The APO Percentage kit (Northern Ireland, UK), a commercial apoptosis detection assay, was utilized to measure the apoptosis rate. The dye inside the assay can only pass through the asymmetric cell membranes of apoptotic cells. Thus, only apoptotic cells stain in red, which was detected by spectrophotometrically at 550 nm wavelength. The level of apoptosis in groups was given as a percentage (%) of the control.[17]

Statistical Analysis: All data were presented as means ± standard deviations. Differences between recorded arithmetic mean values examined between groups were analysed by Prism 8 computer software (GraphPad Software, CA, USA). The significance of inter-groups was assessed using one-way ANOVA and Tukey's multiple comparison test. The p-value less than 0.05 was considered statistically significant for all groups.

RESULTS

The levels of lipid peroxidation were presented in Figure 1. MDA level was measured lowest (11.90±1.21) in the resveratrol group and highest (28.80±3.42) in the HG group. Except for the resveratrol group in all groups, malondialdehyde (MDA) levels were statistically higher ($^{a}p< 0.001$) versus the control group, while it was found to be significantly lower ($^{a}p< 0.001$) in the resveratrol group versus the control. High glucose medium or mannitol supplementation to medium led to a significant increase ($^{a}p< 0.001$) of the MDA level of M and HG groups. Resveratrol incubation succeeded in reversing the level of lipid peroxidation in M+R ($^{b}p< 0.001$) and HG+R ($^{c}p< 0.001$) groups. In the R group, MDA level was significantly lower ($^{a}p< 0.001$, $^{b}p< 0.001$, $^{c}p< 0.001$ and $^{d}p< 0.001$) than all groups, while there was no significance between M+R and HG+R groups.

Interleukin-1β (IL-1β) levels were presented in figure 2. IL-1β level was measured lowest (5.66±0.54) in the resveratrol group and highest (22.65±1.14) in the HG group. IL-1β level was meaningfully increased ($^{a}p< 0.001$) in M, HG, M+R, and HG+R groups compared to the control group, while it dramatically decreased ($^{a}p< 0.001$) in the R group versus the control group. There was no statistically considerable change between M, M+R and HG+R groups. It was shown that resveratrol supplementation alleviated the IL-1β formation in the HG+R group versus the HG group ($^{c}p< 0.001$). On the other hand, no alteration was determined between the M+R group versus the M group. In the R group level of IL-1β formation was significantly lower ($^{a}p< 0.001$, $^{b}p< 0.001$, $^{c}p< 0.001$ and $^{d}p< 0.001$) than all groups, while there was no considerable significance between M+R and HG+R groups.

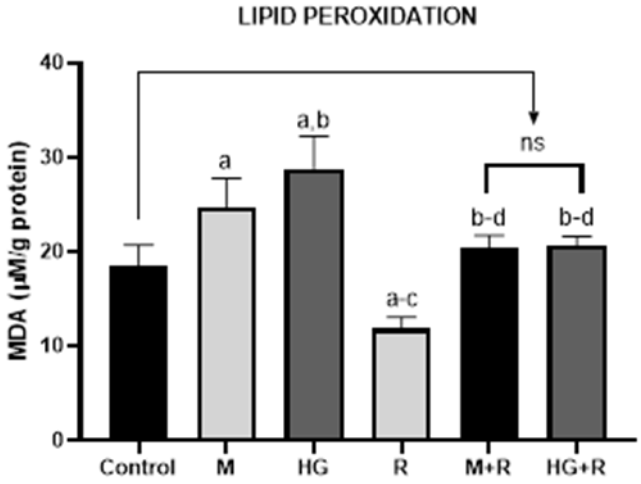

Figure 1. Levels of lipid peroxidation in ARPE-19 Cells. ^{a}: p<0.001 vs. Control; ^{b}: p<0.001 vs. Mannitol; ^{c}: p<0.001vs. High Glucose; ^{d}: p<0.001 vs. Resveratrol; ns: no significance.

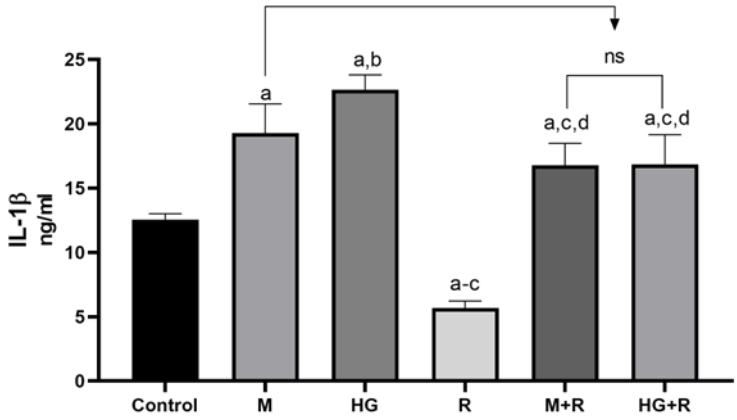

Figure 2. Levels of interleukin-1β in ARPE-19 Cells. ^{a}: p<0.001 vs. Control; ^{b}: p<0.001 vs. Mannitol; ^{c}: p<0.001vs. High Glucose; ^{d}: p<0.001 vs. Resveratrol; ns: no significance. R2 was calculated as 0.996.

TNF- α levels were presented in Figure 3. TNF- α level was measured lowest (22.23±2.00) in the resveratrol group and highest (70.10±4.54) in the HG group. TNF- α level was meaningfully increased in M, HG, M+R, and HG+R groups compared to the control group ($^{a}p< 0.001$), while it was meaningfully decreased ($^{a}p< 0.001$) in the R group versus the control group. No statistically significant difference has been determined between M versus HG and M+R and HG+R groups. Resveratrol supplementation to the medium led to a considerable reduction of the TNF- α levels in M+R and HG+R groups compared to M ($^{b}p< 0.001$) and HG ($^{c}p< 0.001$) groups, respectively. TNF- α production in the R group was significantly less than versus all other groups ($^{a}p< 0.001$, $^{b}p< 0.001$, $^{c}p< 0.001$ and $^{d}p< 0.001$).

VEGF-A levels were presented in figure 4. VEGF-A level was determined lowest (20.07±2.84) in the R group and highest (62.36±5.56) in the M and (60.93±4.32) HG groups. There was no significance between the control group compared to M+R and HG+R groups, albeit a statistical significance has been found between the control group compared to the M, HG and R groups ($^{a}p< 0.001$). It was found that production of VEGF-A decreased in the M+R group versus the M group ($^{b}p< 0.001$) and the HG+R group versus and HG group ($^{c}p< 0.001$) by resveratrol addition to medium. In M+R and HG+R groups, VEGF-A levels considerably raised compared to the R group ($^{d}p< 0.001$).

Apoptosis levels were presented as % change versus control in Figure 5. The highest apoptosis rate was measured in the HG group (182.60±10.72), and was lowest was in the R group (75.44±2.14). No statistical significance has been found between the control, M+R and HG+R groups, but there was a significant decrement in the R group and a significant increment in the HG group versus the control group ($^{a}p< 0.001$). Compared to the M ($^{b}p< 0.001$) and HG ($^{c}p< 0.001$) groups, apoptosis rates were considerably decreased in R, M+R and HG+R groups. The lowest apoptosis rate was measured in the R group compared to all other groups ($^{d}p< 0.001$).

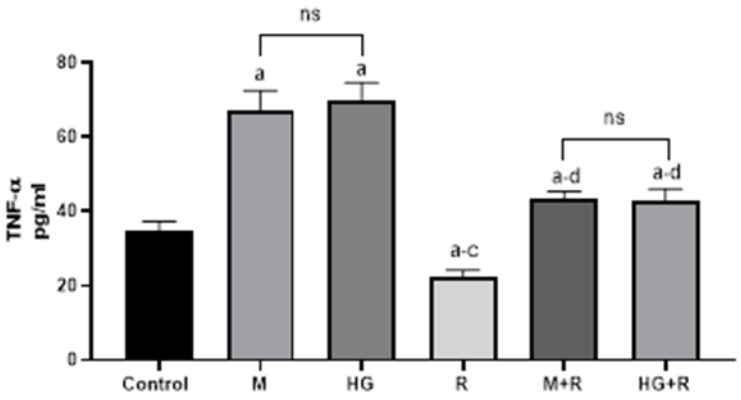

Figure 3. Levels of tumour necrosis factor-alpha (TNF- α) in ARPE-19 Cells. [a]: p<0.001 vs. Control; [b]: p<0.001 vs. Mannitol; [c]: p<0.001vs. High Glucose; [d]: p<0.001 vs. Resveratrol; ns: no significance. R2 was calculated as 0.992.

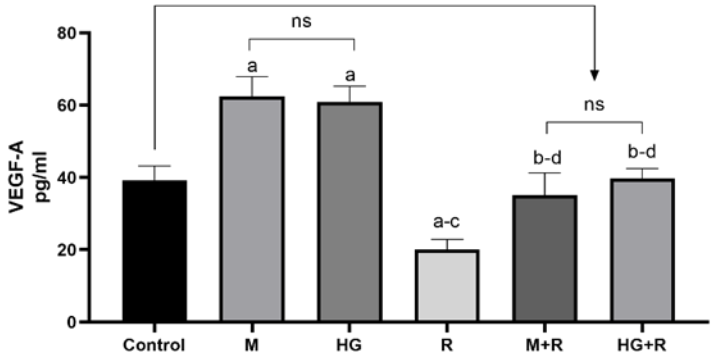

Figure 4. Levels of vascular endothelial growth factor A (VEGF-A) in ARPE-19 Cells. [a]: p<0.001 vs. Control; [b]: p<0.001 vs. Mannitol; [c]: p<0.001vs. High Glucose; [d]: p<0.001 vs. Resveratrol; ns: no significance. R2 was calculated as 0.990.

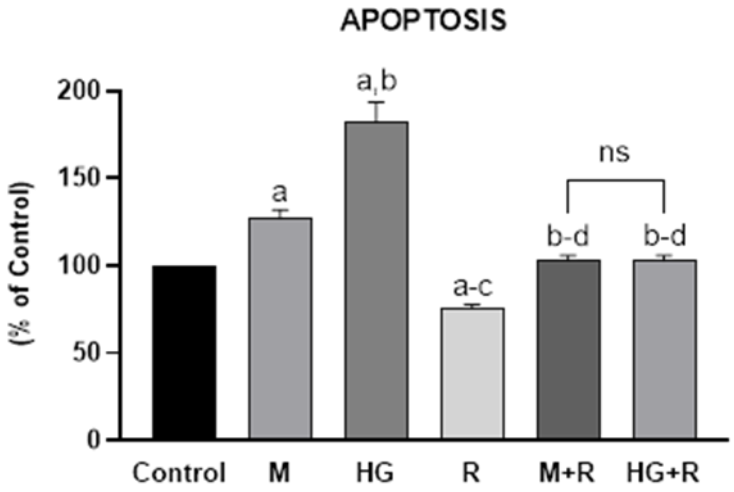

Figure 5. Apoptosis in ARPE-19 cells. [a]: p<0.001 vs. Control; [b]: p<0.001 vs. Mannitol; [c]: p<0.001vs. High Glucose; [d]: p<0.001 vs. Resveratrol; ns: no significance.

DISCUSSION AND CONCLUSION

It has been postulated that resveratrol may lead to reduced oxidation and proliferation of human retinal pigment epithelial cells by extracellular signal-regulated kinase inhibition. Additionally, it is proven that H_2O_2-induced ERK 1/2 activation could be diminished when cells were pre-treated with resveratrol. Similarly, these results showed that resveratrol may reduce the level of cellular lipid peroxidation.[18] Akbel et al. showed that resveratrol and Coenzyme-Q_{10} treatment together or alone may reduce the cyclophosphamide induced lipid peroxidation in rats.[19] It is found that ferroptosis-related lipid peroxidation levels may be attenuated by resveratrol in hepatocytes (HepG2) in cell culture.[20] It has been proven that glyoxal increases lipid peroxidation, ROS production and cell death in rat kidney cells.[21] In the same study, the use of resveratrol, curcumin and gallic acid were shown to reduce lipid peroxidation, ROS production and cell death.[21] The findings support that resveratrol may help to decrease the cellular lipid peroxidation elevated by high glucose in ARPE-19 cells in vitro, and it is consonant with similar studies in the literature.

Inflammation is the normal response of living organisms to injury caused by physical or harmful chemical stimuli or microbiological characteristics. Many proinflammatory mediators, such as IL-1β and TNF-α, play a role in the pathogenesis of inflammation.[22] Resveratrol has anti-inflammatory properties and provides a significant decrease in TNF-α levels.[23] In a study conducted on rat liver cells, Tanaoğlu et al.[24] demonstrated the protective effects of resveratrol use against cell damage by reducing IL-1β levels. In the study, a significant decrease in IL-1β and TNF-α levels was obtained in the resveratrol group.

Many factors, including hypoxia of retinal tissue, inflammatory cytokines, growth factors, and reactive oxygen species in diabetic patients, can cause overexpression of VEGF.[25] VEGF increases vascular permeability in the ischemic retina, stimulating the growth of endothelial cells, increasing angiogenesis and causing neovascularization.[26] In the study, an increase in VEGF levels was found in the control group at high glucose levels. In the resveratrol application, the VEGF level was found to be like the control group. The decrease in VEGF levels when resveratrol was applied supports the antiangiogenic properties of resveratrol.

Retinal pigment epithelium (RPE) cells play an important role in diabetic retinopathy, and hyperglycaemia-induced RPE cell apoptosis is thought to be associated with the progression of diabetic retinopathy. High glucose levels increase cell death by apoptosis in ARPE-19 cells.[27,28] Resveratrol use has been shown to increase nitric oxide levels, reduce oxidative stress and inhibit apoptosis in vascular endothelial cells.[29] Resveratrol inhibits apoptosis and autophagy in heart muscle cells and alleviates heart muscle damage in the experiment conducted on rats by Xiong et al.[30] In our study, it was shown that apoptosis, which increased at high glucose levels in ARPE-19 cells, was significantly reduced in the resveratrol group.

In conclusion, resveratrol can lead the ARPE-19 cell survival by reducing the level of lipid peroxidation and modulating the cellular cytokines such as (IL-1β, and TNF- α) and VEGF-A. Taking it together, it is concluded that resveratrol can reverse the disrupted cellular functions by supporting cellular viability. While cell culture studies provide valuable data, their lack of support from in-vivo studies is considered a limitation.

Ethics Committee Approval: This study doesn't need to have ethics committee approval.

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

Author Contributions: Concept –MA, ÖÇ; Supervision – MA; Materials – MA, ÖÇ; Data Collection and/or Processing – MA, ÖÇ; Analysis and/or Interpretation – ÖÇ; Writing – MA, ÖÇ.

Peer-review: Externally peer-reviewed.

Acknowledgement: The authors thank technician Muhammet Şahin for his help.

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OTJHS
Online Turkish Journal of Health Sciences

e-ISSN: 2459-1467

OTSBD
Online Türk Sağlık Bilimleri Dergisi

Online Turkish Journal of Health Sciences 2025;10(1):45-51 *Online Türk Sağlık Bilimleri Dergisi 2025;10(1):45-51*

Turkish Validity and Reliability Study on the Information Needs in Percutaneous Coronary Artery Intervention Scale (NCPI-10-TR)

Perkütan Koroner Arter Girişiminde Bilgi Gereksinimleri Ölçeği'nin (NCPI-10-TR) Türkçe Geçerlilik ve Güvenirlik Çalışması

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ABSTRACT

Objective: The objective of this study was twofold: firstly, to adapt the Information Needs Scale for Percutaneous Coronary Artery Intervention into Turkish, and secondly, to test the validity and reliability of the scale.

Materials and Methods: This methodological study was conducted with 200 patients who were admitted to the angiography unit of a university hospital between August 1, 2021 and February 28, 2022. Data were collected using the "Patient Questionnaire Form" and the Turkish version of the "Percutaneous Coronary Intervention Information Needs Scale".

Results: In order to ascertain the internal consistency structure of the Turkish form of the scale, the item-total score correlation was examined. It was found that the Cronbach alpha internal consistency coefficient of the scales was 0.98 for the importance level of the need to be informed and 0.98 for the degree of fulfilment. The item-total score correlation values of the scale ranged from 0.75 to 0.92 for the importance level and from 0.78 to 0.95 for the degree of fulfilment. According to the Guttman Split-Half Coefficient, the correlation value between the two half-item means was found to be 0.930, and the Guttman Split-Half Coefficient was found to be 0.957.

Conclusions: It was ascertained that the Turkish iteration of the Percutaneous Coronary Artery Intervention Information Needs Scale (NCPI-10-TR) possesses adequate validity and reliability indicators in determining information needs in percutaneous coronary intervention, as determined by the degree of importance attributed to information requirements and the degree to which these requirements are met in coronary artery patients.

Keywords: Coronary artery disease, information needs, percutaneous coronary artery intervention, reliability, validity

ÖZ

Amaç: Bu çalışma iki temel amaçla yürütülmüştür. İlk olarak, Perkütan Koroner Arter Girişimi için Bilgi İhtiyaçları Ölçeği Türkçe'ye uyarlanmıştır. İkinci olarak, uyarlanan ölçeğin geçerliliği ve güvenilirliği test edilmiştir.

Materyal ve Metot: Metodolojik türde olan çalışma, 1 Ağustos 2021-28 Şubat 2022 tarihleri arasında bir üniversitesi hastanesinin anjiyografi ünitesine başvuran ve araştırmaya katılmada gönüllü olan 200 hasta ile yapıldı. Araştırmanın verileri "Hasta Anket Formu" ve "Perkütan Koroner Arter Girişiminde Bilgi Gereksinimleri Ölçeği'nin" Türkçe formu kullanılarak yüz yüze toplandı.

Bulgular: Ölçeğin Türkçe formunun iç tutarlılık yapısı için madde toplam puan korelasyonu, Ölçeklerin, Cronbach alpha iç tutarlık katsayısı bilgilendirilme ihtiyacının önem derecesine 0,98, yerine getirilme derecesine göre ise 0,98 olarak bulundu. Ölçeğin, önem derecesine göre madde-toplam puan korelasyon değerleri 0,75 ile 0,92 arasında, yerine getirilme derecesine göre ise 0,78 ile 0,95 arasındadır. Guttman Split-Half Katsayısına göre ise, iki yarı madde ortalamaları arasındaki korelasyon değeri 0,930, Guttman Split-half coefficient 0,957 olarak bulundu.

Sonuç: Perkütan Koroner Arter Girişim Bilgi Gereksinimi Ölçeği'nin (NCPI-10-TR) Türkçe versiyonunun, koroner arter hastalarında bilgi gereksinimine verilen önem derecesi ve bu gereksinimlerin karşılanma derecesi ile perkütan koroner girişimlerde bilgi gereksinimini belirlemede yeterli geçerlilik ve güvenirlilik göstergelerine sahip olduğu saptanmıştır.

Anahtar Kelimeler: Bilgi gereksinimi, koroner arter hastalığı, geçerlilik, güvenilirlik, perkütan koroner arter girişim

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Yayın Bilgisi / Article Info:
Gönderi Tarihi/ Received: 05/12/2024
Kabul Tarihi/ Accepted: 20/02/2025
Online Yayın Tarihi/ Published:17/03/2025

Atıf / Cited: Tülüce D and et al. Turkish Validity and Reliability Study on the Information Needs in Percutaneous Coronary Artery Intervention Scale (NCPI-10-TR). *Online Türk Sağlık Bilimleri Dergisi* 2025;10(1):45-51 doi: 10.26453/otjhs.1585337

INTRODUCTION

Cardiovascular diseases rank first among all global causes of death. It is estimated that there will be over 22.2 million deaths annually by 2030.[1,2] Advances in pharmacological treatments and revascularization techniques have contributed to better monitoring and management of cardiac patients. Percutaneous coronary intervention (PCI) is one of the most frequently performed procedures in cardiovascular medicine.[3,4] PCI is well-established as a life-saving procedure. However, due to mobility restrictions and the nature of the PCI technique itself, various complications may arise post-procedure. Common problems include respiratory distress, clotting disorders, rib fractures, pain, catheter infections, and reduced renal blood flow. Additionally, psychosocial challenges like career disruptions, social isolation, and non-cardiac mental health conditions such as anxiety, depression, hopelessness, and sexual dysfunction may also occur.[5] This makes it important to address the comprehensive needs of cardiac patients.

Providing patients with information about their condition, treatment options, and necessary interventions enables them to make informed decisions about their healthcare.[6] Research has shown that educating cardiac patients prior to PCI significantly reduces their levels of anxiety and depression before, process and after the procedure.[7,8] Therefore, understanding the perspectives of cardiac patients regarding their informational needs is critical. Knowledge refers to what patients need to know from their healthcare professionals for effective management of their condition, an approach that is associated with improved long-term clinical outcomes and higher patient satisfaction with care.[9] It is essential to offer tailored education and support to patients during both the pre- and post-procedure phases of PCI, ensuring their informational needs are fully met.[10] A key aspect of patient education is customizing the content to the specific needs and characteristics of each patient, which is particularly crucial for achieving effective discharge education outcomes.[11] While patient and family education is the responsibility of the entire healthcare team during the discharge preparation process, nurses play a central role in discharge planning.[10]

A review of the literature reveals a lack of sufficient research in our country focused on identifying the information needs of patients undergoing PCI. In this context, the Percutaneous Coronary Intervention Information Needs Scale (NCPI-10) was evaluated for its validity and reliability in Türkiye to assess the information needs of PCI patients accurately.

MATERIALS AND METHODS

Ethics Committee Approval: Before you start working, the original creator of the NCPI-10 scale, Maria Polikandrioti, was contacted via email, and permission to use the scale was obtained. Before the study commenced, written approval was secured from the hospital where the research was conducted, and ethics approval was granted by the university's Clinical Research Ethics Committee (Date: 16/08/2021, decision no: HRU/21.14.30). All patients were informed about the study and their consent was obtained. This study was conducted in accordance with the Declaration of Helsinki.

Population and Sampling: In the scale validity and reliability studies, the sample size was stated as five to ten times the total number of questions.[12,13] Therefore, for this study, a minimum sample size of 100 patients was determined, as the NCPI-10 scale contains 10 items. However, given that separate samples are recommended for both exploratory and confirmatory factor analyses in scale validation studies, the final sample size was increased to 200 patients.

Study Instruments: The Percutaneous Coronary Intervention Information Needs Scale (NCPI-10) is a 10-item instrument designed to assess the information needs of patients undergoing PCI. Each question is rated from 'Not at all' to 'Very much' on a four Likert scale. The scale provides two main results: the level of importance assigned to the information needs and the degree to which that need is fulfilled. The score obtained from the scale ranges from 10 to 40, and the higher the score, the higher the perceived importance of information needs or the fulfilment of information needs. Cronbach α coefficient of the original scale is 0.70.[14]

Research Implementation

Language Validity: In order to evaluate the scale in terms of psychometric properties, the researchers translated the NCPI-10 from English into Turkish. Each item was carefully evaluated for linguistic accuracy, meaning, and conceptual alignment with the original. Following this, the scale was back-translated from Turkish to English, and a linguist reviewed the back-translation to ensure clarity and accuracy. To maintain consistency, the researchers cross-referenced the back-translation version with the original English text to ensure that the translated scale retained the same meaning and purpose as the original version.

Content Validity: The Davis technique was applied to determine the content validity index (CVI). Using this method, experts rated each item on a four-point scale: "Completely appropriate," "Appropriate, requires minor revision," "Appropriate, requires major revision," and "Not appropriate, remove." The CVI for each item was calculated by dividing the number of experts who selected either "Completely appropriate" or "Appropriate, requires minor revision" by the

total number of experts. For an item to be considered valid in terms of content, its CVI must be greater than 0.80. If an item's CVI falls below 0.80, it is recommended for removal.[15]

Structural Validity: Exploratory factor analysis (EFA) was used for the construct validity of the NCPI-10 scale. The suitability of the data for factor analysis was evaluated using the Kaiser-Meyer-Olkin (KMO) test and Bartlett's test of sphericity. The KMO test was used to determine whether the sample was sufficient for a robust factor analysis, while Bartlett's test assessed whether the correlations between variables were sufficient for factor extraction. A KMO value of 0.75 or higher was considered "excellent," whereas a value between 0.4 and 0.75 was classified as "fair to good."

Reliability: Item analysis and Cronbach's α coefficient were used to evaluate the internal consistency of the scale. Due to potential temporal variations in responses, a follow-up test was conducted by phone approximately two weeks after the initial data collection. The Guttman Split-Half method was employed to assess the stability of the NCPI-10 scale items over time. The item-total correlation analysis revealed the correlation levels of individual scale items. Additionally, the correlations between each item and the total score, as well as the mean inter-item correlation coefficient, were calculated to assess the reliability of the scale further.

Statistical Analysis: SPSS version 17 was used for analysis. The Kolmogorov-Smirnov test was used for normality analysis. Descriptive statistics were used for the analysis of variables related to descriptive characteristics. Descriptive data were reported as frequency, percentage, mean±standard deviation. The reliability of the NCPI-10 was assessed by test-retest correlation, item analysis, Cronbach's α and item-total correlation. Statistical significance was based on $p<0.05$ and 95% confidence interval.

RESULTS

According to Table 1, the study included 200 patients with a mean age of 60.41 ± 12.34 years. 54% of the patients were male, 49% were literate, 83.5% were married, 64% were housewives or retired, 83% were unemployed, and 75% had an income lower than their expenses.

In terms of disease characteristics, 73.5% of patients had no chronic disease and 55.5% had undergone percutaneous coronary intervention (PCI) for diagnostic or therapeutic purposes. PCI was performed only once in 42.5% of patients and 32.5% had myocardial infarction (MI) or acute coronary syndrome (ACS). Furthermore, 88% of participants did not experience any complications after PCI (Table 2).

Table 1. Comparison of participants based on socio-demographic characteristics.

Characteristics		**n (%)**	**Characteristics**		**n (%)**
Gender	Male	108 (54.0)	**Marital**	Married	167 (83.5)
	Female	92 (46.0)	**Status**	Single	33 (16.5)
Educational	Literate	98 (49.0)	**Occupation**	Housewife / Retired	82 (64.0)
Status	Primary Education	80 (40.0)		Employee	11 (5.5)
	Secondary Education	13 (6.5)		Civil Servant	9 (4.59
	University and above	9 (4.5)		Self-Employed	52 (26.0)
Working Status	Employed	34 (17.0)	**Place of**	City-District	156 (78.0)
	Unemployed	166 (83.0)	**Residence**	Village	44 (22.0)
Income Status	Income less than expenses	150 (75.0)			
	Income equal to expenses	50 (25.0)			
	Mean±SD			**Minimum-Maximum**	
Age, (*yıl*)	60.41±12.34			19-93	
BMI, (kg/m^2)	27.12±4.71			18.59-48.70	

n: Number of units; SD: Standard deviation; minimum: Smallest value; maximum: Largest value.

Table 2. Comparison of disease characteristics.

Characteristics		**n (%)**			**n (%)**
Presence of chronic disease,	Yes	53 (26.5)	**If yes,**	DM	103 (51.5)
				HT	106 (53.0)
	No	147 (73.5)		COPD	6 (3.0)
				CHD	9 (4.5)
Percutaneous	Medical/Diagnostic	111(55.5)	**Number of PCAG**	Never implemented	28 (14.0)
Coronary Artery	Stent	60 (30.0)	**Attempts,**	1	85 (42.5)
Intervention	Balloon	4 (2.0)		2	39 (19.5)
(PCAG),	Balloon+Stent	25 (12.5)		3 and above	48 (24.0)
History of ACS/	Yes	65 (32.5)	**Complications**	None	176 (88.0)
MI,	No	135(67.5)	**after PCAI ACS,**	Bleeding	18 (9.0)
				Hematoma	6 (3.0)

n: Number of units; DM: diabetes mellitus; HT: hypertension; COPD: Chronic Obstructive Pulmonary Disease; CHD:chronic heart disease; MI:myocardial infarction; ACS:acute coronary syndrome

The mean total scores for both the importance of information needs and the extent to which these needs were fulfilled were nearly at the highest level, indicating that patients had a strong need for information, which was also sufficiently met. A statistically significant and strong correlation was found between all sub-items of the scale and the overall scores ($p<0.001$).

The adequacy of the sample for factor analysis was assessed using Bartlett's test of sphericity and the Kaiser-Meyer-Olkin (KMO) measure for the NCPI-10 scale. For the assessment of the importance of information needs, the KMO value was 0.923 and Bartlett's test of sphericity yielded a chi-square value of 3637.793 (df = 45), both of which were significant ($p < 0.001$). Similarly, for the assessment of the fulfilment of information needs, the KMO value was 0.916, and the chi-square value was 3823.486 (df=45), both significant ($p < 0.001$) (Table 4).

In the internal consistency assessment of the scale, both satisfaction and item importance in all items were evaluated using Cronbach α coefficient. Cronbach's α coefficient was 0.97 for satisfaction and 0.98 for importance, indicating excellent internal consistency ($\alpha > 0.70$) and high reliability of the scale. The factor structure was analysed by exploratory factor analysis, which indicated that the scale should be treated as a single dimension. The eigenvalues for the two dimensions were 8.36 and 8.73, explaining 83.64% and 87.36% of the variance, respectively (Table 4).

To further assess reliability, the scale was divided into two halves and the Guttman Split-Half Coefficient was calculated for the importance of information needs. The Guttman Split-Half coefficient is 0.923 and the correlation between the two halves is 0.858, indicating strong consistency and reliability (coefficient > 0.70) (Table 5). Although not included in the table, the Guttman Split-Half Coefficient was

Table 3. Description of the scores (n: 200).

	Statements	**Importance Mean±SD**	**Fulfilment Mean±SD**
1.	I would like to be informed of how responsible I am for my current PCI state of health	2.97±0.76	2.96±0.73
2.	I would like to be informed of how I can self-manage my PCI in order to improve my health	2.94±0.76	2.92±0.76
3.	I would like to be informed about my exact follow-up	2.94±0.76	3.01±0.74
4.	I would like to be informed of every treatment I receive	2.91±0.77	2.91±0.78
5.	I would like to be informed about the prognosis of my PCI	2.95±0.77	2.95±0.75
6.	I would like to be informed about the impact of PCI on my professional life	2.87±0.85	2.88±0.83
7.	I would like to be informed about the impact of PCI to my social life.	2.86±0.81	2.86±0.84
8.	I would like to be informed about the necessary lifestyle changes due to PCI	2.87±0.80	2.85±0.85
9.	I would like to receive written information about my PCI health (reason for re-admission, examinations, medications)	2.76±0.91	2.83±0.87
10	I would like to know if I can contact clinicians to be informed about my PCI	2.84±0.80	2.84±0.85
	Total Score (Range 10-40)	28.92±7.32	29.03±7.52

SD: Standard deviation

Table 4. Construct validity.

	Total Score of Importance		**Total Score of Fulfilment**	
	rho	p-value	rho	p-value
Statement 1	0.879	0.000	0.891	0.000
Statement 2	0.916	0.000	0.944	0.000
Statement 3	0.940	0.000	0.822	0.000
Statement 4	0.949	0.000	0.926	0.000
Statement 5	0.936	0.000	0.942	0.000
Statement 6	0.897	0.000	0.968	0.000
Statement 7	0.943	0.000	0.965	0.000
Statement 8	0.935	0.000	0.969	0.000
Statement 9	0.802	0.000	0.960	0.000
Statement 10	0.937	0.000	0.975	0.000
KMO value	0.923	**0.001**	0.916	**0.001**
Chi-square	3637.793		3823.486	

calculated for the fulfilment of information needs. The coefficient is 0.957 and the correlation between the two halves is 0.930, confirming the high consistency and strong correlation between the two sets of items.

Table 5. Exploratory factor analysis.

	Total Score of Importance Factor 1	**Total Score of Fulfilment** Factor 1
Statement 1	0.884	0.897
Statement 2	0.920	0.945
Statement 3	0.944	0.822
Statement 4	0.952	0.930
Statement 5	0.939	0.941
Statement 6	0.893	0.967
Statement 7	0.943	0.965
Statement 8	0.936	0.959
Statement 9	0.789	0.949
Statement 10	0.933	0.964
Eigenvalue	8.36	8.73
Variance Explained	83.649	87.369

DISCUSSION AND CONCLUSION

A patient-centered care approach aims to enhance patients' ability to care for themselves and improve their understanding of events related to their condition, ensuring better outcomes. This approach not only improves patients' quality of life but also helps to control healthcare costs. Given that patients are often discharged the day after undergoing percutaneous coronary intervention (PCI), healthcare professionals have limited time to provide pre-discharge information, making it challenging to assess and meet patients' informational needs fully.[16] Tailored educational interventions designed to address the specific needs of patients are highly effective. However, research shows that patients' information needs are often inadequately met, and nurses may not be sufficiently involved in delivering structured discharge education.[10]

The tools available to assess the information needs of patients undergoing percutaneous coronary artery intervention are limited. In a sample of Turkish patients receiving PCI, the NCPI-10 was found to be both valid and reliable. This 10-item scale, designed for quick completion, helps identify the specific information needs of PCI patients. Its versatility allows it to be used in both clinical settings and interview-based assessments, and it can also serve as a self-report instrument for patients.

PCI necessitates a thorough evaluation of the patient's needs. Patients undergoing coronary artery intervention require comprehensive information about their treatment, recovery process, medications, lifestyle changes, and potential complications. In addition to this, emotional support is essential to help patients cope with the procedure and its outcomes.[17]

Cronbach's alpha coefficient, which is an important indicator of scale reliability, is 0.98 for the importance and 0.97 for the fulfilment of information needs and has an extremely high internal consistency. A Cronbach's alpha coefficient of 0.70 or higher indicates strong reliability. The scale developed by Bubela et al. to assess patients' information needs and priorities at discharge has a Cronbach's alpha coefficient of 0.92. The similarity of the results between their study and our study further supports the excellent reliability of the NCPI-10 scale.

Test-retest reliability is another method used to assess the reliability of the PCI scale. In order to demonstrate test-retest reliability, the correlation coefficient between the scores obtained from the application of the measurement tool to the same group at different times should be at least 0.70.[18] In our study, test-retest reliability was found to be sufficient and the total correlation coefficient of the scale reached 0.95. This result indicates a high level of reliability. In addition, the test-retest reliability coefficient of the original scale was 0.80, which supports the acceptable and consistent reliability of the scale.

A sufficiently large sample size is necessary for scale research. While Bartlett's test was used to assess the sample size, Kaiser-Meyer-Olkin (KMO) metric was applied to assess its suitability for factor analysis. A KMO value greater than 0.60 is required for a comprehensive factor analysis.[19] In this study, the KMO values for scale fulfilment and importance level were 0.916 and 0.923, respectively. These values show that the sample is sufficient for a reliable factor analysis.

Bartlett's test is important because it indicates that the sample is sufficient and the correlation matrix is suitable for factor analysis.[20] In our study, the results of Bartlett's test of sphericity showed a chi-square

value of 3823.486 (df = 45) for satisfaction and 3637.793 (df = 45) for significance, both of which were statistically significant. It is recommended that factor loading values should be at least 0.40 or higher in the scale development and adaptation process. In our study, the factor loadings of the items in the NCPI-10 scale ranged between 0.78 and 0.96, indicating a strong factor structure and high item relevance.

In exploratory factor analysis (EFA), higher variance ratios, ideally 50% or above, indicate a stronger factor structure for a scale.[20] In this study, EFA results showed that factor loadings were adequate and explained variances exceeded 80%, which is considered to be an extremely high ratio and reflects a robust factor structure.

In conclusion, the NCPI-10 scale was found to be both valid and reliable in determining the information needs of patients undergoing percutaneous coronary intervention. We believe that this scale will be valuable in guiding nursing interventions during coronary angiography and will help better disease management for patients.

Ethics Committee Approval: Our study was approved by the university's Clinical Research Ethics Committee (Date: 16/08/2021, decision no: HRU/21.14.30). The study was carried out following the international declaration, guidelines, etc.

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

Author Contributions: Concept – DT, İCD; Supervision – DT, İCD, AS; Materials – DT, İCD; Data Collection and/or Processing – İCD; Analysis and/or Interpretation – DT, İCD; Writing –DT, İCD, AS.

Peer-review: Externally peer-reviewed.

Acknowledgement: We thank the patients who volunteered to participate in the study.

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OTJHS
Online Turkish Journal of Health Sciences

e-ISSN: 2459-1467

OTSBD
Online Türk Sağlık Bilimleri Dergisi

Online Turkish Journal of Health Sciences 2025;10(1):52-59 *Online Türk Sağlık Bilimleri Dergisi 2025;10(1):52-59*

The Psychological Toll on Healthcare Workers Following Türkiye's Earthquake Disasters

Türkiye'deki Deprem Felaketlerinin Sağlık Çalışanları Üzerindeki Psikolojik Etkisi

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ABSTRACT

Objective: The Kahramanmaraş-centered earthquakes in Türkiye profoundly impacted local healthcare workers' mental health. This study examines the relationships between sociodemographic and clinical variables, perceived social support, and psychological resilience in Post-Traumatic Stress Disorder (PTSD) development.

Materials and Methods: A cross-sectional survey was conducted among 104 healthcare workers from ten affected provinces: Adana, Adıyaman, Diyarbakır, Gaziantep, Hatay, Kahramanmaraş, Kilis, Malatya, Osmaniye, and Şanlıurfa. Participants completed the PTSD Checklist for DSM-5 (PCL-5), Beck Anxiety Inventory (BAI), Beck Depression Inventory (BDI), Multidimensional Scale of Perceived Social Support (MSPSS), and Connor-Davidson Resilience Scale (CD-RISC).

Results: The results revealed that 17.3% of participants exhibited severe trauma responses, while 82.7% had low trauma responses. Higher PTSD rates were associated with individuals living in moderately to severely damaged homes (%13.5, p=0.009) and assistant doctors whose education was interrupted by the disaster (%5.87, p= 0.019). Furthermore, PTSD diagnosis was positively correlated with anxiety (33±9, p<0.001) and depression scores (28±13, p<0,001) and negatively correlated with resilience (43±13, p<0.001).

Conclusions: These findings emphasize the urgent need for improved working conditions and the implementation of long-term follow-up studies for healthcare workers in earthquake-prone areas, to address the psychological impact of such disasters.

Keywords: Earthquakes, healthcare workers, post-traumatic stress disorder, psychological resilience

ÖZ

Amaç: Türkiye'de Kahramanmaraş merkezli depremler, bölgedeki sağlık çalışanlarının ruh sağlığını derinden etkilemiştir. Bu çalışma, sosyodemografik ve klinik değişkenler, algılanan sosyal destek ve psikolojik dayanıklılık ile Travma Sonrası Stres Bozukluğu (TSSB) gelişimi arasındaki ilişkiyi araştırmayı amaçlamaktadır.

Materyal ve Metot: Adana, Adıyaman, Diyarbakır, Gaziantep, Hatay, Kahramanmaraş, Kilis, Malatya, Osmaniye ve Şanlıurfa illerindeki sağlık çalışanları arasında kesitsel bir anket çalışması yapılmıştır. Katılımcılara, DSM-5 TSSB Kontrol Listesi (PCL-5), Beck Anksiyete Ölçeği (BAI), Beck Depresyon Ölçeği (BDI), Çok Boyutlu Algılanan Sosyal Destek Ölçeği (MSPSS) ve Connor-Davidson Dayanıklılık Ölçeği (CD-RISC) uygulanmıştır.

Bulgular: Sonuçlar, katılımcıların %17,3'ünün yüksek düzeyde travma tepkisi gösterdiğini, %82,7'sinin ise düşük düzeyde travma tepkisi gösterdiğini ortaya koymuştur. Orta veya ciddi hasar görmüş evlerde yaşayan (%13,5, p=0,009) ve eğitimleri deprem nedeniyle kesintiye uğrayan asistan doktorlar (%5,87, p= 0,019) arasında daha yüksek TSSB oranları görülmüştür. Ayrıca, TSSB tanısı, anksiyete (33±9, p<0,001) ve depresyon skorları (28±13, p<0,001) ile pozitif, dayanıklılık ile negatif bir ilişki göstermiştir (43±13, p<0,001).

Sonuç: Bu bulgular, sağlık çalışanlarının ruhsal etkilerle başa çıkabilmesi için çalışma koşullarının iyileştirilmesi ve uzun dönem takip çalışmalarının uygulanması gerekliliğini vurgulamaktadır.

Anahtar Kelimeler: Depremler, sağlık çalışanları, post-travmatik stres bozuklukları, psikolojik dirençlilik

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Yayın Bilgisi / Article Info:
Gönderi Tarihi/ Received: 22/11/2024
Kabul Tarihi/ Accepted: 30/12/2024
Online Yayın Tarihi/ Published: 17/03/2025

Atıf / Cited: Gürü M and Şahmelikoğlu Onur Ö. The Psychological Toll on Healthcare Workers Following Türkiye's Earthquake Disasters. *Online Türk Sağlık Bilimleri Dergisi* 2025;10(1):52-59. doi: DOI: 10.26453/otjhs.1589646

INTRODUCTION

The major earthquakes centered in Kahramanmaraş on February 6, 2023, devastated multiple cities in Türkiye, affecting around 15 million people, resulting in over 40,000 deaths and 100,000 injuries.[1] Despite facing personal losses and struggling with basic needs, many healthcare workers continued to care for victims, embodying the dual roles of rescuer and victim.[2]

While research on Post-Traumatic Stress Disorder (PTSD) has frequently focused on rescue teams and emergency responders, there has been limited study of local healthcare personnel who were themselves primary victims of the disaster. These healthcare workers are believed to experience higher rates of PTSD and depression than those who arrived later to assist.[3]

Perceived social support is a key factor influencing both the development and continuation of PTSD symptoms. The nature of social interactions plays a vital role in recovery, as strong support networks can help mitigate PTSD symptoms and enhance overall mental well-being.[4,5]

Additionally, resilience, the capacity to adapt positively to trauma, has emerged as a crucial factor in trauma recovery. Studies, including a large-scale investigation in Japan, indicate that resilience can protect against PTSD, especially when reinforced by stable routines and work opportunities.[6] For healthcare workers who face frequent exposure to traumatic events, including disasters and pandemics, fostering resilience is essential to mental health outcomes.[2,7]

This study aims to assess the impact of earthquakes on the mental health of local healthcare workers, examining how perceived social support and psychological resilience influence PTSD risk. The findings may provide insights into the development of evidence-based support strategies to help healthcare professionals cope with trauma.

MATERIALS AND METHODS

Ethical Approval: Ethical approval for the study was obtained from Gazi University on June 20, 2023 (Date: 20.06.2023; decision no: 12). This study was conducted in accordance with international declarations, guidelines, and ethical principles, including the Declaration of Helsinki.

Study Design and Data Description: Healthcare workers in ten provinces affected by the Kahramanmaraş-centered earthquakes on February 6, 2023 (Adana, Adıyaman, Diyarbakır, Gaziantep, Hatay, Kahramanmaraş, Kilis, Malatya, Osmaniye, Şanlıurfa) were invited to participate through survey forms distributed via Google Forms. Participants were informed about the study's purpose and methodology, and consent was obtained. Surveys were conducted from August 7 to September 7, 2023, six months after the earthquake trauma.

Scales and Calculating the Scores:

Sociodemographic Data Form: Prepared by the researchers based on literature review, this form includes questions about participants' age, education, profession, work status during the earthquakes, earthquake-related losses, living situation post-earthquake, and the return-to-work process.

PTSD Checklist for DSM-5 (PCL-5): The PTSD Checklist for DSM-5 (PCL-5) was developed by Weathers et al.[8] to measure symptoms of post-traumatic stress disorder (PTSD) based on the DSM-5 diagnostic criteria. The scale evaluates PTSD symptoms across four core factors: re-experiencing, avoidance, negative alterations in cognition and mood, and hyperarousal. It consists of a total of 20 items, with responses rated on a 5-point Likert scale (0: Not at all, 4: Extremely). Respondents indicate how often they have experienced each symptom over a specific period.

The total score is calculated by summing the ratings of all 20 items, yielding a possible score range of 0 to 80, where higher scores indicate greater severity of PTSD symptoms. The PCL-5 is widely used in both research and clinical settings for diagnosing PTSD and evaluating symptom severity.

The Turkish adaptation of the scale was carried out by Boysan et al.[9], who confirmed its reliability and validity. In the Turkish version, a cutoff score of 48 was determined for distinguishing individuals at risk of PTSD according to DSM-5 criteria. A total score of 48 or higher suggests that the individual may be at risk for PTSD and warrants further clinical evaluation.

Beck Anxiety Inventory (BAI): The inventory, initially developed by Beck et al.[10], assesses the physical, emotional, and cognitive dimensions of anxiety and the fear of losing control. Ulusoy et al.[11] later adapted the scale into Turkish. Comprising 21 items scored on a scale from 0 to 3, the total score ranges from 0 to 63, reflecting the severity of anxiety.

Beck Depression Inventory (BDI): A self-report scale composed of 21 items measuring somatic, emotional, cognitive, and impulsive symptoms of depression.[12] Each item is scored between 0 and 3. The total score spans from 0 to 63, with higher values representing greater severity of depression. The Turkish adaptation was conducted by Hisli.[13]

Multidimensional Scale of Perceived Social Support (MSPSS): Developed by Zimet et al.[14] and validated in Turkish by Eker et al.[15] It is a 12-item scale that subjectively evaluates the adequacy of social support received from three different sources (family, friends, and a significant other). Higher

scores indicate higher perceived social support.

Connor-Davidson Resilience Scale (CD-RISC): Initially developed by Connor and Davidson[16] and later validated in Turkish[17], this scale comprises 25 items rated on a 5-point Likert scale, where higher scores reflect greater psychological resilience. The Turkish adaptation includes subscales focusing on persistence and personal competence, tolerance for negative experiences, and spiritual inclination.

Statistical Analysis: The data were analyzed utilizing IBM SPSS Statistics version 26.0. Normality was checked with the Kolmogorov-Smirnov test, and nonparametric tests were used due to non-normal distribution. The Kruskal-Wallis test analyzed categorical and numerical variables, with post hoc analysis by Mann-Whitney U test. Chi-square and Fisher Exact tests examined categorical relationships, with significance set at $p<0.05$. A power analysis (medium effect size, Cohen's $d=0.5$; $\alpha=0.05$; power=80%) indicated a necessary sample size of 104, ensuring an 80% chance of detecting a medium effect.

RESULTS

Table 1 presents the sociodemographic and earthquake-related characteristics. Of the 104 healthcare workers, 60 (57.7%) were female and 44 (42.3%) were male, with an average age of 36. In total, 34 (32.7%) reported physical injuries, 48 (46.2%) had homes moderately to severely damaged, and 13 (12.5%) lost a first-degree relative. While 56 (53.8%) continued living in their homes, others stayed with relatives, in guesthouses or hotels, in tents or containers, or relocated. Among assistant doctors, 13 (86.7%) reported educational disruptions, 7 (46.7%) considered changing clinics, and 3 (20%) had already done so. Figure 1 shows the distribution of cities where healthcare workers reside.

Table 1. Sociodemographic and earthquake-related characteristics.

Characteristics		n (%)
Gender	Women	60 (57.7)
	Men	44 (42.3)
Physically injured due to the earthquakes	Yes	34 (32.7)
	No	70 (67.3)
Damaged house due to the earthquakes	Yes	48 (46.2)
	No	56 (53.8)
Death of first-degree relatives due to the earthquakes	Yes	13 (12.5)
	No	87 (87.5)
Residing in the same house as before the earthquakes	Yes	56 (53.8)
	No	48 (46.2)
Disruption in the education of assistant doctors	Yes	13 (86.7)
	No	2 (13.3)
Consider changing clinic	Yes	7 (46.7)
	No	5 (33.3)
	I changed	3 (20)

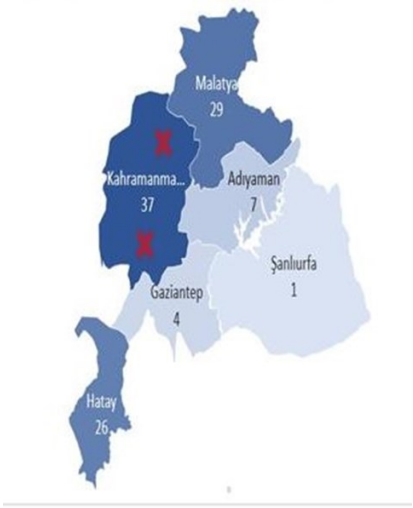

Figure 1: During and after the Kahramanmaraş earthquakes, the provinces where healthcare professionals participating in the study resided, distribution of participants by province (n), and the epicenters of the earthquake (X).

The relationship between sociodemographic variables and PTSD diagnosis is shown in Table 2. Two groups were formed based on PCL-5 total scores: one group with severe trauma response and PTSD diagnosis, and another group with low trauma response. Laboratory technicians had statistically significantly lower rates of PTSD diagnosis compared to other healthcare workers (p=0.027). Healthcare workers whose homes were moderately to severely damaged had higher rates of PTSD diagnosis compared to those with mildly damaged homes (p=0.009). Those who moved in with relatives due to home damage had higher rates of PTSD diagnosis (p=0.027). Assistant doctors experiencing educational disruptions had higher PTSD rates than those without disruptions (p=0.019).

The relationship between clinical characteristics of healthcare workers and PTSD diagnosis is shown in Table 3. Those physically injured due to the earthquake had higher PTSD rates compared to those not injured (p=0.013).

Table 2. Sociodemographic characteristics and their association with PTSD diagnosis.

Characteristics		PTSD		p-value
		No n (%)	Yes n (%)	
Gender	Woman	48 (46)	12	0.345
	Man	38 (36.6)	6 (5.8)	
Marital status	Single	27 (26)	8 (7.7)	0.265
	Married	59 (56.7)	10 (9.6)	
Occupation	Assistant doctor	9 (8.6)	6 (5.8)	0.027*
	Specialist	13 (12.5)	2 (2)	
	Nurse	22 (21.1)	5 (4.8)	
	Clinic staff	14 (13.4)	3 (2.9)	
	Medical secretary	14 (13.4)	2 (2)	
	Pharmacist	2 (2)	0 (0)	
	Laboratory technician	12 (11.5)	0 (0)	
Working during the earthquakes	Yes	26 (25)	7 (6.7)	0.308
	No	60 (57.7)	11 (10.6)	
Damaged house due to the earthquakes	None	3 (2.9)	0 (0)	0.009*
	Yes, light	50 (48)	4 (3.9)	
	Yes, medium	22 (21.1)	12 (11.5)	
	Yes, heavy	11 (10.6)	2 (2)	
Where do you live after earthquakes?	House before the earthquakes	52 (50)	4 (3.9)	0.027*
	With my relatives in their house	10 (9.5)	8 (7.7)	
	Hotel, guesthouse, etc	10 (9.5)	2 (2)	
	Tenth or container	4 (3.9)	2 (2)	
	Migrated to another city	10 (9.5)	2 (2)	
Death of first-degree relatives due to the earthquakes	Yes	8 (7.7)	5 (4.8)	0.026
	No	78 (75)	13 (12.5)	
After the earthquakes, I started to work	On the call of supervisor	41 (39.4)	12 (11.5)	0.057*
	As a volunteer	36 (34.6)	6 (5.8)	
	I did not start working	9 (8.7)	0 (0)	
Workday after the earthquakes	Median range (min-max)	3 (1-100)	5 (1-70)	0.661*
Disruption in the education of assistant doctors	Yes	8 (7.7)	5 (4.9)	0.019
	No	1 (0.97)	1 (0.97)	
Consider changing clinic[a]	Yes	5 (4.9)	2 (2)	0.749*
	No	3 (2.9)	2 (2)	
	I changed	1 (0.97)	2 (2)	

*Mann Whitney-u Test; a 89 participants declared that they were not assistant doctors; The opportunity to change clinics was given only to assistant doctors by the state; PTSD: Post Traumatic Stress Disorder.

Table 3. Clinical characteristics of healthcare workers and their association with PTSD diagnosis.

Characteristics		PTSD		p-value
		No n (%)	Yes n (%)	
Previous psychiatric treatment	Yes	15 (14.4)	4 (3.9)	0.323
	No	71 (68.2)	14 (13.4)	
Previous psychiatric diagnose	None	74 (71.2)	14 (13.4)	0.288*
	Major depressive disorder	10 (9)	0 (0)	
	Generalized anxiety disorder	1 (0.97)	1 (0.97)	
	Panic disorder	1 (0.97)	3 (2.9)	

*Mann Whitney-u Test

Table 3. Continue.

Familial psychiatric treatment	Yes	12 (11.5)	4 (3.9)	0.323
	No	74 (71.2)	14 (13.4)	
Experience a traumatic event before the earthquakes	No	70 (67.3)	11 (10.5)	0.075*
	Yes, earthquake	9 (8.6)	4 (3.9)	
	Yes, violence	4 (3.9)	0 (0)	
	Yes, accident	3 (2.9)	3 (2.9)	
Psychiatric treatment after earthquake	Yes	14 (13.4)	6 (5.8)	116
	No	72 (69.3)	12 (11.5)	
Physically injured due to the earthquakes	Yes	24 (23)	10 (9.6)	0.013
	No	62 (59.7)	8 (7.7)	

*Mann Whitney-u Test

The relationship between PTSD diagnosis and BAI, BDI, MSPSS, CD-RISC total scores, and CD-RISC subscale scores is shown in Table 4. A statistically significant positive correlation was found between PTSD diagnosis and total BAI and BDI scores ($p<0.001$, $p<0.001$). There was an evident negative correlation between PTSD diagnosis and CD-RISC total score and subscales of perseverance and personal competence, and tolerance of negative events ($p<0.001$, $p=0.003$).

Table 4. Scale scores of healthcare workers and their association with PTSD diagnosis.

Scores	PTSD		p-value
	No Mean±SD	Yes Mean±SD	
BAI score[a]	15±7	33±9	0,001
BDI score[b]	15±8	28±13	0,001
MSPSS score[c]	48±14	43±15	0,229
CD-RISC score[d]	58±11	43±13	0,001
Perseverance and personal competence	35±8	24±9	0,001
Tolerance to negative facts	14±4	11±3	0,003
Spiritual inclination	9±3	8±3	0,252
-			

a: Beck Anxiety Inventory; b: Beck Depression Inventory; c: The Multidimensional Scale Of Perceived Social Support; d: The Connor–Davidson Resilience Scale.

DISCUSSION AND CONCLUSION

This study aims to assess the mental health and PTSD risk among healthcare workers in the earthquake zone who directly experienced the trauma, identifying factors that influence this risk. Although studies exist on outside aid teams, detailed research on the mental state of local healthcare workers remains limited.[18]

Our study found a PTSD diagnosis rate of 17.3% among healthcare workers, consistent with previous research showing prevalence rates of 16.37% and 21.9% following earthquakes.[19,20] Differences in PTSD rates across studies may result from the varied cutoff scores used for the PCL-5 scale, ranging from 22 to 49.[21] Using Boysan et al.'s[9] Turkish adaptation, we set a cutoff of 48; if we considered scores above 31 as indicative of PTSD, the rate would be higher.

No significant difference in PTSD diagnosis was observed between genders. Although some studies identify female gender as a risk factor for PTSD [20-22], others find no such effect. These differences might be related to sample size and the number of women in the sample.

Our study found that the profession is a risk factor for PTSD development among healthcare workers, with nurses particularly being more likely to receive a PTSD diagnosis. This may be attributed to the higher proportion of female nurses.[18,23] However, our study found no difference in PTSD diagnosis rates between nurses and other professions. This result might be due to the lack of a gender difference in PTSD diagnosis in our study, with 7 out of 27 nurses being male, potentially influencing the outcome. The only significant professional finding was that laboratory technicians had statistically lower PTSD rates compared to other healthcare workers, possibly due to their behind-the-scenes role in post-trauma interventions.

Of the 15 assistant doctors in our study, 13 (86.7%) reported disruptions in their educational activities post-earthquake, with 3 (20%) changing clinics as a result. Assistant doctors who experienced educational disruptions showed a higher likelihood of being diagnosed with PTSD, underscoring the importance of returning to familiar work and life routines for

psychological recovery. These findings highlight the need for structured support systems that facilitate continuity in educational and professional activities, which, as noted in previous studies, can aid in stabilizing mental health and resilience in the aftermath of trauma [24].

No significant relationship was found between past trauma and PTSD, though earthquake-related trauma was the most common (12.5%), likely due to the study area's seismic activity. Geographic factors thus appear to shape trauma experiences, as repeated exposure to disasters may elevate trauma risks, even if not directly linked to PTSD here.

Other key findings indicate higher PTSD rates among healthcare workers with severely damaged homes, physical injuries, or a first-degree relative loss in the earthquake, aligning with research identifying injury, home loss, and bereavement as PTSD risk factors.[25,26] Those who continued living in their own homes post-earthquake had lower PTSD rates.

Comorbid diagnoses are common in PTSD, with over 50% of patients meeting criteria for another psychiatric disorder.[27] In our study, 38.6% of healthcare workers experienced depression, and 57.7% reported anxiety, with higher scores among those diagnosed with PTSD. Comorbid anxiety and depression in PTSD are linked to chronicity and treatment resistance, highlighting the importance of addressing these symptoms for prognosis. [28] Despite experiencing mental health symptoms, only 20.8% of healthcare workers sought psychiatric support post-earthquake. The Turkish Psychiatric Association offered guidance and remote services with volunteer experts, underscoring the need for targeted mental health teams for healthcare workers post-disaster.[29]

Perceived social support is a known risk factor for PTSD.[4,5] Although healthcare workers with PTSD had slightly lower MSPSS scores, the difference was not statistically significant. Due to widespread disruptions, including mobile and transportation issues, social support was likely limited following the earthquakes.

Psychological resilience is critical for recovery.[30] In our study, healthcare workers with PTSD had lower resilience scores, particularly in perseverance and tolerance for negative events, mirroring findings from other earthquake-affected populations. These results emphasize the value of resilience-building interventions post-disaster.

Our study provides a unique look at the mental health, PTSD prevalence, and resilience of healthcare workers impacted by an earthquake. However, there are several limitations to consider. These include the small sample size, the cross-sectional design, and the reliance on self-reported scales without clinical interviews. Additionally, the absence of a control group and the unequal distribution of occupational groups limit the generalizability of the findings. Future research should incorporate clinical evaluations alongside self-report measures and strive for more representative sampling to address these issues.

In conclusion, our findings reveal a high prevalence of early-onset psychiatric disorders among healthcare workers affected by earthquakes. Resident doctors who experienced training disruptions, home damage, injuries, or the loss of close relatives exhibited higher rates of PTSD. PTSD often coexisted with depression and anxiety, though many individuals avoided seeking psychiatric help. Psychological resilience emerged as a significant protective factor. The mental health of healthcare workers is crucial, emphasizing the need for improved post-disaster working conditions and support that addresses psychological, social, and medical needs. Long-term studies in Türkiye are essential to ensure sustained mental health support in this earthquake-prone region.

Ethics Committee Approval: Ethical approval for the study was obtained from Gazi University on June 20, 2023 (Date: 20.06.2023; decision no: 12). All participants provided informed consent.

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

Author Contributions: Concept – MG, ÖŞO; Supervision – MG, ÖŞO; Materials – MG, ÖŞO; Data Collection and/or Processing – MG, ÖŞO; Analysis and/or Interpretation – MG, ÖŞO; Writing – MG, ÖŞO.

Peer-review: Externally peer-reviewed.

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OTJHS
Online Turkish Journal of Health Sciences

e-ISSN: 2459-1467

OTSBD
Online Türk Sağlık Bilimleri Dergisi

Online Turkish Journal of Health Sciences 2025;10(1):60-68 *Online Türk Sağlık Bilimleri Dergisi 2025;10(1):60-68*

Comparison of Smartphone Applications with Traditional Tools in the Assessment of Patellofemoral Pain: Validity and Reliability Study

Patellofemoral Ağrının Değerlendirilmesinde Akıllı Telefon Uygulamalarının Geleneksel Araçlarla Karşılaştırılması: Geçerlilik ve Güvenirlik Çalışması

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ABSTRACT

Objectives: Patellofemoral pain (PFP) is one of the most confusing and clinically challenging chronic diseases. The aim of this study was to determine the validity and reliability of the smartphone goniometer application in patients with PFP by comparing it with a universal and digital inclinometer.

Materials and Methods: Twenty-seven patients with PFP were included in this study. Flexion range of motion for the knee joint and flexion/extension, abduction, and internal/external rotation range of motion for the hip joint were measured by two examiners using a smartphone application, a digital inclinometer, and a universal goniometer. To assess inter-rater reliability, the two measurements made by the first observer were evaluated at 24-48 hour intervals. To assess intra-rater reliability, the measurements of both observers were compared.

Results: With all three methods, active knee and hip range of motion measurements in PSS patients showed high intra-rater and inter-rater reliability (ICC = 0.69-0.97). Concurrent validity analysis also showed statistically significant, moderate to strong correlations between the three methods (r = 0.562-0.993). SEM and MDC were highest in the goniometer measurement and were intra-observer (3.77-7.94° and 10.44-21.99°, respectively) and inter-observer (2.61-9.45° and 7.23-27.54°, respectively).

Conclusions: The smartphone app, inclinometer, and universal goniometer are valid and reliable for measuring lower limb ROM in PFA patients. They can be used in the clinic.

Keywords: Lower extremity, anterior knee pain syndrome, range of motion, mobile application, test-retest reliability

ÖZ

Amaç: Patellofemoral ağrı (PFA) en kafa karıştırıcı ve klinik olarak zorlayıcı kronik hastalıklardan biridir. Akıllı telefon gonyometre uygulamasının PFA hastalarda geçerlilik ve güvenilirliğinin universal gonyometre ve dijital inklinometre ile karşılaştırılarak belirlenmesi planlanmıştır.

Materyal ve Metot: Bu çalışmaya PFA yirmi yedi hasta dahil edildi. Diz eklemi için fleksiyon hareket açıklığı ve kalça eklemi için fleksiyon/ekstansiyon, abdüksiyon, iç/dış rotasyon hareket açıklığı akıllı telefon uygulaması, dijital inklinometre ve üniversal gonyometre kullanılarak iki denetçi tarafından ölçüldü. Değerlendiriciler arası güvenilirliği değerlendirmek için, ilk gözlemci tarafından yapılan iki ölçüm 24-48 saat aralıklarla değerlendirilmiştir. Değerlendirici içi güvenilirliği değerlendirmek için her iki gözlemcinin ölçümleri karşılaştırılmıştır.

Bulgular: Her üç yöntemle de, PFA hastalarında aktif diz ve kalça hareket açıklığı ölçümleri yüksek gözlemci içi ve gözlemciler arası güvenilirlik göstermiştir (ICC = 0,69-0,97). Eşzamanlı geçerlilik analizi de üç yöntem arasında istatistiksel olarak anlamlı, orta ila güçlü korelasyonlar gösterdi (r = 0,562-0,993). SEM ve MDC en yüksek gonyometre ölçümünde olduğu ve gözlemciler içi (sırasıyla, 3,77-7,94° ve 10,44-21,99°), gözlemciler arasında (sırasıyla, 2,61-9,45° ve 7,23-27,54°) olduğu belirlenmiştir

Sonuç: PFA hastalarında alt ekstremite ROM'ların ölçmek için akıllı telefon uygulaması, inclinometre ve universal gonyometre geçerli ve güvenirdir. Klinikte kullanılabilinir.

Anahtar Kelimeler: Alt ekstremite, diz önü ağrı sendromu, hareket açıklığı, mobil uygulama, test-tekrar test güvenilirliği

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Yayın Bilgisi / Article Info:
Gönderi Tarihi/ Received: 29/11/2024
Kabul Tarihi/ Accepted: 07/12/2025
Online Yayın Tarihi/ Published: 17/03/2025

Atıf / Cited: Çankaya M and Bekaroğlu A. Comparison of Smartphone Applications with Traditional Tools in the Assessment of Patellofemoral Pain: Validity and Reliability Study. *Online Türk Sağlık Bilimleri Dergisi* 2025;10(1):60-68. doi: 10.26453/otjhs.1593588

INTRODUCTION

Patellofemoral pain (PFP) is one of the most common knee disorders that impair function and daily activities.[1] Symptoms usually arise from the anterior aspect of the patella and along the medial aspect of the knee.[2] The symptoms of PFP may develop slowly or suddenly, and pain tends to worsen with activities such as squatting, prolonged sitting, climbing stairs, jumping, and running.[3,4]

Measurements of range of motion (ROM) are widely used in the evaluation of PFP.[1] When the literature is examined, it is seen that the reliability and validity of universal goniometers (UGs) and smartphone applications (SAs) have been verified in samples of healthy individuals.[5,6] Goniometer obtaining accurate and consistent measurements of joint ROM is extremely difficult due to anatomical complexity and associated movements.[7] Tools, including electro goniometers, HALO digital goniometers, photogrammetry software, Hawk goniometers, and Sas, are currently used.[7,8]

Digital inclinometers (DIs) are handheld devices placed on the body's surface to measure the angular position relative to the vertical or horizontal plane.[9] DIs can help in stabilizing the limb and performing the measurements.[10] With the development of smartphone technology and software applications, phone applications with evaluation purposes are increasing alongside the widespread ownership of smartphones. SAs are similar to UGs in that they are easy to use, relatively inexpensive, and highly accessible.[8,11] With the use of SA downloadable data, such as that obtained by electrogoniometry, these measurements can be converted into meaningful assessment data, such as data on joint motion. Therefore, the emergence of smartphone-based goniometer apps offers clinical practitioners a new set of tools to incorporate into clinical practice.[11] Smartphone application needs to be developed further due to its advantages such as portability, low energy requirement, user-friendliness, wide instrumentation possibilities, cost, ease of use and easy applicability in daily rehabilitation. Existing smartphone applications have a great advantage in terms of quality and ease of use.

When the literature was examined, it was found that there were studies examining the validity of UGs and SAs.[12,13] However, the validity and reliability analyses conducted to date were conducted for healthy individuals and no research has been conducted on unhealthy individuals. Research on unhealthy individuals would most likely yield different measurement results due to pain and limitation of movement among unhealthy individuals; thus, the results obtained from such research would be more consistent with the data obtained from other methods. Demonstrating that SA can be applied to patient individuals is important for the dissemination of a new method that can be used in the clinic.

Goniometric measurements are performed on sick individuals rather than healthy individuals in the clinic.[5,6,8,9] Our research is important in terms of showing results on sick individuals. Determining that it can be used on patients is important in terms of its use in the clinic and its widespread use as a preferred method. In addition, when the literature was examined, UGs were found to have been compared with only SA validity analysis.[11] Determining that it can be used on patients is important for its use and dissemination in the clinic. This study aims to compare the SA method with other traditional methods and to analyze its validity and reliability.

MATERIALS AND METHODS

Ethics Committee Approval: This was a descriptive single-blind study. The research was approved by the Necmettin Erbakan University Health Sciences Scientific Research Ethics (Date:03.01.2024, decision no:2024/632), and all procedures were conducted by the Declaration of Helsinki. All participants provided verbal and written informed consent.

Study Sample: The literature suggests that the acceptable power threshold for research should be 0.80.[14] Roach et al. reported an effect size of 0.92 upon calculating the means and standard deviations of hip joint extension.[15] However, in the present study, the effect size was taken as 0.35 to ensure high power. Using G*Power 3.1.9.2 with an effect size of 0.35, standard error of 0.05, and power of 95%, it was determined that calculations made with ANOVA, including repeated measures and within-group and between-group interactions for three groups and two measurements, should be based on 24 participants. In recognition of the risk of patient dropouts during the research, 27 patients were enrolled in the study.[16] It was observed that similar sized samples were taken in the studies.[8,11] The effect size post power analysis was calculated by taking the means and standard deviations of the second measurements of SA and UG from the knee flexion measurements on the Cohend d, Effect Size Calculator for T-Test website (https://www.statskingdom.com/140Mean T2eq.html) and 0.43 was found. G*Power 3.1.9.2 program, Post power analysis, 0.43 effect size was calculated as 27 participants with 0.05 standard error and 95 percent power (ANOVA: Repeated measures, within-between interaction 3 groups, 2 measurements) and it was determined that the power was 97 percent in post hoc analysis. The effect size of our post hoc results was determined as 0.43 and the effect size was taken as 0.35 at the beginning of our study.

This shows that the sample size of 27 people included in the study is sufficient. These participants included individuals with anterior knee pain who presented to Seydişehir State Hospital. A total of 27 patients with PFP were evaluated in the laboratory of the Seydişehir Vocational School of Health Services between January 2024 and August 2024. Only one extremity was evaluated for each patient. Patients with PFP were included in the study by physiotherapists.[17] Inclusion criteria included anterior knee pain or retro patellar pain caused by at least two of the following activities: prolonged sitting knee flexion, bilateral squatting, ascending and descending stairs, kneeling, running, or jumping. Pain in one extremity.[18] The exclusion criteria were as follows: signs or symptoms of any current or past knee dysfunction, history of surgery on any lower limb joint, and a history of physiotherapy treatment of the knee area within the previous 6 months before the clinical evaluation.[18]

Measurement Protocols: Goniometric measurements were performed for each patient by two evaluators. Active ROM measurement was performed with five volunteers for a pilot study. Subsequently, 27 patients were evaluated. Knee and hip ROM was assessed by two assessors using a UG (Saehan SH5110 steel goniometer set), inclinometer (Baseline digital inclinometer), and SA (Electrogoniometer) (Figure 1). Patients rested for 5 –10 minutes after the first evaluation (Figure 2).[19] The second evaluator then evaluated them. ROM measurements were performed in the same order in all assessments. The measured parameters included the flexion and extension of the knee joint, abduction, and internal/external rotation of the hip joint. After 24–48 hours, the assessment was repeated twice (Figure 2). Both examiners were blinded to the other's measurements.[20] Inter-rater measurements were performed by the same assessor.

Outcome Measures

The sociodemographic characteristics of the participants were recorded. Knee and hip ROM values were determined by UG, DI, and SA.

Knee and hip joint ROM assessment: Participants were asked to maintain their final position at the maximum ROM for at least 3 seconds. Three consecutive measurements were performed, and the mean of those three measurements for each direction was used for analysis. Measurements were performed for the affected lower extremity, and the active ROM was assessed.

Knee joint ROM flexion assessment: With the patient in the prone position, the goniometer was positioned with the pivot point on the femoral lateral condyle, the fixed arm in the direction of the greater

Figure 1. Electrogoniometer application.

Figure 2. Range of motion measurement tools.

trochanter, and the movable arm in line with the fibular shaft.[19] Starting from the knee joint extension position of 0°, the degree of the angle at the end-point of the knee joint was measured by following the knee joint flexion of the movable arm.[21] DI and SA measurements were made on the midline lateral to the fibula. The knee was bent from full extension (0°) to full flexion.

Hip Joint ROM flexion/extension assessment: The hip extension was evaluated in the prone position and flexion in the supine position. For hip flexion measurement, the goniometer was placed over the trochanter major of the femur, with the fixed arm parallel to the lateral side of the body and the movable arm parallel to the lateral side of the femur.[22] Participants were then asked to perform maximal active hip flexion. The hip joint extension was performed by placing similar points on the goniometer.[22] Measured in a similar way with the DI/SA.

Hip joint ROM abduction assessment: With the patient in the supine position, were made on the spina iliaca anterior superior (SIAS) of the pelvis, with the fixed arm parallel to an imaginary line between the right and left SIAS and the mobile arm following a line parallel to the longitudinal axis of the femur and aligned with the midpoint of the patella. The DI and SA devices were held parallel to the lateral side of the femoral shaft of the patient in the side-lying position and the patient was asked to perform an abduction movement against gravity.[21,22]

Assessment of hip joint ROM internal/external rotation: Participants assumed a sitting position with their hips in 90° flexion, trunk erect, and arms crossed at the chest. The UG axis was placed on the tuberosity of the tibia, the fixed arm was parallel to the ground, and the mobile arm was parallel to the longitudinal axis of the tibia.[21,22] For DI and SA measurements, the phone was held parallel to the anterior longitudinal axis of the tibia in the same starting position, and the same movements were performed.

Statistical Analysis: IBM SPSS 29.00 was used for statistical analyses. Mean and standard deviation for continuous values and number and percentage for categorical values. Data were checked for accuracy and normal distribution using the Kolmogorov–Smirnov test and kurtosis and skewness analysis.[23] ICC, MDC, SD values were calculated to determine the minimum significant difference and the relationship between the measurements. Intraclass correlation coefficients (ICCs) were calculated with 95% confidence intervals (CIs) and standard errors.[19] Standard error of measurement (SEM) values were calculated using the formula SD× ($\sqrt{(1-ICC)}$). Minimum detectable change (MDC) at a 95% CI was calculated as MDC=1.96×SEM×√2.[13] For absolute measures of reliability and validity, the following criteria were used SEM: Poor SEM > 5˚ and Good SEM ≤5˚; MDC: Poor MDC > 9.8˚ and Good MDC ≤9.8.[8] Test-retest Pearson correlation coefficients were used to assess knee and hip ROM ($p<0.05$).[24] Correlations were interpreted as excellent ($r>0.90$), good ($0.90>r>0.71$), fair ($0.70>r>0.51$), moderate ($0.50>r>0.31$) and poor ($r\leq0.30$).[24]

RESULTS

A single extremity was evaluated for each of 27 participants aged 19–45 years. The physical and sociodemographic characteristics are presented (Table 1).

Table 1. Physical and sociodemographic characteristics of the participants (n=27).

Physical characteristics		**Data**
Age (year) Mean±SD, (Min.-Max.)		30.67±14.40 (19-45)
BMI (kg/m^2) Mean±SD, (Min.-Max.)		24.46±4.67 (18.07-34.77)
D**uration of complaint (month)** Mean±SD, (Min.-Max.)		2.48±1.55 (1.00-6.00)
Pain severity Mean±SD, (Min.-Max.)		52.34± 12.9 (27.00-73.30)
Sex n (%)	Female	19 (70.4)
	Male	8 (29.6)
Education level n (%)	Primary school	5 (18.5)
	Middle school	3 (11.1)
	High school	1 (3.7)
	University and above	18 (66.7)
Occupation status n (%)	Student	18 (66.7)
	Worker	3 (11.1)
	Retired	2 (7.4)
	Housewife	4 (14.8)
Marital status n (%)	Married	8 (29.6)
	Single	18 (66.7)
	Divorced	1 (3.7)
Working Status n (%)	Full time	3 (11.1)
	Part-time	0 (0)
	Not working	24 (88.9)

SD: Standard Deviation; BMI: Body Mass Index.

Table 1. Continue.

Income-Expense balance n (%)	Equal	10 (37)
	Income>expense	2 (7.4)
	Income<expense	15 (55.6)
Patient history n (%)	Hypertension	3 (11.1)
	Diabetes	4 (14.8)
	Other	2 (7.4)
	None	18 (66.7)
Party under evaluation n (%)	Right	23 (85.2)
	Left	4 (14.8)

SD: Standard Deviation; BMI: Body Mass Index.

The results of intra- and interrater reliability analyses are shown in Table 2. Good intra- and interrater reliability were found for hip extension, abduction, and external rotation (intrarater reliability) by UG, while excellent intra- and interrater reliability was found for the other measurements. For all measured active hip and knee joint ROM values, intra- and interrater reliability was excellent for DI and SA. When the interrater reliability of the measurement methods was analyzed at a 95% CI, the highest ICCs were determined for knee flexion and hip internal rotation by DI (ICC: 0.97 and ICC: 0.92, respectively) and for hip flexion, extension, abduction, and external rotation by SA (ICC: 0.97, ICC: 0.91, ICC: 0.80, and ICC: 0.88, respectively). When the intrarater reliability of the measurement methods was analyzed at a 95% CI, it was determined that the highest ICCs were obtained for knee flexion and hip internal rotation by DI (ICC: 0.91 and ICC: 0.92, respectively) and for hip flexion, extension, abduction, and external rotation by SA (ICC: 0.97, ICC: 0.91, ICC: 0.80, and ICC: 0.88, respectively) (Table 2). Further data from intra- and interrater reliability analyses, including ICC values with 95% CI, SEM, and MDC, are reported in Table 2. The SEM and MDC values were highest for the goniometer measurements, with intrarater SEM and MDC values of 3.77–7.94° and 10.44–21.99°, respectively, and interrater SEM and MDC values of 2.61–9.45° and 7.23–27.54°, respectively. There were significant differences ($p<0.05$) among the SA, DI, and UG results for all inter- and intrarater measurements.

Validity analysis and criterion validity reflect the extent to which a measurement correlates with the results of other methods that aim to measure the target construct. In the present study of the concurrent validity of knee flexion, hip flexion, extension, abduction, external rotation, and internal rotation ROM measurements made with three different methods, the strongest correlations were found between the SA and DI methods (r=0.952, r=0.993, r=0.842, r=0.807, r=0.970, and r=0.963, respectively). Correlations were also observed between the SA and UG methods for hip flexion, abduction, and external rotation (r=0.986, r=0.680, and r=0.945, respectively) and between the DI and UG methods for knee flexion, hip flexion, and extension, and internal rotation (r=0.914, r=0.986, and r=0.844, respectively). All correlations were significant ($p<0.001$) (Table 3).

DISCUSSION AND CONCLUSION

Clinical measurements should be accurate, reliable, reproducible, sensitive to changes in outcomes, easy to implement, and accessible.[21] In this study, we aimed to evaluate the validity, interrater reliability, and intrarater reliability of measurements of active knee and hip joint ROM in PFP patients by comparing the results obtained from SA, DI, and UG. These methods yielded valid and reliable results for the measurement of lower extremity ROM in patients with PFP. Furthermore, excellent correlations among SA, DI, and UG were demonstrated. These results suggest that SAs are useful tools for measuring knee and hip ROM in clinical settings.

Although reliable intrarater and interrater analysis results were obtained in this study for knee and hip joint measurements using all three methods, it was determined that the reliability of the SA was higher than that of the UG. Similar results were obtained in this study in terms of the reliability of the SA and DI.

Acar et al. found that the interrater and intrarater ICC values for active knee flexion measurements were higher with the SA method compared to the UG method (ICC = 0.749–0.949) ($p=0.013$).[19] Saraç et al. obtained excellent results in their intrarater reliability analysis of UG and SA measurements of the hip joint, but the ICC measurement values obtained with the UG were lower (ICC: 0.96-0.98).[21] Mohammad et al. determined that the ICC values of their DI and SA reliability results were excellent for the evaluation of the ROM of the knee and hip joints (ICC:0.95-0.98).[5] Our results are similar to those of Saraç et al. and Mohammad et al. in terms of reliability.[5,21]

Knee and hip joint movements are critical for performing activities of daily living, such as squatting, walking on an incline, and walking up and down stairs. In several studies of patients with PFP, active

Table 2. Test-retest Reliability measures for the smartphone, inclinometer, and universal goniometer.

ROM Assessment methods (degrees)		R1a (Mean±SD)	R1b (Mean±SD)	R2 (Mean±SD)	Interrater reliability (R1 vs. R2)				Intrarater reliability (R1a vs. R1b)			
					ICC	95% CI	SEM	MDC	ICC	95% CI	SEM	MDC
Knee Flexion	SA	114.33±13.52	116.48±10.54	113.00±13.90	0.96	0.91-0.98	2.70	7.48	0.89	0.75-0.95	4.48	12.41
	DI	116.18±12.26	117.704±9.85	114.04±13.01	0.97	0.93-0.99	2.12	5.87	0.91	0.80-0.96	3.68	10.19
	UG	120.52±10.48	120.70±8.86	117.81±11.84	0.91	0.81-0.96	3.14	8.70	0.87	0.71-0.94	3.77	10.44
Hip Flexion	SA	99.11±21.06	101.26±20.51	99.96±20.21	0.98	0.96-0.99	2.98	8.25	0.97	0.94-0.99	3.65	10.11
	DI	100.56±21.99	102.74±20.88	100.89±20.21	0.97	0.94-0.99	3.80	10.53	0.95	0.89-0.98	4.92	13.63
	UG	102.29±22.93	103.96±16.78	98.85±24.69	0.83	0.64-0.92	9.45	27.54	0.88	0.80-0.96	7.94	21.99
Hip Extension	SA	26.40±5.32	26.56±5.77	26.55±5.23	0.81	0.68-0.94	2.32	6.42	0.91	0.81-0.96	1.60	4.43
	DI	26.67±6.18	27.44±6.22	26.26±5.10	0.88	0.74-0.97	2.14	5.93	0.85	0.67-0.93	2.39	6.62
	UG	27.74±5.69	28.74±5.61	26.26±5.43	0.69	0.33-0.86	2.61	7.23	0.69	0.32-0.86	2.61	7.22
Hip Abduction	SA	42.11±6.89	40.67±7.26	40.93±7.68	0.95	0.89-0.98	1.54	4.27	0.80	0.56-0.91	3.08	8.53
	DI	41.37±6.54	40.37±7.39	40.33±7.30	0.91	0.80-0.96	1.96	5.43	0.79	0.54-0.90	2.99	8.28
	UG	43.37±6.86	44.14±8.41	43.00±8.22	0.57	0.04-0.80	4.49	12.44	0.56	0.03-0.80	4.55	12.60
Hip Internal Rotation	SA	48.00±8.89	49.70±7.45	46.04±8.72	0.94	0.86-0.97	2.18	6.03	0.90	0.79-0.96	2.81	7.78
	DI	48.18±8.90	46.15±7.71	49.37±7.43	0.90	0.79-0.96	2.81	7.78	0.92	0.83-0.96	2.52	6.98
	UG	49.81±9.29	51.44±8.15	47.66±7.70	0.75	0.45-0.89	4.64	12.85	0.82	0.60-0.92	3.94	10,91
Hip External Rotation	SA	48.04±8.64	49.89±6.68	48.00±9.19	0.96	0.92-0.98	1.73	4.79	0.88	0.75-0.95	2.99	8.28
	DI	48.89±8.50	50.26±6.47	50.26±6.47	0.88	0.74-0.95	2.94	8.14	0.86	0.68-0.93	3.18	8.81
	UG	50.11±8.20	49.40±5.97	47.81±6.64	0.70	0.33-0.86	4.49	12.43	0.69	0.32-0.85	4.57	12,66

SA: Smartphone applications; DI: Digital inclinometer; UG: Universal Goniometer; ROM: range of motion; SD: Standard deviation; ICC: Intraclass correlation coefficient; CI:Confidence; Interval: Rater 1a = Rater 1; first measurement: Rater 1b = Rater 1; second measurement: Rater 2 = Rater 2; SEM: Standard Error of Measurement; MDC: Minimum Detectable Change at the %95 confidence level.

Table 3. Concurrent validity analysis of the smartphone, inclinometer, and universal goniometer (n=27).

ROM Measurements	SA vs. DI	DI vs. UG	SA vs. UG
Knee Flexion	r=0.952, p=0.001	r=0.914, p=0.001	r=0.887, p=0.001
Hip Flexion	r=0.993, p=0.001	r=0.984, p=0.001	r=0.986, p=0.001
Hip Extension	r=0.842, p=0.001	r=0.844, p=0.001	r=0.836, p=0.001
Hip Abduction	r=0.807, p=0.001	r=0.562, p=0.001	r=0.680, p=0.001
Hip Internal Rotation	r=0.970, p=0.001	r=0.941, p=0.001	r=0.901, p=0.001
Hip External Rotation	r=0.963, p=0.001	r=0.926, p=0.001	r=0.945, p=0.001

SA: Smartphone applications; DI: Digital inclinometer; UG: Universal Goniometer; ROM: range of motion; r = Pearson correlation coefficient.

hip and knee ROM measurements were performed as the main assessment method.

In this study, the SEM 5˚ and MDC values of SA and DI were lower than 9. 8, while the SEM 5˚ and MDC values of UG were higher than 9.8. This shows that SA and DI are more reliable methods than UG in NEH measurement. Keogh et al. systematic review of SA found that in 13 of 17 studies, joint motion was reduced by SEM < 5˚ or MDC < ± 9.8˚.[8] Saraç et al. determined that the MDC value was between 3.29° and 5.1° in the validity and reliability of a range of motion measurement in the hip joint.[21] The results of Saraç et al. are similar to the results of our study.[21]

In this study, knee and hip joint ROM measurements in PFP patients showed good to excellent correlations between the SA and DI (r: 0.842–0.993), SA and UG (r: 0.680–0.945), and DI and UG (r: 0.562–0.984). Different combinations of DI, UG, and SA were compared in previous studies, but this is the first study to examine these three methods together in patients with PFP. Acar et al. showed very strong correlations between DI and UG (r: 0.855), SA and UG (r: 0.882), and SA and DI (r: 0.891) based on 6-month postoperative knee flexion ROM measurements in a validity and reliability study of UG, DI, and SA for total knee arthroplasties.[19] Our results are similar to those reported by Acar et al. Furthermore, a systematic review of this topic concluded that SAs provide relatively strong intrarater and interrater reliability and interrater validity for assessing joint ROM. This suggests that clinicians can use a relatively wide variety of SAs to measure joint ROM.[8] Individuals can also use their smartphones to monitor their conditions during rehabilitation processes, which can potentially improve the quality of self-rehabilitation or during home physiotherapy practices to increase their motivation.[25]

This study, the time taken for the second evaluation was 24-48 hours. Acar et al. this period for the second evaluation was performed after 1 hour.[19] Sarac et al. performed their second evaluation after 1 day.[21]

Bilateral PFP cases were not included in our study. Patients with pain in a single extremity were included in the study. This increased the strength of our study. SA has advantages such as being free, user-friendly, and easily accessible. Individuals can use their smartphones to monitor their condition during rehabilitation practices, which can potentially improve the quality of self-rehabilitation or home physiotherapy practices by increasing motivation. It can be used more widely in practical applications in the clinic.

Additionally, new studies can be conducted on the validity and reliability of SA for long-term use. This is the first study conducted on patients. New studies could be done on different populations, such as athletes or older adults. In conclusion, SAs are as valid and reliable as DIs for measuring active hip and knee joint ROM in patients with PFP. Although UGs are valid and reliable tools for ROM measurements, it was determined that the results obtained based on SA and DI measurements may be more reliable and valid. This study provides important data for further research on the use of mobile technologies to measure clinical outcomes and demonstrates their usability in a specific patient population. One of the limitations of this study was that patients were in the supine position during hip abduction measurements with the UG, while they were in the side-lying position for measurements performed with the DI and SA. This may have caused the measurement results to differ. Although previous studies in the literature provide similar examples, the measurement interval of 24–48 hours in this study was relatively short. Evaluators could potentially remember the results obtained the previous day due to the learning effect. However, if the interval were prolonged, there could have been a change in the patient's condition, so care was taken not to extend the measurement interval. Additionally, the Bland-Altman test is not used in research analyses. The fact that SA is a new measurement tool in the clinic may cause a prejudice due to the thought that it is not safe enough. In addition, since it is a technological tool, it is thought that there may be limitations in its safe use in the clinic due to water etc.

Ethics Committee Approval: Our study was approved by the Necmettin Erbakan University Health Sciences Scientific Research Ethics Committee (Date: 03.01.2024, decision no: 2024/632).

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

Author Contributions: Concept – MÇ; Supervision – MÇ, AB; Materials – MÇ, AB; Data Collection and/or Processing – AB; Analysis and/or Interpretation – MÇ; Writing –MÇ.

Peer-review: Externally peer-reviewed.

Financial Support: This study received no funding

Acknowledgment: We would like to thank Beyza Nur Kara and Rahime Sandal for their support in finding the patients.

Other Information: It was presented as an oral presentation at the 4 nd International Congress on Artificial Intelligence in Healthcare İzmir/Türkiye on 15 -17 November 2024.

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OTJHS
Online Turkish Journal of Health Sciences

e-ISSN: 2459-1467

OTSBD
Online Türk Sağlık Bilimleri Dergisi

Online Turkish Journal of Health Sciences 2025;10(1):69-75 *Online Türk Sağlık Bilimleri Dergisi 2025;10(1):69-75*

Bedridden Patients at Emergency Department: Can We Treat Them at Home?

Acil Serviste Yatağa Bağımlı Hastalar: Onları Evlerinde Tedavi Edebilir Miyiz?

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ABSTRACT

Objective: To examine in detail the demographic and clinical characteristics of fully bedridden patients in emergency department (ED) and to evaluate the applicability of home care services to this patient group.

Materials and Methods: This was a retrospective, single-center observational study, conducted in the ED of a tertiary university hospital in Düzce, Türkiye. Study was conducted with 1012 patients between 01.07.2021 - 01.07.2024. Inclusion criteria: being fully bedridden for any reason. Exclusion criteria: Being able to walk with or without support and being temporarily bedridden.

Results: The rate of bedriddennes was 0.003%. The most common reason for admission was urinary catheter replacement (24.2%) in patients younger than 65 years and general condition disorder (25.6%) in elderly patients. The most common diagnoses in both groups were need of care, pneumonia and stroke, respectively. Calcium and albumin values within 48 hours and 30 days were found to be statistically significantly lower and BUN values were found to be higher in deceased patients compared to survivors. ($p<0.05$).

Conclusions: Meeting the needs of bedridden patients at home, such as catheter replacement, will reduce ED admissions and ED crowding. Calcium, albumin and uric acid levels should be investigated as mortality markers in bedridden patients.

Keywords: Bedridden, emergency department, dementia, home care services, stroke

ÖZ

Amaç: Acil servise başvuran yatağa bağımlı hastaların demografik ve klinik özelliklerini ayrıntılı olarak incelemek ve evde bakım hizmetlerinin bu hasta grubuna uygulanabilirliğini değerlendirmek.

Materyal ve Metot: Bu çalışma, Düzce, Türkiye'deki üçüncü basamak bir üniversite hastanesinin acil servisinde yürütülen retrospektif, tek merkezli gözlemsel bir çalışmadır. 01.07.2021 - 01.07.2024 tarihleri arasında 1012 hasta ile yürütülmüştür. Dahil edilme kriterleri: herhangi bir nedenle tamamen yatağa bağımlı olmak. Dışlama kriterleri: Destekli veya desteksiz yürüyebilme, geçici olarak yatağa bağımlı olma.

Bulgular: Yatağa bağımlı hastaların oranı %0,003 idi. En sık başvuru nedeni 65 yaş altı hastalarda üriner kateter replasmanı (%24,2), yaşlı hastalarda ise genel durum bozukluğuydu (%25,6). Her iki grupta da en sık tanılar sırasıyla bakım ihtiyacı, pnömoni ve inme oldu. Ölen hastalarda 48 saat ve 30 gün içinde kalsiyum ve albümin değerleri hayatta kalanlara göre istatistiksel olarak anlamlı derecede düşük, BUN değerleri ise yüksekti ($p<0.05$).

Sonuç: Yatağa bağımlı hastaların kateter değişimi gibi ihtiyaçlarının evde karşılanması acil servis başvurularını ve acil servisteki yoğunluğu azaltacaktır. Kalsiyum, albümin ve ürik asit düzeyleri yatağa bağımlı hastalarda mortalite belirteçleri olarak araştırılmalıdır.

Anahtar Kelimeler: Acil servis, demans, evde bakım hizmetleri, inme, yatağa bağımlı

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Yayın Bilgisi / Article Info:
Gönderi Tarihi/ Received: 30/12/2024
Kabul Tarihi/ Accepted: 25/02/2025
Online Yayın Tarihi/ Published: 17/03/2025

Atıf / Cited: Şengüldür E and Selki K. Bedridden Patients at Emergency Department: Can We Treat Them at Home?. *Online Türk Sağlık Bilimleri Dergisi* 2025;10(1):69-75. doi: 10.26453/otjhs.1610351

INTRODUCTION

Fully bedridden patients constitute one of the most vulnerable groups in terms of health services. These patients cannot perform basic life activities on their own and need continuous physical, medical and psychosocial support.[1] Advanced age, neurological disorders, musculoskeletal disorders and chronic organ failure are the most common causes of this condition.[1-4]

The emergency department (ED) has become one of the primary admission points for bedridden patients.[5] ED admissions are made for reasons such as the transition of chronic health problems to the acute phase, presence of infection, fluid-electrolyte imbalances or inability of caregivers to provide care at home.[1,6-9] However, these admissions often increase the burden of emergency departments due to complex care needs.[6,10]

Some bedridden patients admitted to ED are hospitalized without appropriate assessment or undergo unnecessary further investigations despite not requiring intensive care.[6] This can have negative consequences such as hospital infections, complication risks and unnecessary costs.[10] Home care services promise to provide more appropriate care for bedridden patients at a lower cost.[1,11,12] Identifying which patients can be treated at home may allow for more effective use of resources.

The objective of the study is to determine their everyday care requirements, evaluate the suitability of home care services for this patient population, identify deficiencies experienced in this realm, and offer concrete recommendations for enhancing home care services.

MATERIALS AND METHODS

Ethics Committee Approval: Local ethics committee approval was obtained (Date: 19.08.2024, decision no: 2024/167), and the study was carried out in accordance with the Declaration of Helsinki.

Study Setting and Design: This is a retrospective, single-centre observational study. It was conducted in ED of a tertiary university hospital in Düzce, Türkiye, with approximately 100.000 admissions per year. Bedridden patients admitted to the ED between 01.07.2021 and 01.07.2024 were identified through the hospital's electronic database and included in the study.

Demographic information of the patients, method of admission, complaints at admission, comorbid diseases, blood biochemistry test results, hemogram results, ED diagnoses and mortality results were obtained from the hospital computer system and archive records and written on study forms.

Selection of Participants and Study Protocol: Bedridden patients admitted to the ED for any reason within a three-year period were included in the study. Bedridden patients were defined as patients who were fully dependent on bed for any reason and could not walk on their own or with support [7]. Patients who mostly had to stay in bed due to various diseases but could walk with or without support were not included in the study. Patients who were temporarily bedridden for various reasons (e.g. trauma, surgery) were also excluded. Twenty-three patients were excluded from the study because laboratory parameters or comorbid disease information could not be obtained.

Patients included in the study were divided into groups according to age, 48-hour mortality and 30-day mortality. Comparisons were made between the groups in terms of the parameters screened in the study. A descriptive statistical table was created with the reasons for bedridden, complaints at admission and ED diagnoses.

Statistical Analysis: The conformity of continuous data to normal distribution was evaluated by Shapiro -Wilk and Kolmogorov-Smirnov tests. Continuous data were summarised as median, 25th and 75th percentile and categorical data as frequency and percentage. Continuous data were compared between the two groups by Mann-Whitney U test. The relationship between two categorical variables was analysed by Pearson's Chi-square test or Fisher's exact. Statistical software SPSS version 23 (SPSS Inc., Armonk, NY) was used for these analyses. The significance level was determined as $p < 0.05$.

RESULTS

During the three-year period of the study, 346194 patients were admitted to the ED. 1035 of these admissions were made by bedridden patients. The bedridden rate of ED patients in this study was 0.003. 1035 bedridden patient admissions were made by 723 different patients. The necessary data for the study was obtained from 1,012 admissions. The bedridden patient visits were made by 723 different patients. The data required for the study could be obtained in 1012 of the admissions.

The median age of the patients was 76 years (66-84) and 49.6% were female. The female sex ratio was 34.2% in patients younger than 65 years and 53.8% in patients older than 65 years. The most common comorbid disease was hypertension with a rate of 70.9%. Stroke was the second most common comorbid disease with 64.4%. The prevalence of hypertension was statistically significantly higher in the group older than 65 years ($p<0.001$). 25.5% of patients were hospitalized. While 1.4% of patients died within 48 hours, 5.9% died within 30 days. Demographic characteristics, comorbid diseases, laboratory findings, hospitalization information and mortality

results of bedridden patients admitted to ED are given in Table 1.

Stroke was the most common cause of bedriddennes in all age groups (61.3%), under the age of 65 (60.7%) and 65 years and older (61.4%). In patients under 65 years of age, malignancies (10.5%) were the second most common cause of bedriddennes, while dementia (19.4%) was the second most common in patients over 65 years. The most common reason for ED admission was urinary catheter replacement in patients under 65 years of age (24.2%), while general condition disorder was the most common reason in patients over 65 years (25.6%). The most common ED diagnoses in bedridden patients were needed for care, pneumonia and stroke in all three groups, respectively. The causes of bedridden patients presenting to the ED, complaints at ED admission and ED diagnoses are given in Table 2.

Table 1. Characteristics of bedridden patients and comparisons by age group.

Parameter	All Patients (n=1012)	Patients <65 Years Old (n=219)	Patients ≥65 Years Old (n=793)	p
Gender (Female)	502 (49.6)	75 (34.2)	427 (53.8)	**0.001****
Hypertension	718 (70.9)	98 (44.7)	620 (78.2)	**0.001****
Diabetes Mellitus	367 (36.3)	70 (32.0)	367 (37.5)	0.135**
Cardiac Disorder	434 (42.9)	45 (20.5)	389 (49.1)	**0.001****
Asthma/COPD	145 (14.3)	20 (9.1)	125 (15.8)	**0.013*****
Renal Failure	73 (7.2)	7 (3.2)	66 (8.3)	**0.009*****
Stroke	652 (64.4)	138 (63.0)	652 (64.8)	0.622**
Cancer	131 (12.9)	30 (13.7)	101 (12.7)	0.707***
Demans	246 (24.3)	7 (3.2)	239 (30.1)	**0.001*****
Hemoglbin (g/dL)	11.56 (10.14-13.03)	11.80 (10.41-13.58)	11.37 (9.99-12.80)	**0.002***
Leukocyte (10^3/uL)	9.27 (6.68 – 12.41)	8.72 (6.40-11.35)	9.00 (6.75-12.43)	0.149*
Sodium (mEq/L)	137 (134-141)	137 (135-140)	137 (133-141)	0.780*
Potassium (mEq/L)	4.32 (3.87-4.75)	4.33 (3.96-4.57)	4.32 (3.83-4.77)	**0.039***
Calcium (mEq/L)	9.00 (8.50-9.50)	9.20 (8.90-9.61)	9.00 (8.50-9.44)	**0.001***
Cloride (mEq/L)	101.70 (97.10-105.80)	102.90 (98.00-105.20)	101.30 (97.05-105.90)	0.700*
Albumine (g/dL)	3.64 (3.15-4.02)	4.03 (3.45-4.28)	3.54 (3.06-3.89)	**0.001***
Bun (mg/dL)	23.97 (16.57-36.14)	17.99 (13.22-28.48)	25.76 (17.86-40.19)	**0.001***
Creatinin (mg/dL)	0.95 (0.72-1.34)	0.89 (0.63-1.15)	0.97 (0.73-1.41)	**0.001***
Hospitalization (Yes)	259 (25.5)	50 (22.8)	209 (26.4)	0.290***
48-Hour Mortality (Yes)	14 (1.4)	5 (2.3)	9 (1.1)	0.198***
30-Day Mortality (Yes)	60 (5.9)	11 (5.0)	49 (6.2)	0.521***

Continuous data are given as median (25-75) and categorical data as n (%). In comparisons made with continuous data, Mann Whitney U test was applied due to non-compliance with normal distribution. Chi-Square or Fisher Exact tests were applied for comparisons made with categorical data. Bold p values <0.05 indicate statistical significance. *: Mann Whitney U test; **: Chi-Square test; ***: Fisher Exact tests.

Table 2. Causes of bedriddenness, reasons for admission to the ED and the diagnoses in the ED of the patients evaluated in the study.

	The causes of being bedridden, n (%)		
	All Patients (n=1012)	**Patients <65 Years Old** (n=219)	**Patients ≥65 Years Old** (n=793)
Stroke	620 (61.3)	133 (60.7)	487 (61.4)
Demans	160 (15.8)	6 (2.7)	154 (19.4)
Cancer	85 (8.4)	23 (10.5)	62 (7.8)
Skeletal Disorders	78 (7.7)	13 (5.9)	65 (8.2)
Congenital Disorders	14 (1.4)	12 (5.5)	2 (0.3)
	Reasons for Admission to the Emergency Department, n (%)		
	All Patients (n=1012)	**Patients <65 Years Old** (n=219)	**Patients ≥65 Years Old** (n=793)
General Condition Disorder	230 (22.7)	29 (13.2)	201 (25.3)
Urinary Catheter Replacement	157 (15.5)	53 (24.2)	104 (13.1)
Dyspnea	148 (14.6)	21 (9.6)	127 (16.0)
Vomiting	55 (5.4)	18 (8.2)	37 (4.7)
Fever	45 (4.4)	11 (5.0)	34 (4.3)
	Diagnoses in the Emergency Department, n (%)		
	All Patients (n=1012)	**Patients <65 Years Old** (n=219)	**Patients ≥65 Years Old** (n=793)
Care Requirement	286 (28.3)	90 (41.1)	196 (24.7)
Pneumonia	153 (15.1)	31 (14.2)	122 (15.4)
Stroke	109 (10.8)	19 (8.7)	90 (11.3)
Skin Disorders	66 (6.5)	19 (8.7)	47 (5.9)
Constipation	36 (3.6)	3 (1.4)	33 (4.2)

PEG: Percutan enterogastric catheter. Data is shown as n (%).

There was no statistically significant difference in age between deceased patients within 48 hours and those who survived (75.50 [66.00-84.00] vs 80.50 [63.00-92.00]) (p>0.05). Within 30 days, there was no statistically significant difference in age between deceased patients and survivors (75.00 [66.00-83.00] vs 78.00 [69.00-87.00]) (p>0.05). Deceased patients within 48 hours had statistically lower calcium and albumin values and higher BUN values than survivors (p<0.05). The same situation was also present in the comparison between 30-day mortality groups. The comparison of the parameters screened in the study between 48-hour and 30-day mortality groups is given in Table 3.

Table 3. Comparison of the parameters screened in the study between 48-hour and 30-day mortality groups.

Parameter	**Death in 48 Hours: No** (n=998)	**Death in 48 Hours: Yes** (n=14)	p	**Death in 30 Days: No** (n=952)	**Death in 30 Days: Yes** (n=60)	p
Age (Years)	75.5 (66.0-84.0)	80.50 (63-92)	0.343*	75.0 (66.0-83.0)	78.0 (69.0-87.0)	0.081*
Gender (Female)	494 (49.5)	8 (57.1)	0.570**	471 (49.5)	31 (51.7)	0.742**
Hypertension	713 (71.4)	5 (35.7)	**0.006****	680 (71.4)	38 (63.3)	0.180**
Diabetes Mellitus	363 (36.4)	4 (28.6)	0.547***	351 (36.9)	16 (26.7)	0.111***
Cardiac Disorder	430 (43.1)	4 (28.6)	0.276***	405 (42.5)	29 (48.3)	0.379***
Asthma/COPD	145(14.5)	0 (0)	-	139 (14.6)	6 (10.0)	0.324***
Renal Failure	72 (7.2)	1 (7.1)	0.732***	69 (7.2)	4 (6.7)	0.561***
Stroke	646 (64.7)	6 (42.9)	0.081***	616 (64.7)	36 (60.0)	0.460***
Cancer	129 (12.9)	2 (14.3)	0.559***	120 (12.6)	11 (18.3)	0.200***
Demans	240 (24.0)	6(42.9)	0.098***	225 (23.6)	21 (35.0)	**0.047*****
Hemoglbin (g/dL)	11.44 (10.13-12.90)	11.56 (9.17-13.16)	0.915*	11.46 (10.15-12.89)	11.21 (9.37-13.18)	0.574*
Leukocyte (10^3/uL)	8.90 (6.60-12.27)	9.57 (7.85-14.69)	0.313*	8.87 (6.65-11.97)	10.56 (5.96-15.75)	0.062*
Sodium (mEq/L)	137 (133-140)	140 (137-144)	0.105*	137 (133-140)	136 (130-141)	0.615*
Potassium (mEq/L)	4.28 (3.87-4.69)	3.95 (3.57-4.52)	0.155*	4.29 (3.86-4.70)	4.20 (3.77-4.63)	0.310*
Calcium (mEq/L)	9.00 (8.60-9.50)	8.70 (8.00-9.10)	0.018*	9.07 (8.60-9.50)	8.75 (8.07-9.20)	**0.001***
Cloride (mEq/L)	101 (97-105)	106 (97-112)	0.089*	101 (97-105)	100 (94-107)	0.458*
Albumine (g/dL)	3.60 (3.11-4.00)	2.81 (2.41-3.32)	**0.001***	3.36 (3.16-4.01)	3.00 (2.52-3.59)	**0.001***
Bun (mg/dL)	23.76 (16.48-36.12)	38.67 (26.36-81.02)	**0.032***	23.52(16.19-35.70)	32.23 (22.25-48.12)	**0.001***
Creatinin (mg/dL)	0.93 (0.68-1.34)	1.02 (0.71-2.05)	0.329*	0.93 (0.68-1.34)	0.99 (0.67-1.56)	0.538*

Continuous data are given as median (25-75) and categorical data as n (%). In comparisons made with continuous data, Mann Whitney U test was applied due to non-compliance with normal distribution. Chi-Square or Fisher Exact tests were applied for comparisons made with categorical data. P<0.05 indicates statistical significance. *: Mann Whitney U test; **: Chi-Square test; ***: Fisher Exact tests.

DISCUSSION AND CONCLUSION

The characteristics that differentiate bedridden patients from other patients in their age group are that they cannot perform self-care and most of their basic vital activities without assistance. [1,2] When previous studies were examined in terms of the reasons for hospital admission of bedridden patients, it was observed that care-related problems such as urinary catheter replacement, feeding catheter problems and bed sores were the main reasons for hospital admission.[6,8,13,14] Urinary catheter replacement, which is a practice related to the general care of bedridden patients, was also among the main reasons for admission in this study and was the most common reason for admission in patients younger than 65 years of age. The most common diagnosis of ED in the study was the need for care in all age groups. The diagnosis of need for care includes conditions that can be intervened by home care services in the patient's home, such as the need for catheter care or replacement, the need for wound dressing, and nutritional disorders. The data indicates that 24.7% of bedridden admissions for individuals aged 65 and over, as well as 41.1% of bedridden admissions for those under 65, presented with issues that could have been addressed by home care services. Bringing these manageable complaints to the hospital can result in unnecessary examinations and hospital stays, ultimately raising healthcare costs associated with each complaint.[6,10] Improving the availability and accessibility of home healthcare services will reduce the financial and labor burden of bedridden patients on the healthcare system.

The bedridden population generally consists of elderly patients. In studies in the literature, the mean age of bedridden patients is seen in the range of 75-80 years.[2,6,9,15-17] In our study, the median age was 76 years, which supports existing literature. In patients over 65 years of age, stroke and dementia come to the forefront when the reasons for bedriddennes are investigated.[3,4,6] Dementia and stroke are diseases whose frequency increases in advanced ages.[13,14,18] Congenital disorders, traumas and central nervous system infections are the most common causes of bedriddennes below the age of 65.[19] In this study, stroke was found to be the most common cause of bedriddennes in all age groups. The causes of bedriddennes according to age groups in this study were found to be compatible with the data in the literature.

In some studies with bedridden patients, the proportion of male patients was higher [2,6,15] while in others the proportion of female patients was higher.[6,17] Stroke and dementia are among the leading causes of bedriddenness and both are diseases whose frequency increases in older ages.[13,18] The higher life expectancy in women compared to men indirectly increases the likelihood of encountering these diseases.[13] In our study, the higher proportion of female gender in bedridden patients over 65 years of age may be explained by the fact that life expectancy is higher than that of male gender and women are more likely to encounter age-related diseases because they live longer. In the study, musculoskeletal system disorders came to the forefront among the causes of bedriddenness in patients under 65 years of age. The majority of these disorders are caused by traumas. It has been shown in previous studies that men are more exposed to traffic accidents,[20,21] and the high rate of working in dangerous jobs increases the risk of exposure to central nervous system injuries that may result in bedriddenness for the male population.[22] These mechanisms may explain the higher male-sex ratio in patients under 65 years of age in this study.

Research has shown that diseases such as coronary artery disease, hypertension, and dementia are more prevalent among bedridden patients aged 65 and older. This trend can be attributed to the higher occurrence of these conditions in the general population as people age.[13] However, there was no statistically significant difference in the incidence of stroke as a comorbid condition between patients younger than 65 and those older than 65. This finding is likely due to the fact that the study focused specifically on bedridden patients rather than the general population.

Previous studies have shown that advanced age is a parameter that increases the mortality rate in ED patients.[13,23] In a study conducted with patients hospitalized in the ward, it was found that advanced age increased the mortality rate in bedridden patients.[8] In the literature review, no study was found with bedridden patients admitted to the ED. In this study, the 48-hour and 30-day mortality rates of bedridden patients admitted to the ED did not show a statistically significant difference between the groups under and over 65 years of age. The fact that bedridden patients in both age groups are frequently admitted to the ED for reasons such as care needs, catheter replacements, wound dressings and that these reasons for admission are not life-threatening may be one of the reasons why there is no difference in mortality between the groups. Again, the same explanation can be put forward as a reason for reaching different results within studies conducted with patients hospitalized in the ward. The fact that hospitalization rates were similar between age groups in the study may be explained by the fact that the complaints and diagnoses were mostly care-related conditions.

Bedridden patients may also be admitted to hospitals with potentially fatal complications. Urinary tract infections, bedsores, delirium and pneumonia have

been shown to be common complications in bedridden patients, and a study reported that the presence of three of these complications increased mortality 8 -fold.[9] In this study, pneumonia was found to be the 2nd most common diagnosis in bedridden patients admitted to the ED in all age groups. Urinary tract infection and stroke were the other common ED diagnoses that may be fatal. In one of the previous studies, 3-month mortality of bedridden patients hospitalized in the ward was 14% [16]. In another study conducted with patients admitted to a physical therapy and rehabilitation center, the 1-year mortality rate was 15.24%. The fact that the mortality durations evaluated in this study were not similar to the durations in the literature and that the study was conducted with ED patients prevented comparison. However, the fact that both 48-hour and 30-day mortality rates are quite low indicates that ED admissions are usually made because of the need for care, not because of urgent pathologies.

Various studies have shown that hypocalcemia and hypoalbuminemia are associated with increased mortality in critically ill patients.[24,25] Elevated blood urea nitrogen (BUN) levels are also associated with increased mortality, especially in patients with sepsis.[26] In this study of bedridden patients admitted to the ED, albumin and calcium were significantly lower, and BUN was higher in the mortality groups. The results of the study showed that calcium, albumin and BUN values may be useful when evaluating the mortality of bedridden patients admitted to the ED and when making hospitalization-discharge decisions.

The first limitation of the study is that it was retrospective. The second limitation is that the study was conducted in a single center. The third limitation is that the study was limited to the evaluation of ED admissions and did not include an evaluation of home care services.

In conclusion, meeting the needs of bedridden patients at home, such as catheter replacement, feeding catheter care and wound dressing, will reduce ED admissions and ED crowding. Calcium, albumin and uric acid levels should be investigated as mortality markers in bedridden patients. Home care services should be improved in terms of quality and quantity.

Ethics Committee Approval: This study was initiated in the emergency department of Düzce University Non-Invasive Health Research Ethics Committee's approval (Date: 19.08.2024, decision no: 2024/167). The study was carried out in accordance with the Declaration of Helsinki.

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

Author Contributions: Concept – EŞ, KS; Supervision – EŞ, KS; Materials – EŞ, KS; Data Collection and Processing – EŞ, KS; Analysis and Interpretation – EŞ, KS; Writing – EŞ, KS.

Peer-review: Externally peer-reviewed.

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OTJHS
Online Turkish Journal of Health Sciences

e-ISSN: 2459-1467

OTSBD
Online Türk Sağlık Bilimleri Dergisi

Online Turkish Journal of Health Sciences 2025;10(1):76-81 *Online Türk Sağlık Bilimleri Dergisi 2025;10(1):76-81*

Relationship Between Dipper/Non-Dipper Pattern and Neutrophil-Lymphocyte Ratio and Platelet-Lymphocyte Ratio in Geriatric Patients with Hypertension

Hipertansiyonu Olan Geriatrik Hastalarda Dipper/Non-Dipper Paterni ile Nötrofil-Lenfosit Oranı ve Trombosit-Lenfosit Oranı arasındaki İlişki

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ABSTRACT

Objective: Neutrophil lymphocyte ratio (NLR) and platelet lymphocyte ratio (PLR) are inflammatory markers associated with poor prognoses. Non-dipper hypertension (HT) is linked to a higher risk for cardiovascular events. This study aims to investigate the association between NLR and PLR in geriatric patients with dipper and non-dipper HT.

Materials and Methods: A total of 124 geriatric patients with HT were included in the study. Based on ambulatory blood pressure monitoring, patients were categorized into two groups: non-dippers (n=62, Group 1) and dippers (n=62, Group 2). NLR and PLR were calculated by dividing the absolute neutrophil and platelet counts, respectively, by the absolute lymphocyte count.

Results: There were no significant differences in sex, age, chronic conditions and smoking between the two groups (p>0.005). The NLR was 1.96±0.66 in group 1 and 1.67±0.68 in group 2 (p:0.005). The PLR was 146±42.2 in group 1 and 115±34.2 in group 2 (p:0.001). The NLR and PLR were significantly higher in non-dippers compared to dippers (p<0.005).

Conclusions: Our findings demonstrate that geriatric patients with non-dipper HT have significantly higher NLR and PLR compared to those with dipper HT. This suggests that non-dipper HT is associated with greater inflammation, which may contribute to its higher cardiovascular risk.

Keywords: Dipper, geriatric patients, NLR, non dipper, PLR

ÖZ

Amaç: Nötrofil lenfosit (NLR) ve trombosit lenfosit oranı (PLR), kötü prognozu gösteren bir inflamatuar belirteçtir. Non-dipper hipertansiyon, kardiyovasküler olaylar için daha yüksek risk ile ilişkilidir. Bu çalışmanın amacı, dipper ve non-dipper hipertansiyonu olan hastalarda NLR ve PLR arasındaki ilişkiyi araştırmaktır.

Materyal ve Metot: Çalışmaya hipertansiyonu olan 124 geriatrik hasta dahil edildi. Hastalar ambulatuvar kan basıncı ölçümüne göre non-dipper (n:62, grup 1) ve dipper (n:62, grup 2) olmak üzere iki gruba ayrıldı. Nötrofil lenfosit (NLR) ve trombosit lenfosit oranı (PLR), mutlak nötrofil sayısı ve trombosit sayısının mutlak lenfosit sayısına bölünmesiyle hesaplandı.

Bulgular: İki grup arasında cinsiyet, yaş, kronik hastalıklar e sigara içiciliği açısından anlamlı fark yoktu (p>0,005). Kronik hastalıklar ve sigara kullanımı açısından da anlamlı fark yoktu. NLR grup 1'de 1,96±0,66 iken grup 2'de 1,67±0,68 idi (p:0,005). PLR grup 1'de 146±42,2 iken grup 2'de 115±34,2 idi (p:0,001).

Sonuç: Bulgularımız non-dipper HT'li geriatrik hastaların, dipper HT'li hastalara göre anlamlı derecede daha yüksek NLR ve PLR'ye sahip olduğunu göstermektedir. Bu, non-dipper HT'nin daha yüksek inflamasyonla ilişkili olduğunu ve bunun da daha yüksek kardiyovasküler riske katkıda bulunabileceğini göstermektedir.

Anahtar Kelimeler: Dipper, geriatrik hastalar, NLR, non dipper, PLR

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Yayın Bilgisi / Article Info:
Gönderi Tarihi/ Received: 14/01/2025
Kabul Tarihi/ Accepted: 20/02/2025
Online Yayın Tarihi/ Published: 17/03/2025

Atıf / Cited: Varım P and Çakmak AC. Relationship Between Dipper/Non-Dipper Pattern and Neutrophil-Lymphocyte Ratio and Platelet-Lymphocyte Ratio in Geriatric Patients with Hypertension. *Online Türk Sağlık Bilimleri Dergisi* 2025;10(1):76-81. doi: 10.26453/otjhs.1619335

INTRODUCTION

Hypertension (HT) is one of the most common chronic diseases globally and a significant risk factor for cardiovascular diseases, peripheral vascular diseases, stroke, and renal failure. In patients with HT, blood pressure fluctuates throughout the day, typically decreasing by 10% to 20% at night. This physiological reduction is referred to as the dipper pattern or dipper HT. Conversely, patients who do not experience this nocturnal decrease in blood pressure are classified as having a non-dipper pattern or non-dipper HT.[1]

Non-dipper HT is associated with a worse prognosis compared to dipper HT and poses a higher risk for adverse outcomes, including cardiovascular diseases, peripheral vascular diseases, stroke, and renal failure.[1]

Recently, the neutrophil-to-lymphocyte ratio (NLR) and platelet-to-lymphocyte ratio (PLR) have emerged as reliable and easily measurable markers of inflammation. Inflammatory markers such as interleukin (IL) 6, IL-1b and tumor necrosis factor a (TNF-a) have been found to be associated with HT. Increased inflammation increases the number of neutrophils and decreases the number of lymphocytes.[2] Increased platelet activation has an important role in the initiation and progression of atherosclerosis. Inflamma tory mediators, such as IL 1 and 6, stimulate megakaryocytic proliferation and cause thrombocytosis.[3] NLR and PLR are cost-effective and straightforward to determine, making them advantageous over other inflammation markers.[4] A growing body of evidence highlights the association of NLR and PLR with cardiovascular diseases, peripheral vascular diseases, heart failure, cancer, and rheumatologic conditions.[5-8]

This study aims to investigate the relationship between NLR and PLR in geriatric patients with dipper and non-dipper hypertension, providing insights into the inflammatory processes associated with these distinct patterns of blood pressure regulation.

MATERIALS AND METHODS

Ethics Committee Approval: The study was approved by the Sakarya University Faculty of Medicine Ethical Committee and conducted in compliance with the Helsinki Declaration (Date:07.05.2024. Decision No:16214662-050.01.04 -28543-101).

This retrospective study included 124 geriatric patients with HT who were under follow-up at the cardiology outpatient clinic between June 2023 and June 2024. HT was defined as systolic blood pressure (BP) ≥140 mmHg and/or diastolic BP ≥90 mmHg, previously diagnosed hypertension, or the use of antihypertensive medications.

Patients were categorized into two groups: non-dipper (n=62, Group 1) and dipper (n=62, Group 2) based on ambulatory BP monitoring. All participants underwent 24-hour ambulatory BP monitoring to determine their dipper or non-dipper status. Measurements were taken every 30 minutes during the 24 hours using a cuff placed around the non-dominant arm. Sleep and wake periods were recorded based on patient self-reports, and measurements were repeated if necessary to ensure accuracy.

Nocturnal BP dipping was calculated using the formula: *Nocturnal BP Dipping (%)=100×[1 -(Sleep Systolic BP/Awake Systolic BP)]*

Dipper hypertension was defined as a nocturnal BP decrease of >10% in systolic and diastolic BP, while non-dipper hypertension was defined as a decrease of <10% in either measurement.

Demographic and clinical data, including hemoglobin, hematocrit, neutrophil, lymphocyte, platelet counts, white blood cell (WBC) counts, and C-reactive protein (CRP) levels, were obtained from hospital records. The neutrophil-to-lymphocyte ratio (NLR) was calculated by dividing the absolute neutrophil count by the absolute lymphocyte count, while platelet-to-lymphocyte ratio (PLR) was calculated by dividing the absolute platelet count by the absolute lymphocyte count.

Exclusion Criteria: Patients were excluded if they had systemic inflammatory or autoimmune diseases (e.g., systemic lupus erythematosus, rheumatoid arthritis), hematologic disorders, cancer, acute infections, or were on antibiotic or steroid therapy. Other exclusions included acute coronary syndrome, chronic renal or liver disease, Cushing's syndrome, and thyroid dysfunction.

Statistical Analysis: Data were analyzed using SPSS for Windows 21.0 (SPSS Inc., Chicago, IL, USA). The Kolmogorov-Smirnov test was used to assess data distribution. Continuous variables were compared using the t-test, while categorical variables were analyzed using the Chi-square test. Statistical significance was set at $p<0.05$.

RESULTS

A total of 124 people were analyzed, with 62 patients in each group: Demographic characteristics and medical histories were comparable between the groups. The mean age of the non-dipper group was 68.5 ± 2.8 years, while that of the dipper group was 67.0 ± 2.3 years ($p = 0.34$). There were no significant differences in sex, chronic conditions such as diabetes mellitus and hyperlipidemia, or smoking status ($p>0.005$). There were also no significant differences in weight and height between the groups (Table 1).

Table 1. Demographic characteristics and clinical data of the study population.

Parameters	Non-dipper group (n:62)	Dipper group (n:62)	p-value
Age (years)	68.5±2.8	67.0±2.3	0.34
Sex (male/female)	30/32	32/30	0.938
Height (cm)	162.6±10.3	161.1±7.6	0.532
Weight (kg)	67.8±13.7	64.8±12.8	0.254
Diabetes mellitus (n)	16	18	0.418
Hyperlipidemia (n)	22	27	0.256
Smoking (n)	18	13	0.366

Data are expressed as mean ± SD or as number of patients.

Ambulatory BP monitoring revealed higher mean nocturnal systolic and diastolic BP values in the non dipper group compared to the dipper group. Mean BP measurements during wake periods were similar in both groups. Mean BP measurements during sleep periods were higher in the non-dipper group (Table 2).

Hemogram parameters and CRP levels are summarized in Table 3. Significant findings include:

- Neutrophil count: Higher in the non-dipper group (4.0 ± 1.2 K/μL vs. 3.4 ± 1.3 K/μL, p = 0.003).
- Platelet count: Higher in the non-dipper group (282 ± 78 × 10^3 K/μL vs. 244 ± 54 × 10^3 K/μL, p = 0.01).
- NLR: Higher in the non-dipper group (1.96 ± 0.66 vs. 1.67 ± 0.68, p = 0.005).
- PLR: Higher in the non-dipper group (146 ± 42.2 vs. 115 ± 34.2, p = 0.001).

There were no significant differences in hemoglobin, WBC, lymphocyte counts, or CRP levels between the groups. The hemogram parameters and CRP values of the patients with non-dipper HT and the patients with dipper HT are shown in Table 3. Hemoglobin was 13.1±1.4 g/dL in the patients with non-dipper HT group and 13.4±2.1 g/dL in the patients with dipper HT, respectively, at p= 0.28. Total white blood cell count (WBC) values were 6.8±1.6 K/μL in the patients with non-dipper HT group and 6.3±2.0 K/μL in the patients with dipper HT, respectively, at p= 0.69. Neutrophil counts were 4.0±1.2 K/μL in the patients with non-dipper HT group and 3.4±1.3 K/μL in the patients with dipper HT, respectively, at p= 0.003. Lymphocyte counts were 2.1±0.6 K/μL in the patients with non-dipper HT group and 2.2±0.8 K/μL in the patients with dipper HT, respectively, at p= 0.85. Platelet counts were 282±78 x10^3 K/μL in the patients with non-dipper HT group and 244±54 x10^3 K/μL in the patients with dipper HT, respectively, at p=0.01. NLR values were 1.96±0.66 in the patients with non-dipper HT group and 1.67±0.68 in the patients with dipper HT, respectively, at p=0.005. PLR values were 146±42.2 in the patients with non-dipper HT group and 115±34.2 in the patients with dipper HT, respectively, at p=0.001. CRP values were 10.1 ± 7.4 mg/L in the patients with non-dipper HT group and 9.6 ± 7.3 mg/L in the patients with dipper HT, respectively, at p=0.421 (Table 3).

Table 2. Ambulatory Blood Pressure Monitoring of the study population.

Parameters	Non-dipper group (n:62)	Dipper group (n:62)	p-value
Systolic blood pressure (total) – mmHg	126.5±13.6	124.4±11.1	0.376
Systolic blood pressure (awake) – mmHg	127.2±13.6	130.8±11.5	0.54
Systolic blood pressure (sleep) – mmHg	123.6±14.3	110.5±9.8	**0.001**
Diastolic blood pressure (total) – mmHg	78.8±10.5	78.3±9.2	0.788
Diastolic blood pressure (awake) – mmHg	80.2±10.7	81.6±9.9	0.434
Diastolic blood pressure (sleep) – mmHg	74.4±10.6	67.5±8.5	**0.001**
Mean blood pressure (total) – mmHg	101.2±12.7	99.6±9.6	0.512
Mean blood pressure (awake) – mmHg	102.1±11.6	103.3±10.3	0.496
Mean blood pressure (sleep) – mmHg	97.2 ± 11.1	87.3±9.1	**0.001**

Data are expressed as mean ± SD.

Table 3. Hematological parameters of the study population.

Parameters	Non-dipper group (n:62)	Dipper group (n:62)	Normal Range	p-value
Hemoglobin (g/dl)	13.1±1.4	13.4±2.1	12.2-18.1	0.28
WBC (K/ul)	6.8±1.6	6.3±2.0	4.6-10.2	0.69
Neutrophil (K/ul)	4.0±1.2	3.4±1.3	2.0-6,9	0.003
Lymphocyte (K/ul)	2.1±0.6	2.2±0.8	0.6-3,4	0.85
Platelet x10^3 (K/ul)	282±78	244±54	142-424	**0.01**
NLR	1.96±0.66	1.67±0.68		**0.005**
PLR	146±42.2	115±34.2		**0.001**
CRP (mg/L)	10.1±7.4	9.6±7.3		0.421

Data are expressed as mean ± SD.WBC: White Blood Cell. NLR: Neutrophil lymphocyte ratio. PLR: Platelet lymphocyte ratio. CRP: C-reactive protein

DISCUSSION AND CONCLUSION

This study, to our knowledge, is the first to explore the relationship between NLR and PLR in geriatric patients with dipper versus non-dipper hypertension. Our findings demonstrate significantly higher NLR and PLR values in non-dipper hypertensive patients compared to dipper patients.

Non-dipper hypertension has been linked to autonomic dysfunction and is more commonly associated with conditions such as diabetes, chronic kidney disease, sleep apnea, and hypercortisolism.[9] It carries a higher risk for cerebrovascular events, cardiovascular diseases, sudden death, and end-organ damage due to heightened inflammation and endothelial dysfunction, [10-11] as also suggested by presented work.

Neutrophils are primarily elements of the innate immune system, whereas lymphocytes are elements of an adaptive immune system. Higher neutrophil levels are associated with increased inflammatory response and also cardiovascular diseases.[12-13] Low lymphocyte levels are associated with poor general health and high physiological stress.

Recent studies have shown that lymphocyte counts decrease in acute coronary syndrome and congestive heart failure.[14] Platelets have an important role in the initiation of atherosclerotic lesions. Mediators released from platelets such as thromboxane A2, adenosine diphosphate, serotonin, platelet-activating factor, and platelet-derived growth factor increase platelet activation and aggregation. High platelet levels are associated with cardiovascular events such as acute myocard infarctus and stent thrombosis.[15-16] We found high neutrophil and platelet counts and also low lymphocyte counts in the patients with non-dipper HT.

NLR is an inexpensive and useful marker for inflammation and stress response. High NLR values were found in several acute and chronic diseases such as COVID-19, thyroiditis, fibromyalgia, malignancies and cardiovascular events.[17-20] Cardiovascular events are shown in patients with non-dipper HT than in patients with dipper HT. The high NLR levels we found in our study are consistent with the literature.

PLR is a cost-effective and easy marker for inflammation and thrombosis. High PLR values were found in several cardiovascular diseases, such as MI, heart failure, HT, and peripheral arterial disease.[21-24] Cardiovascular events are shown in patients with non-dipper HT than in patients with dipper HT. The high PLR levels we found in our study are consistent with the literature.

Increased neutrophil counts in non-dipper patients may reflect heightened leukocyte activation and cytokine production, contributing to inflammation and vascular damage. High platelet counts in non-dipper patients suggest enhanced platelet activation, a key factor in atherothrombosis and cardiovascular events.

NLR and PLR are simple, cost-effective markers for assessing inflammation and have been linked to various cardiovascular and inflammatory diseases. The elevated NLR and PLR values observed in non-dipper patients align with the literature, supporting their potential utility as indicators of heightened cardiovascular risk.

In conclusion, Non-dipper HT is associated with increased cardiovascular events, likely mediated by inflammation. This study highlights significantly higher NLR and PLR values in non-dipper hypertensive patients, underscoring the role of inflammation in this condition. Our study had some limitations. One of them was the small sample size. We were also not able to evaluate the prognostic value of the NLR and PLR in patients with hypertension. Our study had a cross-sectional design, and it would be better if we had followed the patients and explore the relation between adverse cardiac events and NLR and/or PLR in these patients While our findings are derived from a retrospective study, larger prospective and multicenter studies are needed to elucidate further the relationship between NLR, PLR, and non-dipper hypertension.

Ethics Committee Approval: The study was approved by the Sakarya University Faculty of Medicine

Ethical Committee and conducted in compliance with the Helsinki Declaration (Date:07.05.2024. Decision No:16214662-050.01.04-28543-101).

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

Author Contributions: Concept – PV; Supervision – AÇ; Materials – PV; Data Collection and/or Processing – PV; Analysis and/or Interpretation – AÇ; Writing –PV.

Peer-review: Externally peer-reviewed.

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OTJHS
Online Turkish Journal of Health Sciences

e-ISSN: 2459-1467

OTSBD
Online Türk Sağlık Bilimleri Dergisi

Online Turkish Journal of Health Sciences 2025;10(1):82-88 *Online Türk Sağlık Bilimleri Dergisi 2025;10(1):82-88*

Impact of Surgeon Experience on Clinical Outcomes in Cardiovascular Surgery: A Retrospective Analysis

Kardiyovasküler Cerrahide Cerrah Deneyiminin Klinik Sonuçlar Üzerindeki Etkisi: Retrospektif Bir Analiz

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ABSTRACT

Objective: This study aimed to assess the impact of surgeons' experience (10–20 years vs. over 20 years) on clinical outcomes in coronary artery bypass grafting (CABG) surgeries, considering the multidisciplinary nature of cardiovascular surgery and the critical role of experience in influencing mortality, morbidity, and complications.

Materials and Methods: A retrospective analysis was conducted, including 201 patients who underwent elective or emergency CABG between 2019 and 2024 at a single tertiary center. Patients were grouped based on the experience level of their surgeons. Demographic, intraoperative, and postoperative data were collected from hospital records.

Results: Patients operated on by surgeons with over 20 years of experience had significantly higher rates of hypertension (83% vs. 70.3%; p=0.033) but showed no significant differences in mortality (3% vs. 2%; p=0.170) or complication rates (7% vs. 9.9%; p=0.460). Intraoperative parameters, such as cross-clamp time and cardiopulmonary bypass time, did not differ significantly between the groups (p>0.05). Weak positive correlations were found between cross-clamp time and postoperative ICU stay (r=0.189; p=0.007), as well as cardiopulmonary bypass time and ICU stay (r=0.205; p=0.003).

Conclusions: Surgeons' experience levels influence certain clinical outcomes, particularly in managing high-risk patients. However, mortality and complication rates appear to depend more on multidisciplinary care and standardized protocols than on individual experience. Future studies should explore these dynamics across broader patient populations and different surgical procedures to optimize cardiovascular surgical practices.

Keywords: Clinical outcomes, coronary artery bypass grafting, cardiovascular surgery, retrospective study, surgeon experience

ÖZ

Amaç: Bu çalışmada, kardiyovasküler cerrahinin multidisipliner doğası ve deneyimin mortalite, morbidite ve komplikasyonları etkilemedeki kritik rolü göz önünde bulundurularak, koroner arter bypass greftleme (KABG) ameliyatlarında cerrahların deneyiminin (10-20 yıl ve 20 yıldan fazla) klinik sonuçlar üzerindeki etkisinin değerlendirilmesi amaçlanmıştır.

Materyal ve Metot: Tek bir üçüncü basamak merkezde 2019-2024 yılları arasında elektif veya acil KABG uygulanan 201 hastayı içeren retrospektif bir analiz yapılmıştır. Hastalar, cerrahlarının deneyim düzeyine göre gruplandırıldı. Demografik, intraoperatif ve postoperatif veriler hastane kayıtlarından toplanmıştır.

Bulgular: Yirmi yıldan fazla deneyime sahip cerrahlar tarafından ameliyat edilen hastalarda hipertansiyon oranları anlamlı derecede yüksekti (%83'e karşı %70,3; p=0,033) ancak mortalite (%3'e karşı %2; p=0,170) veya komplikasyon oranlarında (%7'ye karşı %9,9; p=0,460) anlamlı bir fark yoktu. Kros-klemp süresi ve kardiyopulmoner bypass süresi gibi intraoperatif parametreler gruplar arasında anlamlı farklılık göstermemiştir (p>0,05). Kros-klemp süresi ile ameliyat sonrası YBÜ'de kalış süresi (r=0,189; p=0,007) ve kardiyopulmoner baypas süresi ile YBÜ'de kalış süresi (r=0,205; p=0,003) arasında zayıf pozitif korelasyon bulundu.

Sonuç: Cerrahların deneyim düzeyleri, özellikle yüksek riskli hastaların yönetiminde belirli klinik sonuçları etkilemektedir. Bununla birlikte, mortalite ve komplikasyon oranları bireysel deneyimden ziyade multidisipliner bakım ve standartlaştırılmış protokollere bağlı görünmektedir. Gelecekteki çalışmalar, kardiyovasküler cerrahi uygulamalarını optimize etmek için bu dinamikleri daha geniş hasta popülasyonlarında ve farklı cerrahi prosedürlerde araştırmalıdır.

Anahtar Kelimeler: Kardiyovasküler cerrahi, klinik sonuçlar, koroner arter baypas greftleme, retrospektif çalışma, cerrah deneyimi

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Yayın Bilgisi / Article Info:
Gönderi Tarihi/ Received: 19/01/2025
Kabul Tarihi/ Accepted: 22/02/2025
Online Yayın Tarihi/ Published: 17/03/2025

Atıf / Cited: Sağlam MF and et al. Impact of Surgeon Experience on Clinical Outcomes in Cardiovascular Surgery: A Retrospective Analysis. *Online Türk Sağlık Bilimleri Dergisi* 2025;10(1):82-88. doi: 10.26453/otjhs.1623206

INTRODUCTION

Cardiovascular surgery is a field that requires a multidisciplinary approach and attracts attention with its patient characteristics and complexity of surgical applications.[1] In this field, the experience of the surgeon stands out as an important determinant of surgical outcomes and can have significant effects on mortality, morbidity and complication rates.[2,3] The literature reveals that technical skills and clinical decision-making capacity in cardiovascular surgery are closely related to the surgeon's level of experience. In particular, the effect of many years of surgical experience on patient recovery and complication rates has been proven by various studies.[4-6] Surgical experience is not only limited to individual skills but also includes multidimensional factors such as teamwork, patient selection and intraoperative decision-making skills. Experienced surgeons stand out with their ability to prevent complications and make more effective decisions in situations requiring rapid intervention.[7,8] However, the impact of experience on parameters such as operative time, complication rates, and patient recovery remains to be extensively studied. A previous meta-analysis emphasized that an increase in experience level leads to a significant shortening of operation times and a decrease in postoperative complications.[9,10] The impact of differences in experience among cardiovascular surgeons on surgical outcomes, especially in high-risk patient groups, is a critical factor to consider in clinical practice. In another study, surgeons with 20 years or more of experience were reported to have lower mortality rates and shorter hospital stays.[11,12] In addition, the experience level of surgical teams and multidisciplinary approaches are also reported to have important contributions to improving patient outcomes.[13]

This study aims to evaluate the effect of surgeon experience (10-20 years and more than 20 years) on clinical outcomes in cardiovascular surgery. The demographic characteristics of the patients, complications encountered during surgery and differences in the postoperative process were considered in this context and statistically compared. Furthermore, it was discussed how these differences could be optimized with a multidisciplinary team approach.

MATERIALS AND METHODS

Ethics Committee Approval: This study was approved by the Ankara Bilkent City Hospital Medical Research Scientific and Ethical Evaluation Ethics Committee (Date: 17/07/2024, Decision No: TABED-1-24-381). It was conducted in accordance with the principles of the Declaration of Helsinki.

Study Design and Participants: In this study, a retrospective analysis was conducted to evaluate the effects of cardiovascular surgeons' length of experience (10-20 years and over 20 years) on surgical outcomes. A total of 201 patients who underwent cardiovascular surgery between 2019 and 2024 were included in the study. Inclusion criteria were elective or emergency coronary artery bypass grafting (CABG), no missing data, and preoperative ejection fraction (EF) above 20%. Exclusion criteria were defined as patients with a diagnosis of multiple organ failure and patients with a previous history of complex congenital cardiac surgery.

Patients were evaluated according to two different surgical experience groups. The first group consisted of operations performed by surgeons with 10-20 years of experience and included 101 patients. The second group consisted of operations performed by surgeons with 20 years or more experience, and this group included 100 patients.

Data Collection: Demographic and clinical data were collected retrospectively through the hospital's electronic record system. Data collected included age, gender, body mass index (BMI), preoperative risk factors (diabetes, hypertension, COPD, hyperlipidemia, smoking), intraoperative data (number of vessels bypassed, cross-clamp time, cardiopulmonary bypass time), and postoperative outcomes (length of intensive care unit and ward stay, mortality, morbidity and complication rates).

Statistical Analysis: Mean Standard Deviation, Median and Minimum-Maximum values were given in descriptive statistics for continuous data, and number and percentage values were given in discrete data. Kolmogorov Smirnov test was used to examine the suitability of the data for normal distribution. In comparisons of continuous data between groups, Independent Samples t test was used for normally distributed data, and the Mann-Whitney U test was used for data not conforming to normal distribution. Chi-square and Fisher's Exact test were used in group comparisons of nominal variables (cross-tabulations). The relationships between continuous data were analyzed with Spearman's correlation coefficient. IBM SPSS for Windows 20.0 (SPSS Inc. Chicago, IL) program was used in the evaluations, and $p<0.05$ was accepted as the limit of statistical significance.

RESULTS

According to Table 1, the average age of patients was 60.92 ± 8.87 years in the 10-20 years of experience group and 62.64 ± 9.32 years in the >20 years of experience group (p=0.215). The mean body mass index (BMI) was 28.51 ± 4.62 kg/m² in the 10-20 years group and 29.18 ± 4.88 kg/m² in the >20 years group (p=0.342). The gender distribution was 57.4% male and 42.6% female in the 10-20 years group and

58.0% male and 42.0% female in the >20 years group (p=0.942). Hypertension was 70.3% in the 10-20 years group and 83.0% in the >20 years group (p=0.033). Diabetes was 46.5% in the 10-20 years group and 49.0% in the >20 years group (p=0.753). Hyperlipidemia was 36.6% in the 10-20 years group and 42.0% in the >20 years group (p=0.476). COPD was 11.9% in the 10-20 years group and 13.0% in the >20 years group (p=0.810). Smoking was 27.7% in the 10-20 years group and 25.0% in the >20 years group (p=0.675).

According to Table 2, the number of bypass grafts per patient was 3.17 ± 0.90 in the 10-20 years of experience group and 3.32 ± 0.90 in the >20 years of experience group (p=0.238). The cross-clamp time was 73.55 ± 20.92 minutes in the 10-20 years group and 72.57 ± 30.57 minutes in the >20 years group (p=0.360). The cardiopulmonary bypass (CPB) time was 111.50 ± 31.15 minutes in the 10-20 years group and 110.63 ± 43.67 minutes in the >20 years group (p=0.337). Postoperative intensive care unit stay was 2.12 ± 3.00 days in the 10-20 years group and 2.08 ± 3.05 days in the >20 years group (p=0.180). The length of hospital stay was 5.73 ± 4.45 days in the 10-20 years group and 5.87 ± 5.78 days in the >20 years group (p=0.940). Mortality rates were 3.0% in the 10-20 years group and 2.0% in the >20 years group (p=0.170). Complication rates were 9.9% in the 10-20 years group and 7.0% in the >20 years group (p=0.460). Table 2 summarizes intraoperative and postoperative characteristics based on surgeon experience. Parameters such as the number of bypass grafts, cross-clamp time, and CPB time showed no significant differences between the two groups (p>0.05). Mortality and complication rates were also similar.

Table 3 outlines the clinical characteristics of patients based on surgeon experience. Hypertension prevalence was significantly higher in patients treated by surgeons with over 20 years of experience (83% vs. 70.3%; p=0.033). However, no significant differences were observed for other demographic and clinical features (p>0.05).

Table 1. Demographic and clinical characteristics of patients by surgeon experience.

Variable	10-20 Years of Experience (n=101)	>20 Years of Experience (n=100)	p-value
Age, (years)	60.92 ± 8.87	62.64 ± 9.32	0.215
BMI, (kg/m²)	28.51 ± 4.62	29.18 ± 4.88	0.342
Gender, (Male/Female)	58 (57.4) / 43 (42.6)	58 (58.0) / 42 (42.0)	0.942
Diabetes, (DM)	47 (46.5)	49 (49.0)	0.753
Hypertension, (HT)	71 (70.3)	83 (83.0)	0.033 *
Hyperlipidemia	37 (36.6)	42 (42.0)	0.476
COPD	12 (11.9)	13 (13.0)	0.810
Smoking	28 (27.7)	25 (25.0)	0.675

Table 2. Intraoperative and postoperative characteristics by surgeon experience.

Variable	10-20 Years of Experience (n=101)	>20 Years of Experience (n=100)	p-value
Number of Bypassed Grafts	3.17 ± 0.90	3.32 ± 0.90	0.238
Cross-Clamp Time, (min)	73.55 ± 20.92	72.57 ± 30.57	0.360
CPB Time, (min)	111.50 ± 31.15	110.63 ± 43.67	0.337
Postop ICU Stay, (days)	2.12 ± 3.00	2.08 ± 3.05	0.180
Postop Ward Stay, (days)	5.73 ± 4.45	5.87 ± 5.78	0.940
Mortality, (Ex), n (%)	3 (3.0)	2 (2.0)	0.170
Complications, n (%)	10 (9.9)	7 (7.0)	0.460

Table 3. Clinical characteristics by surgeon experience.

Variable	10-20 Years of Experience (n=101)	>20 Years of Experience (n=100)	p-value
Hypertension, (%)	70.3	83	0.033
Mortality, (%)	3.0	2.0	0.170
Complications, (%)	9.9	7.0	0.460

Also, in Table 4, correlation analysis revealed a weak positive correlation between cross-clamp duration and ICU length of stay (r=0.189, p=0.007) and between CPB duration and ICU length of stay (r=0.205, p=0.003). However, no significant correlation was found between cross-clamp duration, CPB duration and length of stay in the ward (p>0.05).

The figüre 1 illustrates the percentages of hypertension, mortality, and complications in patients operated on by surgeons with 10–20 years of experience and those with over 20 years of experience. Hypertension rates were higher in the >20 years group, while mortality and complication rates were similar between the groups.

Table 4. Correlations between cross-clamp and cardiopulmonary bypass times and postoperative intensive care and ward times.

Variable	Duration of Postoperative Intensive Care		Postop Servis süresi	
	r*	p	r*	p
Cross-Clamp Time, (min)	**0.189**	**0.007**	0.065	0.359
Duration of cardiopulmonary bypass, (min)	**0.205**	**0.003**	0.044	0.531

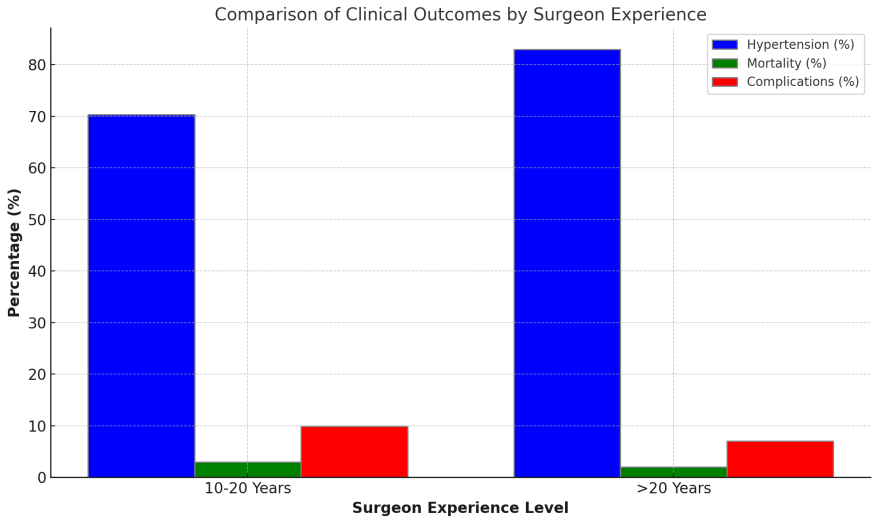

Figure 1. Comparison of clinical outcomes based on surgeon experience.

DISCUSSION AND CONCLUSION

This study retrospectively analyzed the effects of cardiovascular surgeons' length of experience (10-20 years and over 20 years) on clinical and surgical outcomes. Our findings show that the association of surgical experience with risk factors such as hypertension is significant, but its impact on mortality and complication rates is limited. This suggests that surgical outcomes depend not only on individual experience but also on team approach and multidisciplinary care processes. In our study, the rate of hypertension was significantly higher in patients of surgeons with 20 years or more experience (p=0.033). The literature shows that experienced surgeons tend to manage more complex and high-risk patient groups.[14] This may be explained by surgeons relying on their experience in patient selection and undertaking more difficult cases. However, mortality rates did not differ between the two groups, suggesting that experienced teams successfully manage these high-risk patient groups. Especially the role of multidisciplinary teams is critical here.[15,16] No significant difference was found between the two groups in terms of intraoperative parameters such as the number of bypassed vessels, cross clamp time and cardiopulmonary bypass time. While it is emphasized in the literature that more experienced surgeons can shorten the operation times, no significant difference in operation times was observed in this study.[17] This may be due to the fact that all surgeons included in our study were above a certain level of experience. In addition, the fact that the surgical teams worked according to standardized protocols may have limited the effect of individual differences. The postoperative mortality and complication rates of 4% and 8.5%, respectively, indicate that the patient group in our study had generally low complication rates. The fact that there was no significant difference between

the two groups, especially in mortality rates (p=0.170), emphasizes the importance of multidisciplinary care processes regardless of surgical experience.[18,19] In our study, a weak positive correlation was found between cross-clamp duration and cardiopulmonary bypass duration and postoperative intensive care unit duration. This relationship has been reported to be stronger in the literature, but the weak correlation in our study suggests that postoperative processes may be more closely related to other factors such as patient characteristics, team management and complication management.[20,21] The study by Harrison et al. emphasizes that experienced surgeons provide a significant reduction in mortality rates. However, no significant difference was found in mortality rates in our study.[22] This may be attributed to differences in patient populations, the retrospective design of our study, and the generally low mortality rates. Similarly, Brooks et al. reported a correlation between experience level and intraoperative times, whereas no significant difference was observed in this study.[23] This may be attributed to the homogeneous group of surgeons included in our study in terms of experience level. Our findings suggest that surgical outcomes are not only dependent on individual experience but also strongly depend on the contribution of multidisciplinary teams. In cardiovascular surgery, collaboration between units such as the anesthesia team, intensive care staff and nursing services plays a critical role in improving patient outcomes. In addition, standardization of protocols in the postoperative process is considered to be an effective factor in keeping complication rates low.[24] This study shows that the experience level of surgeons is an important factor, especially in high-risk patient groups, but surgical outcomes should be associated with broader teamwork and patient care management. The results emphasize the need to promote multidisciplinary approaches in surgical practices. Furthermore, the low complication rates reveal the importance of standardized surgical protocols. This study has some limitations. First, it may be prone to biases such as missing data and recording errors due to its retrospective design. This limits the evaluation of cause-and-effect relationships. Secondly, the surgeons included in the study were above a certain level of experience, and the results of surgeons with less experience were not analyzed. This limits the generalization of the findings to a large group of surgeons. Third, the fact that the study was conducted in a single center limits the possibility of evaluating the results of variable approaches and surgical procedures in different health centers. Finally, the inclusion of only coronary artery bypass grafting operations led to the exclusion of other types of cardiovascular surgery. This limits the applicability of the findings to different surgical procedures.

In our study, we observed that hypertension prevalence was significantly higher in the group operated on by surgeons with more than 20 years of experience (83% vs. 70.3%, p=0.033). This difference may be attributed to the fact that more experienced surgeons tend to manage higher-risk patients, including those with multiple comorbidities such as hypertension. Although hypertension is a well-known risk factor for cardiovascular complications, in our study, it did not lead to significant differences in mortality (p=0.170) or complication rates (p=0.460) between the groups. This finding suggests that standardized perioperative management and multidisciplinary care play a crucial role in mitigating the adverse effects of hypertension in cardiovascular surgery. Additionally, postoperative parameters such as intensive care unit stay and hospital stay did not differ significantly between groups, indicating that despite a higher prevalence of hypertension, experienced surgical teams effectively managed these patients, ensuring comparable postoperative outcomes.

In conclusion, this study provides valuable retrospective evidence on the impact of cardiovascular surgeons' experience levels on surgical outcomes, emphasizing that while expertise is crucial, particularly in managing complex and high-risk patients, multidisciplinary teamwork and standardized protocols also significantly influence mortality and complication rates. Although cardiovascular surgery requires a five-year specialization period, an additional ten years are estimated to be necessary for surgeons to achieve high proficiency in complex procedures, enabling them to manage high-risk patients more effectively. To further enhance surgical outcomes, fostering multidisciplinary collaboration, integrating advanced technologies, and implementing standardized protocols are essential. Future large-scale, prospective, multi-center studies could provide a more comprehensive evaluation of surgical experience, while research on the contributions of the entire surgical team may offer deeper insights into the benefits of multidisciplinary approaches.

Ethics Committee Approval: The study was reviewed by the Scientific and Ethical Review Board for Medical Research of Ankara Bilkent City Hospital No. 1 and was deemed ethically appropriate. (Date: 17/07/2024, Decision No: TABED-1-24-381). The study was conducted in accordance with the principles of the Declaration of Helsinki, ensuring full protection of patient data confidentiality.

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

Author Contributions: Concept – MFS, EU; Supervision – MFS, KEE, HÜE; Materials – MY, EŞ; Data Collection and/or Processing – MFS, EU;

Analysis and/or Interpretation – KEE, HÜE, MY; Writing – MFS, EU.

Peer-review: Externally peer-reviewed.

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OTJHS
Online Turkish Journal of Health Sciences

e-ISSN: 2459-1467

OTSBD
Online Türk Sağlık Bilimleri Dergisi

Online Turkish Journal of Health Sciences 2025;10(1):89-95 *Online Türk Sağlık Bilimleri Dergisi 2025;10(1):89-95*

A Cross-Sectional Study on Emergency Department Nurses' Knowledge, Practices and Factors Affecting About Triage

Acil Servis Hemşirelerinin Triyaja İlişkin Bilgileri, Uygulamaları ve Etkileyen Faktörler Üzerine Kesitsel Bir Çalışma

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ABSTRACT

Objective: The study aimed to evaluate the knowledge and practices of emergency nurses working in adult emergency departments of two public hospitals serving as tertiary care in the same city and the factors associated with them.

Materials and Methods: This cross-sectional and descriptive study was conducted with 82 emergency service nurses. The research data were obtained with a three-part questionnaire form consisting of questions about some personal characteristics of emergency nurses, the theoretical knowledge of nurses about triage and their practices about triage.

Results: Nurses' triage knowledge and triage application scores were above the average score. Additionally, emergency nurses' theoretical knowledge about triage score averages was higher than their practice score averages. However, it was noteworthy that there was a lack of information and incorrect practices on some subjects of triage. There was no significant difference in the nurses' gender, educational level triage training status and their triage knowledge and practices ($p > 0.05$). 78.0% of the nurses stated that they practiced triage in the emergency department, but 42.7% of them did not consider themselves sufficient in triage, and 59.8% stated that patient density was the most important factor in ensuring effective triage.

Conclusions: Emergency department nurses have deficiencies in triage knowledge and practice and deficiencies in transforming their knowledge into practice. According to the results of the study, it is recommended that professional education should be improved, and information should be updated with continuous in-service training in order to prevent knowledge deficiencies and incorrect triage practices in emergency nursing.

Keywords: Emergency department, nurse, triage

ÖZ

Amaç: Çalışma, acil servis hemşirelerinin triyaj hakkındaki bilgi ve uygulamaları ile bunlarla ilişkili faktörleri değerlendirmeyi amaçlamaktadır.

Materyal ve Metot: Araştırma 82 acil servis hemşiresi ile kesitsel ve tanımlayıcı özellikte yapılmıştır. Araştırma verileri, acil servis hemşirelerinin bazı kişisel özellikleri ve hemşirelerin triyaj hakkında teorik bilgileri ile triyaj hakkında uygulamalarını sorgulayan sorulardan oluşan üç bölümden oluşan anket formu ile elde edilmiştir. İstatistiksel analiz, SPSS 22.0 paket programında, tanımlayıcı istatistikler, Mann Whitney U Testi ve Kruskal-Wallis Testi kullanılarak yapılmıştır.

Bulgular: Hemşirelerin triyaj bilgi ve triyaj uygulama puanları ortalama puanın üstünde bulundu. Ayrıca, acil hemşirelerinin triyaj hakkında teorik bilgi puan ortalamaları, uygulama puan ortalamalarına göre daha yüksekti. Ancak triyajın bazı konuları hakkında bilgi eksikliği ve yanlış uygulamalarının olduğu dikkati çekiciydi. Hemşirelerin cinsiyet, eğitim durumu ve triyaj eğitimi alma durumu ile triyaj bilgi ve uygulamalarında anlamlı bir farklılık yoktu ($p>0,05$). Hemşirelerin %78,0'i acilde triyaj uyguladıklarını ancak %42,7'si triyaj konusunda kendini yeterli görmediğini ve %59,8'i hasta yoğunluğunun etkin triyajın sağlanmasında en önemli faktör olduğunu ifade etti.

Sonuç: Acil servis hemşirelerinin triyaj bilgisi ve uygulamasına ilişkin bilgi eksiklikleri ve bilgilerinin pratiğe dönüştürülmesinde eksiklikleri bulunmaktadır. Çalışma sonuçlarına göre, acil hemşireliğinde bilgi eksikliklerini ve yanlış triyaj uygulamalarını önlemede mesleki eğitimin geliştirilmesini ve sürekli hizmetiçi eğitimlerle bilgilerin güncellenmesi önerilmektedir.

Anahtar kelimeler: Acil servis, hemşire, triyaj

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Yayın Bilgisi / Article Info:
Gönderi Tarihi/ Received: 27/01/2025
Kabul Tarihi/ Accepted: 07/03/2025
Online Yayın Tarihi/ Published: 17/03/2025

Atıf / Cited: Çelik P and et al. A Cross-Sectional Study on Emergency Department Nurses' Knowledge, Practices and Factors Affecting About Triage. *Online Türk Sağlık Bilimleri Dergisi* 2025;10(1):89-95. doi: 10.26453/otjhs.1627554

INTRODUCTION

Emergency services are the most important component of health service delivery. Nurses working in emergency departments are frontline healthcare personnel who take care of patients who present to emergency departments in acute and life-threatening situations.[1] The knowledge and practices of emergency department nurses play an important role in providing quality nursing care in emergency departments, maintaining the quality of care and personalising the treatment according to the needs of each patient.

One of the critical roles of emergency nurses is triage. Triage is a process that consists of timely and accurate identification of patients requiring emergency treatment and separating those who can wait among patients.[2] Due to the clinical nature of the emergency department, nurses are expected to have the skills, knowledge and qualifications that allow them to meet the high demands and expectations of patient care in this area.[3] Despite the availability of existing, validated scales to improve the accuracy of triage of patients presenting to the ED, research suggests that accurate identification of patients and appropriate resource allocation remains a significant challenge for ED nurses.[4] Although the scales used to determine the level of triage are helpful, the process is dynamic and requires considerable patient-centred judgement. At this stage, the decision-making skills and critical thinking capacity of emergency department nurses, who have to make quick decisions about patient care under limited information, a tense environment and time pressure, play an important role.[5] In studies conducted in the literature on the knowledge and skill levels of nurses working in the emergency department regarding triage, it was found that they did not have sufficient knowledge about triage and could not categorise patients into appropriate triage categories.[6,7]

Lack of knowledge and practice of triage among emergency department nurses is a problem not only in Türkiye but also in developing countries.[6,7] In Türkiye, there is a lack of research data on how well emergency department nurses apply the triage knowledge gained during their undergraduate education to their practices in the emergency department, as well as the factors that influence their triage practices.[8-10]

This study aimed to evaluate triage knowledge, practices and related factors among emergency department nurses working in Türkiye. The results of the study will contribute to the literature in finding ways to develop and improve the triage knowledge and practices of emergency department nurses and to fill the gap in the transformation of knowledge into practice.

MATERIALS AND METHODS

Ethics Committee Approval: The study was conducted in accordance with the Declaration of Helsinki. Official permission was obtained from Sivas Cumhuriyet University Non-Interventional Clinical Research Ethics Committee (Decision no: 2023-03/12 Date: 22.03.2023). The study adhered to the ethical guidelines of the Declaration of Helsinki. The nurses participating in the study were informed that they could leave the study at any time and that the confidentiality of their information would be protected.

Design: The research was cross-sectional and descriptive. The study was conducted in two public hospitals providing emergency services as tertiary care between January and April 2023. For emergency department triage, color codes defined as red (very urgent), yellow (urgent), and green (non-urgent) are used in the communiqué published by the Ministry of Health in the official gazette.[11] The research sample was planned to include all personnel who volunteered to participate in the study in a way to reach the minimum number of personnel to be reached from a total of 120 nurses working in the adult emergency departments of two public hospitals, one of which was a state hospital and the other a university hospital, serving in the same city between January and April 2023. For this purpose, n=80 was determined using the sample calculation formula with a certain population. When the sample calculation was made separately for each institution using the stratified sampling method, it was targeted to reach at least 30 nurses from the emergency department of the university hospital and at least 50 nurses from the emergency department of the state hospital. During data collection, a total of 82 nurses volunteered to participate in the study. In addition, the G*Power (Version 3.1.9.6) program was used to calculate the power of the sample. In the study, reliability was taken as 95%, effect level as 0.50 and power was found to be 90% with a sample of 82 people. The data collection forms were delivered to the nurses whose consent was obtained by the researcher and given 1 month, following which the questionnaire forms were collected. Participants were informed about the subject, aim and objective of the study and their right to participate and/or withdraw from the study if they wished to exercise this right without any victimisation. Participants received all information before signing a consent form. Questionnaires were only given to those who agreed by signing informed consent.

Data Collection Tools: A questionnaire form consisting of three parts and questions inquiring about the nurses' theoretical knowledge about triage and their triage practices, which was prepared based on

some personal characteristics of the nurses and the literature, was used to collect the research data.[3,7,9] In the first part of the questionnaire, demographic characteristics of emergency nurses; in the second part, their level of knowledge about triage; in the third part, questions evaluating how much of their knowledge about triage they reflect to practice. The questions in the second and third parts of the questionnaire form were answered as "Agree" or "Disagree". Participants were given 1 point for each correct answer and 0 points for each incorrect answer. Total scores ranged from "0 to 15" for "triage knowledge" and "0 to 10" for "triage practice", with an increase in total scores indicating better triage knowledge or practice. Prior to the calculation of the total score, the reverse statements were reverse-coded. Content validity analysis was conducted utilizing the Davis technique for the questionnaire form prepared in accordance with the literature.[13] The internal consistency of the study questions was assessed using Cronbach's Alpha coefficient (α=0.80).

Statistical Analysis: Statistical analysis was conducted using the SPSS 22.0 package program. Knowledge scores were calculated by taking the mean. Number and percentage distributions of the descriptive characteristics of the nurses were given. The data in the descriptive characteristics of the nurses were compared with the mean knowledge scores. As a result of the Normality test, the Mann-Whitney U Test was used for variables for which a normal distribution was not possible in groups of two. The Kruskal-Wallis Test was used for variables for which a normal distribution was not possible in groups of more than two. Post hoc analysis (Tamhane's T2 since the data were not normally distributed) was used to determine the difference between the groups in terms of mean scores. The results were evaluated at a confidence interval of 95% and a significance level of $p<0.05$.

RESULTS

A total of 82 emergency department nurses participated in the study. Of the participants, 78.0% received triage training; 42.7% did not consider themselves adequate in triage, the reasons for not considering themselves adequate in triage; 57.2% stated that triage training was not given during vocational training, 20.0% stated that triage practice was not important in the institution where they worked and 22.8% stated that they did not trust themselves in triage practice. The most important factor affecting the effectiveness of triage in emergency departments was expressed as patient density by 59.8%. (Table 1).

Table 1. Distribution of nurses' descriptive characteristics and triage practices.

Characteristics		Data
Age, Mean±SD		27.2±4.2
Gender, n (%)	Female	54 (65.9)
	Male	28 (34.1)
Education level, n (%)	High school	22 (26.8)
	Associate's Degree	14 (17.1)
	Bachelor's degree	46 (56.1)
Duration of work in the emergency department, n (%)	1-5 years	54 (65.8)
	6-10 years	20 (24.4)
	11-15 years	8 (9.8)
Triage practice status, n(%)	Yes	64 (78.0)
	No	18 (22.0)
Knowing the name of the procedure/scale used for triage in the emergency department, n(%)	Know	24 (29.3)
	Unknown	58 (70.7)
Status of receiving training on triage, n(%)	Yes	64 (78.0)
	No	18 (22.0)
Type of training, n(%)	In-service training	58 (90.6)
	Congress/symposium/seminar/ course	6 (9.4)
Self-sufficiency in triage, n(%)	Yes	47 (57.3)
	No	35 (42.7)
Reason for not feeling competent in triage, n(%) **(n:35)**	Lack of triage training in undergraduate education	20 (57.2)
	Failure to apply triage in the hospital	7 (20.0)
	Lack of self-confidence in triage	8 (22.8)
Factors affecting effective triage in the emergency department, n(%)	Patient density in the emergency department	49 (59.8)
	Lack of technical and medical equipment	10 (12.2)
	Lack of triage knowledge	16 (19.5)
	Lack of communication within the team	7 (8.5)

The mean total triage knowledge score of emergency nurses in the study was 10.5±1.5. It was determined that the participants had the highest level of agreement with the statements about triage related to the determination of the priority of triage according to the patient's medical need (98.8%) and the correct colour coding defined for triage (95.1%). The participants (67.1%) answered the expression 'AVPU' incorrectly. Additionally, nurses had a high rate of incorrect responses (81.7%) regarding the situations in which triage can be applied in inpatient wards (Table 2).

The total triage practice score of the participants was 6.01 (SD=1.3). The participants largely agreed that longer waiting times could negatively influence patient outcomes (86.6%) and that reducing waiting times would alleviate overcrowding and enhance patient satisfaction (82.9%). A total of 67.1% of nurses agreed with the statement that patients coded as green should wait for one hour or less. Additionally, 62.2% concurred that patients coded in yellow should receive intervention within ten minutes at the latest. However, these responses are incorrect. The appropriate examination and observation times for patients coded in green should not exceed two hours, while those for patients coded in yellow should not exceed one hour (Table 3).

Table 2. Emergency nurses' knowledge about triage.

Knowledge about Triage	**Agree**	**Disagree**
Triage is the prioritisation of the patient according to medical care needs, n (%)	81 (98.8)	1 (1.2)
The aim of triage is to identify the patients who cannot wait and to ensure that they are intervened as soon as possible, n (%)	76 (92.7)	6 (7.3)
In triage, one of the degrees of urgency classification systems, such as binary, triadic, quadruple, quadruple and quintuple, is used to prioritise treatment, n (%)	69 (84.1)	13 (15.9)
In our country, according to the communiqué of the Ministry of Health, colour coding is used in triage, defined as red (very urgent), yellow (urgent), green (non-urgent) and black (dying), n (%)	78 (95.1)	4 (4.9)
In triage, patients are evaluated according to their order of arrival at the hospital, n (%)	21 (25.6)	61 (74.4)
Stable patients admitted to the hospital as outpatients should be directed to the red area, n (%)	10 (12.2)	72 (87.8)
Patients coded green during triage should be treated first, n (%)	16 (19.5)	66 (80.5)
If an urgent finding is detected in the first step, the patient's vital signs are taken first, n (%)	62 (75.6)	20 (24.4)
Individuals with potentially life-threatening illnesses (e.g. chest pain not compatible with cardiac history and conscious individuals with moderate head trauma) are directed to the yellow area, n (%)	57 (69.5)	25 (30.5)
Patients admitted to the triage area should be assessed at regular intervals, as the patient's condition may change from one area to another, n (%)	57 (69.5)	25 (30.5)
The nurse can triage by making independent judgement, n (%)	49 (59.8)	33 (40.2)
The condition of a patient in the red area can return to the green area without intervention, n (%)	11 (13.4)	71 (86.6)
In inpatient wards, triage is only applied in case of insufficient personnel and medical equipment. n (%)	15 (18.3)	67 (81.7)
Patients with high social status, such as senior people and politicians, should be considered as very urgent, even if triaged as green, n (%)	18 (22.0)	64 (78.0)
AVPU is the abbreviation of "Alert", "Verbal", "Pulse" and "Unresponsive", n (%)	55 (67.1)	27 (32.9)
Total Triage Knowledge Score, Mean±SD	10.5±1.5	

Table 3. Emergency nurses' practices on triage.

Practices about Triage	**Agree**	**Disagree**
Triage should only be carried out by professional nurses, n (%)	40 (48.8)	42 (51.2)
The first evaluation of the patient arriving at the hospital starts with taking vital signs, n (%)	67 (81.7)	15 (18.3)
Determining the patient's triage code is the last step in the triage process, n (%)	63 (76.8)	19 (23.2)
Triage reduces the waiting time of patients in the emergency department, n (%)	67 (81.7)	15 (18.3)
Waiting time should not be taken into account when providing emergency care, n (%)	25 (30.5)	57 (69.5)
Patients coded yellow in triage should be intervened within 10 minutes at the latest, n (%)	51 (62.2)	31 (37.8)
Patients coded green in triage must wait 1 hour or less, n (%)	55 (67.1)	27 (32.9)
Delays in waiting time may adversely affect the patient's condition, n (%)	71 (86.6)	11 (13.4)
Short waiting times in emergency departments reduce overcrowding and increase patient satisfaction, , n (%)	68 (82.9)	14 (17.1)
It is illegal to delay triage of patients in emergency departments, n (%)	31 (37.8)	51 (62.2)
Total Triage Practice Score, Mean±SD	**6.01 ±1.3**	

When the score differences were tested according to the groups, no significant difference was found between the mean triage knowledge and practice score and gender, educational status and triage training status ($p > 0.05$). Only a significant difference was found between the duration of working in the emergency department and the mean triage practice score ($P<0.05$). It was detected that the mean triage practice score of those working between 1-5 years in the emergency department was higher than those working 6-10 years (Post hoc- Tamhane's T2) (Table 4).

Table 4. Comparison of sociodemographic characteristics of nurses and total triage knowledge and practice score means.

Sociodemographic Characteristics	Average Triage Knowledge Score p-value	Average Triage Practice Score p-value
Gender	0.36[a]	0.26[a]
Education level	0.74[b]	0.18[b]
Duration of work in the emergency department	0.67[b]	0.03[b]
Status of receiving training on triage	0.47[a]	0.49[a]

[a]: Mann Whitney U Test was used; [b]: Kruskal-Wallis H Test was used.

DISCUSSION AND CONCLUSION

Determining the priority and performing triage practices effectively is quite essential in emergency department units where patient load and appointments cannot be planned. In the 'Communiqué on the Implementation Procedures and Principles of Emergency Services in Inpatient Healthcare Facilities" published by the Ministry of Health in Türkiye in 2022, "triage can be performed by physicians or health personnel trained for triage".[11] In this study, it is observed that the majority of the people performing triage in emergency departments are nurses. It is very important for nurses to have up-to-date knowledge and skills about triage in order to perform triage practices systematically in emergency services.[12]

It was determined that the majority of the nurses participating in the study received in-service training on triage. Still, almost half of them did not consider themselves sufficient in triage, and the reasons for this were "lack of training on triage during vocational training" and "lack of self-confidence" with high rates. Although knowledge is the key factor affecting the accuracy of triage decisions, it is stated that nurses should also have advanced identification, good communication and organisational skills, emergency department experience and triage experience in order to assume triage responsibility.[9,14] It is stated in the literature that training and orientation programs will be effective in increasing the reliability and effectiveness of nurses' roles related to triage and preventing errors.[15,16] The fact that nearly half (42.7%) of the emergency department nurses in this present study did not consider their knowledge and skills on triage to be sufficient revealed that this issue should be prioritized in in-service training and that triage knowledge and practices should be adequately included in the curriculum during their academic education. Bahre et al. determined that the triage knowledge and skill levels of nurses working in the emergency department were low, similar to our study.[17]

In the study, it was stated that the most important factors affecting the effective triage of emergency department nurses were the patient load in the emergency department and the lack of triage knowledge. In the study by Soola et al., inadequate triage knowledge was shown to be the most important factor affecting effective triage.[10] Education is the most important factor in improving nurses' triage decision -making skills and accuracy. Therefore, nursing educators and hospital administrators should address this important issue, and well-designed triage training should be provided to improve triage nurses' judgement and decision-making in the future.

It was determined that the knowledge and practice scores of the nurses participating in the study about triage were above the average score. However, it is noteworthy that the knowledge scores of emergency nurses about triage were higher than the practice scores. On the other hand, although the practice scores of the nurses were above the average, a lack of knowledge was observed in some items related to knowledge (e.g., the abbreviation 'AVPU' and the questions 'in which cases triage will be applied in inpatient services' were answered incorrectly at a high rate) and practice (the waiting time for examination and observation of patients coded as yellow and green was answered incorrectly). Although it was stated that triage was performed at a high rate in the emergency departments where the study was conducted, the lack of knowledge about the waiting times of the patients according to the colour codes, the 'AVPU' scale used to evaluate the level of consciousness and the situations in which triage will be

applied in inpatient services shows that emergency nurses need more theoretical and practical education and training to improve their triage knowledge.

The highest participation of the nurses participating in the study regarding triage knowledge was seen in the statements related to the definition and purpose of triage and the colour coding used in triage in our country. In studies conducted in the literature, it was observed that the rate of nurses answering the questions about the 'definition', 'purpose' and 'colour coding system' of triage correctly was high, similar to our study. [16,18]

In the study, it was determined that gender, educational status, and having received training on triage did not make a difference in the triage knowledge and practices of the nurses, and only concerning the working time in the emergency department; it was detected that the mean triage practice score of nurses with a working time between 1-5 years was higher than those with a working time between 6-10 years. In fact, it has been suggested that the triage performance of nurses has historically been related only to the triage experience of nurses. Still, studies and reviews show that this is not the case. Tamari et al.[19] and Hussein et al.[20] revealed in their studies that less experienced nurses may be more successful. Our study supports this situation.[19,20] This may be due to the fact that most of the sample consisted of nurses who have been working in the emergency department for 1-5 years, in addition to the fact that less experienced nurses experience anxiety and fear of taking responsibility during triage. Experienced nurses are often more confident in their triage skills, sometimes even overconfident; therefore, they may be more likely to perform inadequate triage.

In conclusion, emergency departments are very chaotic environments due to the urgency and seriousness of the conditions of the patients admitted. In such an environment, in order for emergency nurses to triage effectively, their knowledge and practices related to triage should be at an acceptable level. The issue of nurses' competence in triage is a multifactorial process. Various strategies can be proposed to optimise the competence of triage-related nursing practice, including supervision and feedback, training, reminder systems, simulation and artificial intelligence-supported electronic decision support tools. In this study, it was determined that the triage knowledge score of emergency nurses was higher than the practice score. However, the results of the study also revealed the existence of knowledge gaps and deficiencies in nurses' triage practice, which can be increased through capacity building of the staff. Therefore, the study recommends the development of vocational education and training to prevent knowledge gaps and incorrect triage practices in emergency nursing and that hospital administrators should establish frameworks that mandate the updating of knowledge and skills about triage among emergency nurses through in-service vocational training. Limitations of the study include the fact that it was conducted only in two public hospitals located in a single city centre and cannot be generalised to other hospitals outside the district and province and that there may be bias in the responses since no attempt was made to measure behavioural components that may affect the actual triage practice skills of the participants.

Ethics Committee Approval: The study was conducted in accordance with the Declaration of Helsinki. Official permission was obtained from Sivas Cumhuriyet University Non-Interventional Clinical Research Ethics Committee (Date: 22.03.2023, decision no: 2023-03/12). The study adhered to the ethical guidelines of the Declaration of Helsinki. The nurses participating in the study were informed that they could leave the study at any time and that the confidentiality of their information would be protected.

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

Author Contributions: Concept–PÇ, MM; Supervision–PÇ, MM, FH; Materials–PÇ, MM, FH; Data Collection and/or Processing–PÇ, MM; Analysis and/or Interpretation–PÇ, MM, FH; Writing–PÇ, MM.

Peer-review: Externally peer-reviewed.

Acknowledgements: Thank you to the participants.

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OTJHS
Online Turkish Journal of Health Sciences

e-ISSN: 2459-1467

OTSBD
Online Türk Sağlık Bilimleri Dergisi

Online Turkish Journal of Health Sciences 2025;10(1):96-102 *Online Türk Sağlık Bilimleri Dergisi 2025;10(1):96-102*

Predictors of Beliefs About Thirdhand Tobacco Smoke Among Adult Individuals

Yetişkin Bireylerin Üçüncü El Tütün Dumanına Yönelik İnanışları ve Etkileyen Faktörler

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ABSTRACT

Objective: This study aimed to determine the predictors of the beliefs about thirdhand tobacco smoke among adult individuals.

Materials and Methods: This was a cross-sectional study. The study sample consisted of community-dwelling adult individuals living in Türkiye (n=835). The data were collected via a questionnaire and the Beliefs about Thirdhand Smoke Scale between June 10th-July 31st, 2021. The data were analyzed via IBM SPSS v.25.0. Descriptive statistics, student t-test, Mann-Whitney U, One-way ANOVA, and multiple linear regression analysis were used to present the data. The statistical significance level was accepted as $p<0.05$.

Results: The mean age was 29.10±9.76, 74.9% were women, 64.8% were homeowners, and 85.3% had not heard about thirdhand smoke before. The total mean score of the Beliefs about Thirdhand Smoke Scale was 4.30±0.64. The total mean score of the Beliefs about Thirdhand Smoke Scale was higher in women, those who were rural residents, who had pre-knowledge about thirdhand smoke, who were non-smokers, who preferred not to be in a smoking-allowed-place, and those who entirely banned smoking in their homes (R^2= 0.079, F=7.064, $p<0.001$).

Conclusions: Beliefs about thirdhand smoke among adult individuals were strong. The results of this study will contribute to the studies to be conducted to increase the motivation of community-dwelling adult individuals to quit smoking. Experimental studies should be performed to increase the knowledge and awareness of adults by determining their beliefs about thirdhand smoke.

Keywords: Community-based participatory research, environmental smoke pollution, passive smoking, primary care nursing, Tobacco smoke pollution

ÖZ

Amaç: Bu araştırma yetişkin bireylerin üçüncü el tütün dumanına yönelik inanışlarını ve etkileyen faktörleri belirlemek amacıyla yapıldı.

Materyal ve Metot: Kesitsel tipteki araştırmanın örneklemi, Türkiye'de toplumda yaşayan yetişkin bireylerden oluşturuldu (n=835). Veriler, 10 Haziran-31 Temmuz 2021 tarihleri arasında anket formu ve Üçüncü El Dumana Yönelik İnançlar Ölçeği kullanılarak toplandı. Veriler, IBM SPSS v.25.0 programında tanımlayıcı istatistikler, karşılaştırmalı analizler ve çoklu doğrusal regresyon analizi kullanılarak test edildi. İstatistiksel anlamlılık düzeyi $p<0,05$ kabul edildi.

Bulgular: Katılımcıların yaş ortalaması 29,10±9,76 olup, %74,9'unun kadın, %64,8'inin ev sahibi ve %85,3'ünün üçüncü el duman kavramını daha önce duymadıkları belirlendi. Üçüncü El Dumana Yönelik İnançlar Ölçeği'nin toplam puan ortalamasının 4,30±0,64 olduğu bulundu. Kadınların, kırsal bölgede yaşayanların, üçüncü el duman kavramını daha önce duyanların, sigara içmeyenlerin, sigara içilmesine izin verilen yerlerde bulunmayı tercih etmeyenlerin ve evlerinde sigara içilmesi tamamen yasak olan yetişkin bireylerin Üçüncü El Dumana Yönelik İnançlar Ölçeği'nin toplam puan ortalamasının daha yüksek olduğu belirlendi (R^2= 0,079; F=7,064; $p<0,001$).

Sonuç: Yetişkin bireylerin üçüncü el dumana ilişkin inanç düzeylerinin yüksek olduğu belirlendi. Çalışma sonuçlarının, toplumda yaşayan yetişkin bireylerin sigarayı bırakma motivasyonunu artırmak için yapılacak çalışmalara katkıda bulunacağı düşünülmektedir. Yetişkinlerin üçüncü el dumana ilişkin inançlarının belirlenerek bilgi ve farkındalıklarını artırmaya yönelik deneysel çalışmaların yapılması önerilir.

Anahtar Kelimeler: Birinci basamak hemşirelik hizmetleri, çevresel tütün dumanı kirliliği, edilgen sigara içimi, sigara dumanı kirliliği, toplum tabanlı katılımcı araştırma

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Yayın Bilgisi / Article Info:
Gönderi Tarihi/ Received: 09/02/2025
Kabul Tarihi/ Accepted: 20/02/2025
Online Yayın Tarihi/ Published: 17/03/2025

Atıf / Cited: Terzi H and Sönmez Sarı E. Predictors of Beliefs About Thirdhand Tobacco Smoke Among Adult Individuals. *Online Türk Sağlık Bilimleri Dergisi* 2025;10(1):96-102. doi: 10.26453/otjhs.1636394

INTRODUCTION

The tobacco smoking epidemic, as one of the preventable risk factors of non-communicable diseases, is globally declared as a health threat. WHO accepts adult smoking as an indicator worldwide.[1,2] The current global adult smoking prevalence is reported as 22.3%.[1] In the USA, smoking prevalence among adult individuals is stated as 23%.[3] In the WHO European Region, the rates vary between 12%-39.8%.[3] Moreover, changes in the daily routine with the COVID-19 pandemic, such as lockdowns and working at home, caused an increase in the smoking prevalence among the adult populations.[4] Therefore, smoking has currently become an important global issue not only for individuals but also for environmental health.[2]

Exposure to environmental tobacco smoke, whether directly (secondhand smoke) and/or exposure to the residue of the particles in the cigarette smoke (thirdhand smoke), is as harmful to health as active smoking.[5-6] The environmental tobacco smoke has caused approximately 600.000 premature deaths/ year worldwide.[7] Thirdhand smoke is defined as the remaining tobacco smoke and the residues of its chemicals absorbed by indoor surfaces, dust, and even the human's skin and hair after smoking indoors.[8] It was determined that the risk of thirdhand smoke exposure continued to increase over time, though the passive smoke was removed in a smoking environment.[9] However, the awareness of thirdhand smoke among parents was found to be not at the intended level.[10] Women and children are known as the most fragile populations regarding the health effects of thirdhand smoke.[10-11] The health beliefs of individuals are one of the remarkable motivational sources for promoting health.[12] Therefore, it is thought to be important to increase community awareness by determining the beliefs about thirdhand smoke specifically among the adult individuals.[13]

The thirdhand smoke concept is relatively new to community health, and there is scarce evidence about it. Most of the evidence aimed to determine the beliefs about thirdhand smoke, especially among parents. In those studies, there was a general lack of knowledge about the concept of thirdhand smoke; the awareness about the issue was low, and thirdhand smoke was believed to be harmful to health.[11,14,15] In a current study, a social media campaign to raise public awareness about thirdhand smoke was effective in knowledge and attitude among adult individuals but not in their behaviors about the issue.[16]

This study aimed to determine the predictors of the beliefs about thirdhand tobacco smoke among adult individuals.

MATERIALS AND METHODS

Ethics committee approval: Ethical approval was obtained from the University's Ethics Board before collecting the data (Approval number: 2021-55/ Date: 09.06.2021). This study followed the principles of the Declaration of Helsinki. Written informed consent was obtained from the individuals who agreed to participate in the study at the beginning of the online form.

Study design: This study adopted a cross-sectional design. The answers to the following questions were sought:

- What is the level of beliefs about thirdhand smoke among adult individuals?
- What are the predictors of beliefs about thirdhand smoke among adult individuals?

Participants: The study population consisted of community-dwelling adult individuals living in Türkiye. The sample size was calculated via G*Power 3.1.9.4 with α=0.01, 1-β=95%, and d=0.306 as a minimum of 676 adults.[11] It was planned to include at least 20% more of the calculated sample size to prevent data loss (n=811). The inclusion criteria were a) having technical opportunities and the ability to fill in the online forms, b) being ≥18 years old, and c) participating in the research voluntarily.

Instruments: The data were collected via a questionnaire and the Beliefs about Thirdhand Smoke Scale.

The questionnaire was prepared by researchers based on the relevant literature.[11,13,17] It consisted of 20 questions to determine the sociodemographic features, including age, sex, graduation, marital status, employment, income, place of residence, home ownership, and smoking habits of the adult individuals.

The Beliefs about Thirdhand Smoke Scale (BATHS) was developed by Haardörfer et al. to determine the beliefs about thirdhand smoke, understand their relations to smoking behavior, and define the harmful effects on health.[18] Turkish validity and reliability study was conducted by Çadirci et al. as BATHS-T.[19] BATHS-T is a five-point Likert-type scale (1=totally disagree-5=totally agree) with nine items and two subscales ("impact on health" and "persistence in the environment"). The total score was calculated as the arithmetic means of the sum of the scores obtained per item. The Cronbach alpha of the original form for the whole scale was 0.91 and 0.88 for each subscale.[18] The Cronbach alpha of the BATHS-T was found to be 0.90 and 0.93 for the subscales.[19] The Cronbach alpha was 0.85 for the total of the scale and 0.75 for each of the subscales in this study.

Data collection: The data were collected between

June 10 and July 31, 2021. Instruments were prepared using Google Forms online and sent to the individuals through various social media platforms and e-mail. The sample was constituted using a convenience sampling method through the voluntary adult individuals who shared the survey link on online platforms. The online survey was designed to reach the questions after gathering the participants' written informed consent.

Statistical analysis: The data were analyzed via IBM SPSS 25.0 (Armonk, NY: IBM Corp.). The normal distribution of the data was assessed via the Skewness-Kurtosis (±2) values.[20] Descriptive statistics, student t-test, Mann-Whitney U, and One-way ANOVA were used to present the data. The predictors of thirdhand smoke beliefs were determined via multiple linear regression analysis with the "enter model". The multicollinearity and normality of the data were analyzed before performing the regression analysis. The statistical significance level was accepted as $p<0.05$.

RESULTS

This study was completed with 835 voluntary adult individuals who were reached between the predetermined data collection dates (n=835). The mean age was 29.10±9.76, and 74.9% were women. Of the adult individuals, 64.8% were homeowners, and 85.3% had not heard about thirdhand smoke before (Table 1). In the comparison analysis, the total mean scores of BATHS-T of the women, those who were married, who lived in rural areas, and those who had pre-knowledge about thirdhand smoke were significantly higher ($p<0.05$) (Table 1).

The total mean score of the BATHS-T was 4.30±0.64, 4.33±0.60 for the impact on health subscale, and 4.25±0.76 for the persistence in the environment subscale (Table 2).

Characteristics of cigarette smoking habits and their relationship to the mean score of BATHS-T of the adults are depicted in Table 2. Of the adult individuals, 28.7% were smokers, 20.8% preferred to be in smoking-allowed places, 64.3% had a partial home smoking ban, and 39.8% had a partial private car

Table 1. Sociodemographic characteristics and their associations with the BATHS-T (n=835).

Sociodemographic characteristics			**The BATHS-T**		
Age [Mean±SD] 29.10±9.76		**n (%)**	**Mean±SD**	**test**	**p**
Sex	Women	625 (74.9)	4.34±0.63	t=3.040	**0.002**
	Men	210 (25.1)	4.18±0.68		
Graduation	Secondary school	61 (7.3)	4.39±0.64	F=1.196	0.303
	High school	311 (37.2)	4.26±0.67		
	University and above	463 (55.4)	4.31±0.63		
Marital status	Married	310 (37.1)	4.37±0.61	t=2.369	**0.018**
	Single	525 (62.9)	4.26±0.66		
Having kids	Yes	556 (66.6)	4.35±0.63	t=-1.495	0.136
	No	279 (33.4)	4.28±0.65		
Employment	Employed	389 (46.6)	4.32±0.61	t=0.974	0.330
	Not employed	446 (53.4)	4.28±0.67		
Income	Less than expense	276 (33.1)	4.31±0.67	F=0.539	0.584
	Equal to expense	403 (48.3)	4.28±0.65		
	More than expense	156 (18.7)	4.34±0.58		
Place of residence	Urban	556 (66.6)	4.25±0.65	t=-2.908	**0.004**
	Rural	279 (33.4)	4.39±0.62		
Homeownership	Owner	541 (64.8)	4.29±0.64	t=-0.296	0.768
	Resident	294 (35.2)	4.31±0.64		
Pre-knowledge about the thirdhand smoke	Yes	123 (14.7)	4.41±0.56	t=2.087	**0.037**
	No	712 (85.3)	4.28±0.66		

t: independent sample's t-test; F: One-way ANOVA.

smoking ban (Table 2). In the comparison analysis, the total mean scores of BATHS-T of the non-smokers, those who did not prefer to be in a smoking-allowed place, who did not live with another smoker, who entirely banned smoking in the home and their private cars, and those whose daily smoked cigarette consumption was unchanged, were significantly higher ($p<0.05$) (Table 2).

The variables significant in the comparison analysis were included in the multiple regression analysis (Table 3), and they were found to explain 7.9% of the variance for the BATHS-T ($R^2=0.079$, $F= 7.064$, $p<0.001$). The mean score of the BATHS-T was higher in women (β=0.079), those who were rural residents (β=-0.078), who had pre-knowledge about thirdhand smoke (β=0.068), who were non-smokers (β=-0.092), those who preferred not to be in a smoking-allowed place (β=0.005), and those who entirely banned to smoke in their homes (β=-0.089) (Table 3).

Table 2. Characteristics of smoking habits and their associations with the BATHS-T (n=835).

Scale and subscales		**Mean±SD**	**Min-Max**		
Total BATHS-T		4.30±0.64	2.67-5		
Impact on health subscale		4.33±0.66	2.20-5		
Persistence in the environment subscale		4.25±0.76	2-5		
Characteristics of the smoking habit		**n (%)**	**The BATHS-T Mean±SD**	**test**	**p**
Cigarette smoking status	Smoker	240 (28.7)	4.11±0.71	t=-0.412	**<0.001**
	Non-smoker	595 (71.3)	4.39±0.60		
Preference to be in a smoking-allowed place	Yes	174 (20.8)	4.05±0.73	t=-5.910	**<0.001**
	No	661 (79.2)	4.37±0.60		
Smoking around the children at home	Yes	18 (2.2)	4.06±0.75	Z=-1.328	0.184
	No	817 (97.8)	4.30±0.64		
Living with another smoker	Yes	494 (59.2)	4.26±0.66	t=2.003	**0.046**
	No	341 (40.8)	4.37±0.62		
Allowing to smoke around children at home	Yes	17 (2.0)	4.09±0.67	Z=-1.492	0.136
	No	818 (98.0)	4.30±0.64		
Home smoking ban	Full ban	278 (33.3)	4.43±0.58	F=8.579	**<0.001**
	Partial ban	537 (64.3)	4.23±0.67		
	No ban	20 (2.4)	4.30±0.50		
Private car smoking ban (n=455)	Full ban	259 (56.9)	4.40±0.59	F=8.911	**<0.001**
	Partial ban	181 (39.8)	4.15±0.65		
	No ban	15 (3.3)	4.10±0.73		
The number of daily smoked cigarettes after having COVID-19 (n=227)	Unchanged	12 (5.3)	3.62±0.83	Z=-2.945	**0.003**
	Decreased	215 (94.7)	4.34±0.62		

t=independent sample's t-test; F=One-way ANOVA; Z=Mann-Whitney-U test.

Table 3. The predictors of the thirdhand smoke beliefs among adult individuals.

	Unstandardized coefficients		**Standardized coefficients**			**95% CI**	
Independent variable	**B**	**SE**	**β**	**t**	**p**	**Lower Bound**	**Upper Bound**
Age	0.003	0.003	0.047	1.092	0.275	-0.002	0.009
Sex **(ref: Men)**							
Women	0.118	0.052	0.079	2.273	**0.023**	0.016	0.220
Marital status **(ref: Married)**							
Single	-0.098	0.057	-0.073	-1.721	0.086	-0.210	0.014
Place of residence **(ref: Rural)**							
Urban	-0.107	0.049	-0.078	-2.178	**0.030**	-0.203	-0.011
Pre-knowledge about thirdhand smoke **(ref: No)**							
Yes	0.125	0.062	0.068	2.021	**0.044**	0.004	0.246
Smoking status **(ref: Non-smoker)**							
Smoker	-0.132	0.066	-0.092	-1.996	**0.046**	-0.262	-0.002
Preference to be in a smoking-allowed place **(ref: No)**							
Yes	-0.194	0.068	-0.121	-2.845	**0.005**	-0.327	-0.060
Living with another smoker **(ref: No)**							
Yes	0.074	0.054	0.056	1.365	0.173	-0.032	0.180
Home smoking ban **(ref: Full ban)**							
Partial ban	-0.121	0.051	-0.089	-2.356	**0.019**	-0.221	-0.020
No ban	0.068	0.153	0.016	0.446	0.656	-0.232	0.368

Constant; Durbin-Watson= 1.877; $F= 7.064$, $p<0.001$, $R= 0.281$, $R^2= 0.079$, Adjusted $R^2= 0.068$, CI=confidence interval; SE=standard error; β=standardized regression coefficient.

DISCUSSION AND CONCLUSION

The predictors of the beliefs about thirdhand tobacco smoke among adult individuals were determined in the present research. The beliefs about thirdhand smoke levels of adult individuals were found to be strong in this study. This finding is supported by the literatures.[11,15] The daily cigarette consumption among adults is known to increase in the lockdown among the general population during COVID-19.[4,13,21] This has inevitably caused a more significant risk regarding environmental tobacco smoke exposure.[22] Therefore, proactive determination of adult individuals' beliefs about thirdhand smoke is considered crucial to ensure the continuity of interventions regarding the smoke-free home initiative in public health emergencies like pandemics.[16,22]

In the regression analysis, the "preference to be in a smoking-allowed place" variable, which was one of the significant predictors of thirdhand smoke beliefs, was first in order of importance. The total mean score of the BATHS-T of the adults who prefer to be in the smoking-allowed places was found to be lower than that of those who did not prefer in this study.

The second variable in order of importance was "smoking status." The total mean score of the smokers' BATHS-T was lower than that of the non-smokers in the present study. Considering that smokers are more likely to prefer to be in smoking-allowed places, a lower level of beliefs about thirdhand smoke among them is an expected result. However, in a study conducted in China, there was no significant difference between smokers and non-smokers regarding their beliefs about thirdhand smoke scale total mean scores.[11] Although smokers and non-smokers accept the harmful effects of thirdhand smoke, COVID-19 may have affected the awareness and belief that cigarette smoke is detrimental to health on any occasion, especially among non-smokers.

In order of importance, the third variable was the "home smoking ban." The total mean score of the BATHS-T of the adults who entirely banned smoking at home was higher than those who partially banned in this study. Accordingly, the beliefs about thirdhand smoke among parents who had strict home smoking bans were found to be significantly more potent in a Kuwait-based study.[15] Additionally, approximately one out of every two adults who had strict rules about smoking in their private cars were found to have higher beliefs about thirdhand smoke in this study. In a study conducted in China, less than half of parents with private cars were found to have a specific policy of a private car smoking ban.[23] Indoor smoking is known to adversely affect especially the health of children and non-smokers.[11,24] Although smoking has been banned in most indoor public places and workplaces in line with Article 8 in the WHO Framework Convention on Tobacco Control in Türkiye since 2009, home smoking is not firmly framed by Turkish laws.[25] Therefore, political regulations to strengthen the beliefs about thirdhand smoke among adults will provide more health-friendly living environments for vulnerable groups, even during pandemic emergencies.

The fourth variable in order of importance was "sex." The total mean score of the BATHS-T was higher in women in this study. In the literature, women's beliefs about thirdhand smoke were also found to be stronger than men's.[11,15,26] Considering that smoking directly affects the beliefs about thirdhand smoke, the smoking prevalence is known to be much higher in men than in women globally, and factors including pregnancy and motherhood roles of women,[27-29] they are expected to have stronger beliefs about the issue.

"Place of residence" was the fifth variable in order of importance. The total mean score of the BATHS-T was found to be lower in the urban adult residents than in the rural residents. No study has been found in the literature comparing the relationship between the beliefs about thirdhand smoke among adults during the COVID-19 pandemic and the place of residence. The stringent implementation of stay-at-home restrictions in urban areas may have negatively affected the beliefs about thirdhand smoke among adult individuals by causing them to smoke in their home environments compulsorily.

The sixth variable in order of importance was "pre-knowledge about the thirdhand smoke." Approximately eight out of every 10 adults in this study had not heard about the thirdhand smoke issue before, and their total mean score of the BATHS-T was found to be lower. A study determined that six out of 10 adults living in California had not heard about thirdhand smoke before.[16] In a systematic review conducted before the COVID-19 pandemic, knowledge of the general population about thirdhand smoke and its hazardous impacts on health was not at the intended level. Moreover, the health effects of thirdhand smoke were defined to be poorly understood.[17] Increasing the knowledge level of adults about thirdhand smoke is stated to affect their attitude toward smoking.[16] Therefore, raising the general health literacy level of adult individuals is crucial to increasing their knowledge about the effects of thirdhand smoke on health and the environment.[30] Accordingly, empowering knowledge and increasing awareness at the community level will encourage adult individuals not to smoke in indoor places, including homes, even in compulsory situations like lockdowns in prospected pandemics.

This is one of the leading studies in the literature determining the beliefs about thirdhand smoke and

the predictors among community-dwelling adult individuals during the COVID-19 pandemic, to the best of our knowledge. However, because of its cross-sectional design, the results only reflected the data collection situation. Additionally, the online data collection based on self-reports of the individuals may have affected the quality of the obtained data. The low rate of explained variance in the regression model may stem from the variables that were not included in the constructed model. This may indicate that the excluded variables could also predict the total mean score of the BATHS-T. Future studies could run more comprehensive regression models to uncover the predictive effects of additional variables.

In conclusion, the beliefs about thirdhand smoke among adult individuals were found to be strong in this study. Sex, place of residence, pre-knowledge about thirdhand smoke, smoking status, preference to be in a smoking-allowed place, and home smoking ban were the significant determinants of the adults' beliefs about thirdhand smoke. Raising public awareness about thirdhand smoke can motivate individuals to change their behavior and promote their health by reducing the potential health hazards related to thirdhand smoke. The results of this study will contribute to the studies to be conducted to increase the motivation of community-dwelling adult individuals to quit smoking. In this context, interventional studies are recommended to be performed to increase knowledge and awareness of adult individuals via determining the beliefs about thirdhand smoke in the general population.

Ethics Committee Approval: This study was approved by the Ufuk University Ethics Committee (Approval number: 2021-55/Date: 09.06.2021). This study followed the principles of the Declaration of Helsinki. Written informed consent was obtained from the individuals who agreed to participate in the study at the beginning of the online form.

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

Author Contributions: Concept – HT; Supervision – HT, ESS; Materials – HT, ESS; Data Collection and/or Processing – HT, ESS; Analysis and/or Interpretation – HT, ESS; Writing –HT, ESS.

Peer-review: Externally peer-reviewed.

Acknowledgement: The authors would like to thank all adult individuals for their voluntary participation and valuable contributions to this study.

Other Information: This study was orally presented at the 3rd International 4th National Public Health Nursing Conference, which was held on January 11-13, 2023, as online.

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