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The Adaptation of Individuals with Coronary Heart Disease to the Mediterranean Diet, Its Relationship with Lipid Profile and Blood Pressure

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ABSTRACT
Objective: The aim of this study is to assess the adherence of individuals with existing coronary heart disease (CHD) to the Mediterranean Diet and to evaluate its association with blood parameters. **Materials and Methods:** This cross-sectional study enrolled 66 individuals aged 30-70 with CHD from a cardiology outpatient clinic between June and September 2022. To ensure sample homogeneity, patients with comorbid conditions such as cancer, kidney disease, liver disease, and pregnant women were excluded. Participants completed a detailed survey including sociodemographic data, biochemical parameters, a Food Frequency Questionnaire (FFQ), and 24-hour dietary recalls. Adherence to the Mediterranean diet was assessed using the Mediterranean Diet Score (MedDietScore). Statistical analyses were performed using SPSS, employing Independent Samples T-tests, Mann-Whitney U tests, ANOVA, and correlation analyses. **Results:** The mean Mediterranean Diet Score was 32.5 ± 5.7, indicating moderate adherence. Significant differences were observed in LDL cholesterol and triglyceride levels across different adherence levels (p= 0.006 and 0.02 respectively), with higher Mediterranean Diet Scores correlating with lower levels of these lipids. Additionally, a moderately positive correlation was found between diet scores and systolic blood pressure. **Conclusion:** Moderate adherence to the Mediterranean diet correlates with improved lipid profiles in CHD patients. These findings support the promotion of the Mediterranean diet for cardiovascular health. However, further studies are needed to validate these findings, particularly through randomized controlled trials focusing on the long-term effects of Mediterranean diet adherence on lipid metabolism, inflammatory markers, and endothelial function.
Keywords: Coronary Heart Disease, Mediterranean Diet, Lipid Profile, Blood Pressure.

Koroner Kalp Hastalığı Olan Bireylerin Akdeniz Diyetine Uyumu, Lipit Profili ve Kan Basıncı ile İlişkisi

ÖZ
Amaç: Bu çalışmanın amacı, mevcut koroner kalp hastalığı olan bireylerin Akdeniz Diyetine uyumunu değerlendirmek ve bu uyumun kan parametreleri ile olan ilişkisini incelemektir. **Gereç ve Yöntem:** Bu kesitsel çalışmaya, Haziran-Eylül 2022 tarihleri arasında bir kardiyoloji polikliniğinden 30-70 yaş aralığında, KKH tanısı almış 66 birey dahil edilmiştir. Örnek homojenliğini sağlamak için kanser, böbrek hastalığı, karaciğer hastalığı gibi eşlik eden hastalıkları olan hastalar ve hamile kadınlar hariç tutulmuştur. Katılımcılar, sosyodemografik veriler, biyokimyasal parametreler, Besin Tüketim Sıklığı Anketi ve 24 saatlik diyet hatırlatmalarını içeren ayrıntılı bir anket doldurmuşlardır. Akdeniz diyetine uyum, Akdeniz Diyeti Skoru (MedDietScore) kullanılarak değerlendirilmiştir. İstatistiksel analizler SPSS programı kullanılarak, Bağımsız Örneklem T-testi, Mann-Whitney U testi, ANOVA ve korelasyon analizleri ile yapılmıştır. **Bulgular:** Ortalama Akdeniz Diyeti Skoru 32.5 ± 5.7 olup, orta düzeyde uyumu göstermektedir. Farklı uyum seviyeleri arasında LDL kolesterol ve trigliserid seviyelerinde anlamlı farklılıklar gözlenmiş olup (sırasıyla p= 0.006 ve 0.02), daha yüksek Akdeniz Diyeti Skorlarının bu lipitlerin daha düşük seviyeleri ile ilişkili olduğu bulunmuştur. Ayrıca, diyet skorları ile sistolik kan basıncı arasında orta düzeyde pozitif bir korelasyon bulunmuştur. **Sonuç:** Akdeniz diyetine orta düzeyde uyum, KKH hastalarında iyileştirilmiş lipit profilleri ile ilişkilidir. Bu bulgular, kardiyovasküler sağlık için Akdeniz diyetinin teşvik edilmesini desteklemektedir. Ancak, bu bulguları doğrulamak için, özellikle Akdeniz diyetine uyumun lipid metabolizması, inflamatuar belirteçler ve endotel fonksiyonu üzerindeki uzun vadeli etkilerine odaklanan randomize kontrollü çalışmalara ihtiyaç vardır.
Anahtar Kelimeler: Koroner Kalp Hastalığı, Akdeniz Diyeti, Lipit Profili, Kan Basıncı.

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INTRODUCTION

Cardiovascular disease (CVD) encompasses a range of disorders affecting the heart and blood vessels, including conditions such as coronary heart disease (CHD), cerebrovascular disease, peripheral artery disease, rheumatic heart disease, congenital heart disease, deep vein thrombosis, and pulmonary embolism (WHO, 2022). CHD is among the most prevalent of these conditions (CDC, 2021). It results from cholesterol deposits on the walls of the coronary arteries, which supply blood to the heart. Over time, these deposits lead to the gradual narrowing of the arteries' inner lumen. This process, known as atherosclerosis, causes the vessel walls to harden, thereby obstructing blood flow (Jebari-Benslaiman et al. S, 2022). Atherosclerosis is a key precursor to CHD and is quite common. It is characterized by an impaired endothelial structure, lipid accumulation, and plaque formation within the arterial walls (Bauersachs et al., 2019).

CVD, including CHD and stroke, is estimated to have caused approximately 18.6 million deaths in 2019, making it the leading cause of mortality globally, accounting for about 37% of deaths from non-communicable diseases. CHD is the most common form of CVD, responsible for an estimated 9 million deaths in 2017. It has consistently been a leading cause of death and is most prevalent in Central Asia and Eastern Europe (Khan et al., 2020). According to the World Health Organization (WHO) data from 2019, CHD accounts for 16% of all deaths, reinforcing its status as the most common cause of death (WHO, 2022).

The Mediterranean Diet, prevalent in Greece and Southern Italy since the late 1950s and early 1960s, has been widely recognized for its health benefits over the past five decades (Sanchez-Tainta & Sanchez-Villegas, 2018). In Turkey, studies have also highlighted the Mediterranean diet's positive impact on lipid profiles and cardiovascular risk factors. These findings confirm its effectiveness as a dietary model for improving heart health, suggesting that adherence to the Mediterranean diet can positively influence cardiovascular health in various populations, including those in Turkey (Akbulut & Gönder, 2017).

This dietary model is characterized by high consumption of fruits, vegetables, salads, whole-grain products, potatoes, legumes, oilseeds, and moderate amounts of dairy products such as yogurt and cheese. It also includes fish, shellfish, poultry, and eggs up to four times a week, with low consumption of meat and processed meats. Herbs and spices are commonly used to reduce salt and fat intake. Additionally, moderate consumption of wine and other fermented foods is recommended. The diet is low in saturated fatty acids and rich in monounsaturated and omega-3 polyunsaturated fatty acids, with olive oil as the primary fat source. The Mediterranean Diet provides various nutrients with known health benefits, including antioxidants, phytochemicals, phenolic compounds, vitamins C and E, β-carotene, glutathione, resveratrol, selenium, and folate. It has demonstrated positive effects on inflammatory conditions such as CHD, obesity, and Type 2 diabetes (Mazzocchi et al., 2019).

Balanced nutrition, regular physical activity, ideal body weight and composition, moderate alcohol consumption, and avoidance of smoking can prevent approximately 80% of heart diseases (Houston, 2018).

The aim of this study is to assess the adherence of individuals with existing coronary heart disease to the Mediterranean Diet and to evaluate its association with lipid profile.

MATERIALS AND METHODS

This study was conducted with individuals previously or recently diagnosed with coronary heart disease (CHD) who presented to the Cardiology outpatient clinic of the hospital between June 2022 and September 2022. The study included individuals between 30 and 70 years of age. Patients with cancer, kidney disease, liver disease, and pregnant women were excluded. The sample size estimation was performed using the G*Power 3.1.9.7 software, considering an effect size of 0.5 and a power of 95%. Accordingly, the required sample size was calculated to be a minimum of 54 participants. By the end of the study, 66 participants were included. Ethics Committee approval was obtained for the study (details removed for blind peer review). Participants were informed about the study and provided written consent to participate.

Participants completed a survey that included sociodemographic characteristics, biochemical parameters, a food consumption frequency questionnaire (FFQ) (portion sizes included), and a 24-hour food consumption record, all administered through face-to-face interviews (Soykan, 2007). All participants answered all questions. The biochemical parameters were obtained from routine tests requested by the hospital cardiologist, which were included in the patient's medical records. The FFQ data and 24-hour food consumption records were analyzed.

Blood pressure, triglyceride, HDL-cholesterol, LDL-cholesterol, and fasting blood glucose measurements were examined to observe differences based on participants' adherence to the Mediterranean diet.

Participants' food consumption was determined using their responses to the FFQ and 24-hour food consumption records, analyzed for energy and nutrient intake using BeBiS software. The Mediterranean Diet Score (MedDietScore), developed by Panagiotakos et al., was used to determine adherence levels (Panagiotakos et al., 2006). The 11 components of the Mediterranean diet (unrefined grains, fruits, vegetables, potatoes, legumes, olive oil, fish, meat, chicken, whole milk

products, and alcohol) were scored between 0 and 5. Higher consumption of unrefined grains, potatoes, fruits, vegetables, legumes, olive oil, fish, and alcohol was scored higher, while higher consumption of meat, chicken, and whole milk products was scored lower. The total score range was 0 to 55, with 0 indicating minimum adherence and 55 indicating maximum adherence.

Statistical analysis

Data were evaluated using the Statistical Package for the Social Sciences (SPSS) 16.0 software. Quantitative variables were expressed as mean ($\bar{X}$), standard deviation (SD), and minimum and maximum values, while qualitative variables were presented as number (n) and percentage (%). The Kolmogorov-Smirnov test was used to assess normal distribution. The Independent Samples T-test compared two independent groups with normal distribution, and the Mann-Whitney U test compared two independent groups with non-normal distribution. One-way ANOVA evaluated differences among three or more independent groups with normal distribution, and the Kruskal-Wallis test evaluated differences among three or more groups with non-normal distribution. The Pearson Correlation Test examined relationships between two numerical variables with at least one normally distributed variable, and the Spearman Correlation Test was used for non-normally distributed variables. A p-value of <0.05 was considered statistically significant.

Ethical considerations

Before the study, ethics committee approval was acquired from the Hamidiye Scientific Research Ethics Committee (Approval Number: 2022/14/8, Date: 12.05.2022).

RESULTS

The age and BMI distribution of individuals by gender is shown in Table 1. 30 women (45.5%) and 36 men (54.5%) between the ages of 30 and 70 participated in the research. The average age for men and women is 56.3±9.2 and 58.5±9.8 years, respectively. The age distribution of the two groups is similar to each other. Considering the measurements recorded in female individuals, BMI values were found to be 32.1±5.0 kg/m^2 and 29.1±4.8 kg/m^2 in male individuals. Looking at the Mediterranean diet scores, the mean value was found to be 32.6 ± 4.7 in female participants and 32.4 ± 6.5 in male participants. The mean values of both groups were similar to each other. When Mediterranean diet scores were classified as poor, moderate, and high fit, the number of moderately fit individuals was higher among both male and female participants (60.0% and 55.6%, respectively). No significant difference was found between the two genders (Table 1).

Table 1. General characteristics of individuals by gender.

	Female (n=30) x̄±SD Min-Max		Male (n=36) x̄±SD Min-Max		Total (n=66) x̄±SD Min-Max	
Age	56.3±9.2 38-69		58.5±9.8 35-70		57.5±9.5 35-70	
			p=0.29[a]			
BMI (kg/m^2)	32.1±5.0 24.3-46.1		29.1±4.8 18.5-42.5		30.5±5.1 18.5-46.1	
			p=0.02[b]			
Mediterranean diet score	32.6±4.7 23.0-39.0		32.4±6.5 20.0-48.0		32.5±5.7 20.0-48.0	
			p=0.88[b]			
	n	**%**	**n**	**%**	**n**	**%**
Mediterranean diet score classification						
Poor adherence (25 and under)	2	6.7	4	11.1	6	9.1
Moderate adherence (26-35)	18	60.0	20	55.6	38	57.6
High adherence (36 and above)	10	33.3	12	33.3	22	33.3
			p=0.87[c]			

[a]Mann Whitney U Test; [b]Independent samples T-test; [c]Fischer's Exact Test
BMI: Body Mass Index

The energy and nutrient intake of participants was examined based on their adherence levels to the diet. Individuals with low adherence had an energy intake of 2549.3±601.0 kcal, those with moderate adherence had an energy intake of 2020.1±735.9 kcal, and individuals with high adherence had an energy intake of 1862.8±429.5 kcal. The differences between the groups were statistically significant (p<0.05). Further analysis revealed that the differences were primarily observed between the low adherence and moderate adherence groups, as well as between the low adherence and high adherence groups (Table 2).

Table 2. Evaluation of energy and nutrient intake according to Mediterranean diet scores of individuals.

	Mediterranean Diet Score Classification			P	Total
	Poor adherence (n=6)	Moderate adherence (n=38)	High adherence (n=22)		
	x̄±SD Min-Max	x̄±SD Min-Max	x̄±SD Min-Max		x̄± SD Min-Max
Energy	2549.3±601.0 1885-3260	2020.1±735.9 1032-4064	1862.8±429.5 1238-2963	0.039[b†]	2015.8±655.6 1032-4064
Protein (g)	94.15±31.7 65-155	73.0±30.8 33-187	63.3±24.4 27-119	0.051[b]	71.7±29.7 27-187
Protein (%)	15.0±2.4 12-17	14.9±3.4 9-23	13.7±3.3 8-20	0.358[a]	14.5±3.3 8-23
Fat (g)	107.6±19.7 79-138	91.9±40.7 36-203	88.2±24.4 41-140	0.200[b]	92.1±34.6 36-203
Fat (%)	38.5±6.7 26-44	40.0±7.6 21-56	42.8±10.3 24-68	0.374[a]	40.8±8.5 21-68
Carbs (g)	284.0±115.0 191-506	220.8±84.4 108-464	200.0±69.6 60-407	0.148[b]	219.6±84.6 60-506
Carbs (%)	44.8±8.3 31-57	45.1±8.6 28-70	43.5±9.7 19-59	0.792[a]	44.6±8.9 19-70
Polyunsaturated fatty acid	21.9±7.2 13-31	21.3±13.3 4-58	18,3±7,6 6-36	0.599[b]	20.3±11.2 4-58
Monounsaturated fatty acid	43,5±12,6 31-65	34.4±15.2 9-77	37.1±13.9 18-82	0.169[b]	36.1±14.6 9-82
Saturated fatty acids	35.5±6.4 27-44	29.6±14.9 8-74	27.2±11.4 7-64	0.131[b]	29.5±13.3 7-74
Cholesterol	247.6±111.6 115-399	299.6±201.6 23-876	244.35±144.2 0-484	0.714[b]	276.4±177.7 0-876
Fiber	23.3±5.6 16-29	22.3±6.9 7-40	28.4±11.6 13-58	0.067[b]	24.4±9.0 7-58
Sodium	5320.6±1775.8 3614-7862	3914.5±1472.7 947-7196	4496.61±2028.7 1652-10400	0.223[b]	4326.4±1731.7 947-10400
Potassium	2414.8±474.2 1902-3089	2467.2±750.8 982-3872	2857.6±847.3 1810-4809	0.146[a]	2592.6±778.5 982-4809
Calcium	679.1±208.6 304-942	675.3±240.0 275-1296	739.3±297.9 415-1714	0.816[b]	697.0±256.4 275-1714
Magnesium	280.3±74.3 194-365	292.3±139.6 109-726	312.2±105.7 130-508	0.493[b]	297.8±123.5 109-726

[a]One Way ANOVA; [b]Kruskal-Wallis Test

[†]The significance is between the groups showing poor adherence-high adherence and poor adherence-moderate adherence (Mann Whitney U Test).

The biochemical parameters of the participants according to the Mediterranean diet scores were presented in Table 3. When the recorded values were examined, a statistically significant difference was observed between LDL cholesterol and triglyceride levels among the biochemical parameters according to the Mediterranean diet scores (p=0.006 and p=0.02, respectively). No significant difference was found in other parameters.

Looking at the groups with significant differences among the values with significant differences, a significant difference was found between the groups with moderate and those with high adherence in terms of LDL cholesterol, and between the groups with poor adherence and those with high adherence in terms of triglyceride (p=0.004 and p=0.02, respectively) (Table 3).

The correlation coefficients between the blood parameters of the participants according to the Mediterranean diet scores were presented in Table 4. According to the data obtained, a moderately positive correlation was found between the Mediterranean diet score and systolic blood pressure (r= 0.313; p= 0.01). A moderately negative correlation was found in LDL cholesterol values, and a weak negative correlation was found in triglyceride values (r= -0.320, p= 0.009, and r= -0.255, p= 0.039, respectively).

Table 3. Evaluation of biochemical parameters according to Mediterranean diet scores of individuals.

	Mediterranean Diet Score Classification				
	Poor adherence (n=6)	Moderate adherence (n=38)	High adherence (n=22)	P	Total
	x̄±SD Min-Max	x̄±SD Min-Max	x̄±SD Min-Max		x̄±SD Min-Max
Systolic blood pressure	125.7±6.3 120-135	133.2±20.5 98-178	144.9±23.7 94-188	0.06[b]	136.4±21.5 94-188
Diastolic blood pressure	75.8±7.6 68-87	81.4±13.1 37-103	83.9±15.7 55-130	0.44[a]	81.7±13.7 37-130
HDL Cholesterol	40.5±7.2 28.2-47	45.4±13.3 27.7-96.1	44±9.4 26.9-60	0.75[b]	44.5±11.6 26.9-96.1
LDL Cholesterol	121.1±36.4 79-177	128.9±40.9 48-204	93.7±36.5 30.6-172	0.006[a†]	116.5±41.9 30.6-204
Triglyceride	272.9±112.6 118-429	188.6±80.9 69-420	162±86.4 40-355	0.02[a† †]	187.4±89.5 40-429
Fasting blood glucose	127.7±35.7 84-178	117.4±29.3 81-216	122.7±37.5 90-262	0.76[b]	120.1±32.5 81-262

[a]One Way ANOVA; [b]Kruskal-Wallis Test
[†]The significance is between the groups showing moderate adherence and those with high adherence (Hochberg Test).
[† †]The significance is between the groups showing poor adherence and those with high adherence.

Table 4. Correlation of individuals' Mediterranean diet scores and biochemical parameters.

	Systolic blood pressure	Diastolic blood pressure	HDL Cholesterol	LDL Cholesterol	Triglyceride	Fasting blood glucose	Mediterranean diet score
Systolic blood pressure	[b]1.000	[b]0.662**	[b]0.210	[b]-0.220	[b]-0.092	[b]0.140	[b]0.313*
Diastolic blood pressure		[b]1.000	[b]0.222	[b]-0.022	[b]-0.170	[b]0.023	[b]0.113
HDL Cholesterol			[b]1.000	[b]0.048	[b]-0.373**	[b]-0.171	[b]0.222
LDL Cholesterol				[b]1.000	[a]0.205	[b]-0.032	[a]-0.320**
Triglyceride					b1.000	[b]0.342**	[a] -0.255*
Fasting blood glucose						[b]1.000	[b]-0.011
Mediterranean diet score							[b]1.000

[a]Pearson Correlation Test; [b]Spearman Correlation Test
*p<0.05
**p<0.01

DISCUSSION

Cardiovascular diseases are among the leading causes of death in the world. This prevalence may be attributed to various CVD risk factors, including smoking, hypertension, unhealthy nutrition, insufficient physical activity, and inadequate prevention strategies. The American Heart Association/American College of Cardiology (AHA/ACC) underscores that adopting a healthy lifestyle is the most effective way to prevent heart disease (Arnett et al., 2019). Some studies have demonstrated the positive effects of the Mediterranean diet on CVD risk factors; however, there is a lack of comprehensive studies examining its effects specifically on individuals with coronary heart disease (CHD) (Martinez-González et al., 2020).

A study investigating the relationship between different dietary models and CHD risk classified diets into the "Semi-Western model," the "Sugar-Fast Food Model," and the "Semi-Mediterranean Model." The study found a significant difference in CHD risk between the “Semi-Western model” and the “Sugar-Fast Food model,” with both increasing CHD risk in both men and women. Conversely, the "Semi-Mediterranean model" was associated with a reduced risk of CHD (Gholizadeh, Ayremlou, & Nouri Saeidlou, 2020). This aligns with findings from Martínez-González et al. (2020), who demonstrated that adherence to the Mediterranean diet is linked with a lower incidence of cardiovascular events.[13]

In a study conducted in Turkey, adherence to the Mediterranean diet was examined in 900 healthy individuals over 5.5 years, revealing an inverse

relationship between Mediterranean diet adherence and CVD risk (Hoşcan, Yiğit, & Müderrisoğlu, 2015). Similarly, Estruch et al. (2018) reported that adherence to the Mediterranean diet was associated with a reduced risk of cardiovascular events in a large cohort (Estruch et al., 2018).

In our study, which focused on individuals with CHD, the mean Mediterranean diet score was 32.5 ± 5.7, indicating moderate adherence (Table 1).

The observed energy intake in our study was 2015.8 ± 655.6 kcal per day and it has been observed that energy intake decreases as compliance with the Mediterranean diet increases. Despite these differences, there was no significant variation in fiber, saturated fat, monounsaturated fat, polyunsaturated fat, calcium, magnesium, sodium, and potassium intakes. According to the Nutrition Guide of Turkey (TUBER), recommended macronutrient distributions are 45-65% carbohydrates, 20-35% fat, and 10-20% protein (TÜBER, 2022). Our study found that carbohydrate and protein intakes were close to recommended limits, but fat intake, especially among female participants, was relatively high.

The American Heart Association recommends a sodium intake below 2400 mg and a potassium intake above 4.7 grams for individuals with CVD (Güler, Fedai, & Demirbağ, 2021). Our findings indicate that participants' average sodium intake was 4326.4 ± 1731.7 mg, and potassium intake was 2592.6 ± 778.5, both significantly deviating from these recommendations. This highlights a potential area for improvement in dietary adherence among the participants.

High cholesterol levels significantly increase the CVD risk (Karr, 2017). Our study corroborates findings from Sacks et al. (2022), which suggest that dietary fat impacts cardiovascular risk factors (Sacks, 2022). Participants with high Mediterranean diet scores exhibited lower LDL-cholesterol and triglyceride levels, consistent with Estruch et al. (2018), which demonstrated that Mediterranean diet adherence positively affects lipid profiles (Estruch, 2018).

Unexpectedly, In our study, it was observed that as adherence to the Mediterranean diet increased, systolic blood pressure also increased (Table 3 and table 4). This finding contrasts with the general trend in the literature, where the Mediterranean diet is commonly associated with beneficial effects on heart health and a reduction in blood pressure. For instance, a study by Estruch et al. (2013) demonstrated the positive effects of the Mediterranean diet on cardiovascular disease and hypertension. Similarly, Martínez-González et al. (2019) noted that adherence to the Mediterranean diet improved cardiovascular health and regulated blood pressure.

However, some studies have reported different findings. Cross-sectional studies, in particular, may struggle to reflect the varying effects of the diet among individuals. Such studies should consider other factors, such as genetic predispositions, existing health conditions, medication use, and lifestyle variables (Trichopoulou et al., 2009). Therefore, the difficulty in establishing causal relationships in cross-sectional studies can complicate the accurate interpretation of the diet's effects on blood pressure.

Moreover, some research suggests that the Mediterranean diet may increase blood pressure in individuals sensitive to high sodium intake (Panza et al., 2017). This could be linked to the high consumption of olive oil and unprocessed foods in the diet, although individual metabolic responses and existing health conditions can shape this relationship differently.

In conclusion, the findings of our study suggest that further research is needed to more deeply investigate the relationship between adherence to the Mediterranean diet and systolic blood pressure. Specifically, more data is needed to explore the long-term effects of the diet and how individual factors influence this relationship. Future research should comprehensively examine the interactions between diet and blood pressure while considering various genetic, biochemical, and lifestyle factors.

The Mediterranean diet has been shown to reduce blood pressure, LDL cholesterol, and triglyceride levels while increasing HDL cholesterol (Gholizadeh, Ayremlou, & Nouri Saeidlou, 2020). It has been reported that a 2-point increase in the Mediterranean diet score is associated with a 33% decrease in deaths related to CVD (Trichopoulou et al., 2003). Studies have provided evidence that high adherence to the Mediterranean diet may help reduce inflammation, which plays a role in the development of atherosclerosis and CVD (Giugliano et al., 2006 & Mena et al., 2009). The PREDIMED study further supports these findings, showing that a Mediterranean diet improves blood pressure, insulin sensitivity, and lipid profiles (Ros et al., 2014).

In our study, LDL-cholesterol and triglyceride levels were significantly lower among those with high Mediterranean diet scores. The lower LDL-cholesterol levels in individuals with poor adherence compared to those with moderate adherence could be attributed to the small number of poor adherents, suggesting that results may differ with a larger sample size. We observed a moderately negative correlation between the Mediterranean diet and LDL-cholesterol, and a weak negative correlation with triglycerides (Table 4). High fasting blood glucose and triglyceride levels were also noted, consistent with the view that elevated blood sugar and triglyceride levels increase CVD risk (Mente et al., 2021).

In our study, the sample included both newly diagnosed and long-term patients, which may have influenced the distribution of adherence levels to the Mediterranean diet. Specifically, the number of participants with high adherence was higher, while those with low adherence were fewer. This uneven distribution could be a result of patients with longer

disease duration being more accustomed to following dietary recommendations. Future studies with more balanced distributions of adherence levels might provide a clearer understanding of the relationship between diet adherence and cardiovascular health outcomes.

This study has several limitations. Data were collected from a single center, and the cross-sectional design prevents causal inferences. Multicenter studies with larger populations are needed to validate these findings and explore the long-term effects of Mediterranean diet adherence.

CONCLUSION

This study highlights the potential benefits of adhering to the Mediterranean diet for individuals with coronary heart disease (CHD). Our findings suggest that moderate adherence to this diet improves lipid profiles, particularly by lowering LDL cholesterol and triglyceride levels. However, the observed increase in systolic blood pressure among high adherents points to the need for further investigation into the underlying factors influencing this outcome.

Despite the limitations of a single-center, cross-sectional design, this study offers valuable insights into dietary patterns of CHD patients and their associations with key blood parameters. It underscores the importance of dietary interventions in managing cardiovascular risk factors. Health professionals should incorporate Mediterranean diet recommendations into clinical practice. Public health policies can further promote this diet through awareness campaigns, healthy school and workplace nutrition programs, and economic incentives such as subsidies for Mediterranean diet-friendly foods. These efforts, particularly those aimed at increasing access to healthy foods, could significantly contribute to reducing the global burden of cardiovascular diseases. Future studies should explore the long-term effects of Mediterranean diet adherence and address the factors contributing to the observed rise in systolic blood pressure, on the other hand, large-scale and multicentered trials will enhance the generalizability of these findings and offer more specific guidance for health professionals.

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Conflict of Interest
The author declare no potential conflicts of interest with respect to the research, authorship and/or publication of this article.

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Comparison of Clinical Effects of Propofol-Sevoflurane, Midazolam-Sevoflurane and Medetomidine-Ketamine-Sevoflurane Anesthesia in Rabbits

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Abstract
Objective: This study aimed to compare the clinical effects of propofol-sevoflurane (PS), midazolam-sevoflurane (MS), and medetomidine-ketamine-sevoflurane (MKS) anesthesia protocols in rabbits and to propose a safe and controlled alternative inhalation anesthesia technique using the endotracheal intubation method. **Materials and Methods:** The study was conducted on 30 white New Zealand rabbits (5 females and 5 males randomly selected per group) divided into three groups. In the PS group, propofol 7 mg/kg IV was administered; in the MS group, midazolam 0.3 mg/kg IM; and in the MKS group, medetomidine 0.3 mg/kg IM followed by ketamine 30 mg/kg IM. Subsequently, all groups received sevoflurane at 4% with 500 ml/kg/min oxygen. In all groups, anesthesia induction time, chewing reflex time (extubation time), righting reflex time, heart rate, respiratory rate, body temperature, and peripheral arterial hemoglobin saturation were determined. **Results:** During anesthesia, decreases in heart rate and body temperature were observed in all groups. Respiratory rate decreased during the first 30 minutes of anesthesia but increased again after the 45th minute. **Conclusion:** For both clinical and experimental procedures in rabbits, the propofol-sevoflurane combination is considered appropriate for less painful and short-term interventions, while the medetomidine-ketamine-sevoflurane combination is recommended for highly painful and long-term procedures.
Keywords: Rabbit, Anesthesia, Propofol, Midazolam, Sevoflurane.

Tavşanlarda Propofol-Sevofluran, Midazolam-Sevofluran ve Medetomidin-Ketamin-Sevofluran Anestezisinin Klinik Etkilerinin Karşılaştırılması

Öz
Amaç: Bu çalışmanın amacı, tavşanlarda propofol-sevofluran (PS), midazolam-sevofluran (MS) ve medetomidin-ketamin-sevofluran (MKS) anestezi protokollerinin tavşanlardaki klinik etkilerini karşılaştırmak ve tavşanlarda endotrakeal entübasyon tekniği ile güvenli ve kontrollü alternatif inhalasyon anestezisi tekniği önermektir. **Gereç ve Yöntem:** Çalışma, her bir grupta rastgele seçilen 5'i dişi, 5'i erkek 10 adet beyaz renkli Yeni Zelanda ırkı 30 adet tavşanda 3 grupta yapıldı. PS grubunda propofol 7 mg/kg IV, MS grubunda midazolam 0.3 mg/kg IM, MKS grubunda medetomidin 0.3 mg/kg IM ve ketamin 30 mg/kg IM uygulandı. Takiben tüm gruplarda tavşanlara sevofluran %4 olarak 500 ml/kg/dk oksijen ile uygulandı. Bütün gruplarda; anestezi indüksiyon süresi, çiğneme refleksi zamanı (ekstübasyon zamanı), doğrulma refleksi zamanı, dakikadaki kalp atım sayısı, solunum sayısı, vücut ısısı ve periferik arteriyel hemoglobin satürasyonu belirlendi. **Bulgular:** Çalışmadaki tüm gruplarda oluşan anestezi süresince kalp atım sayısı ve vücut ısısında düşüşler gözlendi. Solunum sayısında anestezinin ilk 30 dakikasında düşüşler gözlendi. Ancak, 45. dakikadan sonra tekrar yükseldi. **Sonuç:** Tavşanlarda yapılacak olan gerek deneysel gerekse klinik cerrahi uygulamalarda; az ağrılı ve kısa süreli girişimlerde propofol-sevofluran kombinasyonunun; çok ağrılı ve uzun süreli girişimlerde ise medetomidin-ketamin-sevofluran kombinasyonunun kullanılmasının uygun olacağı kanaatine varıldı.
Anahtar Kelimeler: Tavşan, Anestezi, Propofol, Midazolam, Sevofluran.

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INTRODUCTION

Rabbits are among the most suitable animal models for pharmacology, toxicology, surgery, and genetic research due to their advantageous characteristics, including docility, ease of handling, straightforward care and feeding requirements, and large ear veins (Cruz et al., 2010). Despite the availability of numerous safe anesthetic options for clinical procedures in rabbits, their mortality and morbidity rates remain higher compared to cats and dogs. This can be attributed primarily to species-specific physiological traits that render rabbits prone to respiratory depression, their small anatomical structures, the narrow margin between anesthetic and toxic doses, and their sensitivity to stress during the preoperative period (Borkowski & Karas, 1999).

While low-complication anesthesia protocols are commonly used for research purposes, clinical cases in rabbits are often associated with a high incidence of anesthesia-related complications and mortality. Contributing factors to this elevated mortality rate include the frequent use of short-term general anesthesia in scientific studies, the lack of species-specific anesthesia protocols, clinicians' limited familiarity with rabbits, and the poor health condition of rabbits presenting to clinics (Hall et al., 2001; Kim et al., 2004).

Both injectable and inhalation anesthetic methods are utilized for rabbits. While inhalation anesthetics are commonly used as the sole anesthetic in smaller guinea pigs, injectable agents are often combined with inhalation anesthesia in rabbits and larger guinea pigs. In rabbits, short-term general anesthesia can be safely administered with injectable anesthetic drugs, either alone or in combination with sedatives, tranquilizers, and analgesics. Anesthetic combinations, particularly xylazine/ketamine, were widely used in the past. However, research has demonstrated that these combinations often lack adequate analgesic properties for major surgical procedures and frequently cause significant hypotension, increasing the risk of mortality. Therefore, in cases where a combination of injectable anesthetic drugs and sedatives is necessary, each selected drug must fulfill one of the balanced anesthesia criteria: narcosis, analgesia, or muscle relaxation (Hall et al., 2001; Henke et al., 2005).

This study aims to compare the clinical effects of three anesthesia protocols: propofol-sevoflurane, midazolam-sevoflurane, and medetomidine-ketamine-sevoflurane in rabbits, and to recommend a safe and controlled alternative inhalation anesthesia technique using the endotracheal intubation.

MATERIALS AND METHODS

Study group

In this study, 30 New Zealand White rabbits (15 females and 15 males), aged 1–3 years and weighing 1.5–3 kg, were randomly divided into three groups, 10 each containing five females and five males.

Procedures

In the Propofol-Sevoflurane (PS) group, rabbits received propofol (Propofol 1% Fresenius, Fresenius Kabi, Germany) at 7 mg/kg intravenously, administered as half the dose rapidly and the remainder over 30 seconds, followed by sevoflurane (Sevoflurane, Baxter, Türkiye) at 4% with an oxygen flow rate of 500 ml/kg/min. In the Midazolam-Sevoflurane (MS) group, rabbits were administered midazolam (Demizolam, Delta Select GmbH, Germany) intramuscularly at 0.3 mg/kg, followed by sevoflurane at the same concentration and oxygen flow rate. In the Medetomidine-Ketamine-Sevoflurane (MKS) group, medetomidine (Domitor, Pfizer, Germany) at 0.3 mg/kg was given intramuscularly, followed by ketamine (Alfamine, Alfasan, Nederland) at 30 mg/kg three minutes later, and then sevoflurane as described for the other groups. In all groups, anesthesia was maintained for 30 minutes using an anesthesia machine (TMS, Maxi 2200, Türkiye) with a size 2.5 cuffed endotracheal tube and a Magill-type non-rebreathing circuit. The rabbits were disconnected from the device at the end of the 30 minutes.

Monitoring

In all groups, various parameters were evaluated to assess the effects of the anesthesia protocols. These included the anesthesia induction time, defined as the time from sevoflurane application until the rabbit lay on its side; the time to loss of response to pain and reflex tests; the chewing reflex time (extubating time), which measured the time from the cessation of sevoflurane until chewing movements resumed after 30 minutes of inhalation anesthesia; and the righting reflex time, representing the time required for the rabbit, placed on its back after discontinuation of sevoflurane, to stand on all four legs. The quality of anesthesia induction, surgical anesthesia, analgesia and emergence from anesthesia were subjectively evaluated by modified criteria from a previous study by Allweiler et al. (2010) with scores assigned as excellent (3 points), good (2 points), or poor (1 point) (Table 1). Pain and reflex tests—such as pricking, needle pricks, and pinching with toothed hemostatic forceps—were applied to the pinna and interdigital regions of the fore and hind legs every 10 minutes during the 30-minute anesthesia period and at 15, 30, 60, and 90 minutes after anesthesia to assess surgical anesthesia quality and duration. Intubation quality was similarly scored based on the number of attempts and time taken (<2 attempts and <2 minutes for good, <4 attempts and <5 minutes for mediocre, >4 attempts and >5 minutes for poor), using modified criteria from Allweiler et al. (2010). The number of attempts determined the intubation ease and whether direct visualization via an laryngoscope was required.

To evaluate the cardiopulmonary effects of the anesthetic combinations, cardiopulmonary parameters and body temperature were recorded before anesthesia,

every 10 minutes during the 30-minute anesthesia period, and at 15-, 30-, 60-, and 90-minute post-anesthesia. Heart rate was measured with a stethoscope, while the respiratory rate was determined by observing costo-abdominal movements and body temperature with a thermometer, and peripheral arterial hemoglobin oxygen saturation (SpO_2) was recorded using a pulse oximeter (G9000F, Cardel) with probe placed on the shaved tail root. Additional physiological changes and complications such as apnea, apneustic breathing, salivation, anorexia, and laryngospasm were also documented during the trials and up to 24 hours afterward.

Statistical analysis

The data were presented as mean ± standard deviation (Mean±SD). For analyzing cardiopulmonary parameters and body temperature, two-way analysis of variance (Two-Way ANOVA) was employed for intragroup (repeated measures) comparisons. In contrast, one-way analysis of variance (One-Way ANOVA) was used for intergroup comparisons at the same time points. The nonparametric Mann-Whitney U test was also applied to evaluate clinical anesthesia parameters. A p-value of ≤ 0.05 was considered statistically significant. Statistical analyses were conducted using the Minitab v.11.0 software.

Ethical considerations

The study was conducted with the approval of the Erciyes University Animal Experiments Local Ethics Committee (Date: 15.02.2017, Approval No: 17/019).

RESULTS

The anesthetic combinations of propofol-sevoflurane (Group I, PS), midazolam-sevoflurane (Group II, MS), and medetomidine-ketamine-sevoflurane (Group III, MKS), administered at the specified doses, were all effective in producing safe general anesthesia. The protocols provided relatively good muscle relaxation and analgesia without causing any mortality.

Table 1. Evaluation criteria for the quality of anesthesia induction, the quality of surgical anesthesia and analgesia, the quality of emergence, and ease of intubation.

Excellent=3 points	Good=2 points	Poor=1 points
Induction Quality		
He quickly came to sternal position or lay on his side. No excitation. Good muscle relaxation. No response to pain and reflex tests.	Induction prolonged. Mild excitation. Attempts to get up after lying on the side. Poor muscle relaxation. Mild response to pain and reflex tests.	Induction is too long. Marked excitation. Did not lie on the side. Weak muscle relaxation. Vocalized. Marked response to pain tests.
Quality of Surgical Anesthesia and Analgesia		
No response to pain and reflex stimuli.	Light response to pain and reflex stimuli. Slight head movement. Slight foot movement.	Clear response to pain stimuli. Clear movements entire the body. Chewing movements are present. The jaw tone is not completely lost.
Quality of Waking Up		
Recovery of the righting reflex is fast. Able to walk with slight ataxia.	Recovery of the righting reflex is slow. Ataxia is evident when standing and walking. Mild excitation.	Recovery of the righting reflex is very slow. Unable to stand. Struggling and flailing on the ground are significant and prolonged. Marked excitation.
Ease/Comfort of Intubation		
< 2 attempts, time < 2 minutes	< 4 attempts, time < 5 minutes	> 4 attempts, time > 5 minutes

The cardiopulmonary effects of Groups I, II and III are detailed in Table 2, while the clinical anesthesia effects are summarized in Table 3. Heart rate showed statistically significant decreases ($p<0.05$) compared to the initial value at all sampling times following anesthesia induction in all groups. When comparing heart rates between groups, Group III exhibited statistically significantly lower values ($p<0.05$) than Groups I and II across all sampling times.

In terms of respiratory rate, statistically significant decreases ($p<0.05$) were observed during the anesthesia period (10, 20, and 30 minutes) compared to the initial value in all groups. After the rabbits were disconnected from the anesthesia device, respiratory rate increased significantly ($p<0.05$) in all groups at subsequent sampling times. Between-group comparisons revealed that Group III had significantly lower respiratory rates ($p<0.05$) than Groups I and II at all sampling times. Additionally, while respiratory rates in Groups I and II exceeded their respective initial values at 60, 90, and 120 minutes, the respiratory rate in Group III remained below the initial value at these time points.

In all groups, statistically significant decreases in body temperature ($p<0.05$) were observed during the first 60 minutes of anesthesia compared to the initial values. However, body temperature increased after the 60th minute in all groups ($p<0.05$), though it remained lower than the initial values. Between-group comparisons showed that Group I exhibited statistically significantly lower body temperature values ($p<0.05$) than the other groups at the 10th, 20th, 30th, and 45th minutes. Despite increases in body temperature at the 60th, 90th, and 120th minutes in all groups, it remained below the initial (control) values, and the differences in body temperature between the groups at these later time points were statistically insignificant.

Peripheral arterial hemoglobin oxygen saturation (SpO_2) showed a statistically significant increase ($p<0.05$) compared to the initial values during the anesthesia period across all groups. After oxygen administration ceased and the rabbits were disconnected from the anesthesia device, SpO_2 values decreased in all groups compared to the initial values. At the 120th minute, SpO_2 in Groups I and II remained slightly below the initial value, while in Group III, it was higher than the initial (control) value. Group III exhibited significantly lower SpO_2 values ($p<0.05$) in between-group comparisons than the other groups, particularly at the 20th, 30th, 45th, and 60th minutes. However, the SpO_2 of Group III increased after the 45th minute, returning to levels comparable to the initial value by the 120th minute..

Table 2. Mean values of heart rate, respiratory rate, body temperature, pulse oximetry measurements and surgical anesthesia/analgesia quality of the groups (Mean±SD).

	Control	10. min	20. min	30. min	45. min[1]	60. min[2]	90. min[3]
Heart Rate (/min)							
Group I	310.3±15.7^{x,a}	279.9±32.1^{x,b}	267.9±29.6^{x,b}	262.0±31.9^{x,b}	231.1±25.4^{x,c}	231.0±19.8^{x,c}	217.1±29.7^{x,c}
Group II	308.8±18.9^{x,a}	262.7±38.3^{x,b}	252.7±38.4^{x,bc}	244.2±41.5^{x,bc}	233.7±29.2^{x,bc}	229.6±38.3^{x,bc}	221.4±49.6^{x,c}
Group III	299.5±11.8^{x,a}	200.2±13.6^{y,b}	193.1±15.2^{y,bc}	187.7±13.6^{y,bc}	178.7±21.3^{y,c}	174.3±19.5^{y,c}	168.1±17.3^{y,c}
Respiratory Rate (/min)							
Group I	68.4±19.8^{x,a}	37.6±7.4^{x,b}	38.0±7.4^{x,b}	39.4±6.8^{x,b}	60.4±22.8^{x,a}	84.0±22.4^{x,ac}	96.0±18.7 ^{x,c}
Group II	73.1±10.2^{x,a}	38.0±7.4^{xy,bc}	35.2±8.2^{x,b}	33.6±7.6^{x,b}	51.6±19.4^{x,c}	74.0±19.1 ^{xy,a}	82.4±17.1^{xy,ad}
Group III	68.2±11.3^{x,a}	27.2±14.9^{y,b}	23.2±11.4^{y,b}	23.6±10.4^{y,b}	48.0±12.1^{x,c}	56.8±10.8^{y,ac}	64.4±23.9 ^{y,ac}
Body Temperature (°C)							
Group I	39.8±0.2 ^{x,a}	38.3±0.4 ^{x,b}	38.0±0.5 ^{x,bc}	37.6±0.5 ^{x,c}	37.4±0.6 ^{x,c}	37.7±0.9 ^{x,c}	38.2±0.5 ^{x,b}
Group II	39.8±0.2 ^{x,a}	38.7±0.6 ^{xy,b}	38.2±0.4 ^{y,b}	37.9±0.6 ^{y,c}	37.7±0.8 ^{xy,c}	37.7±0.6 ^{x,c}	38.1±0.9 ^{x,bc}
Group III	39.7±0.3 ^{x,a}	39.0±0.7 ^{y,b}	38.9±0.7 ^{y,bc}	38,8±0.7 ^{y,bc}	38.3±0.8 ^{y,c}	38,3±0.8 ^{x,c}	38.2±0.9 ^{x,c}
Peripheral Arterial Hemoglobin Oxygen Saturation (SpO_2) (%)							
Group I	96.9±1.5 ^{x,a}	98.6±0.5 ^{x,b}	98.6±0.7 ^{x,b}	98.6±0.7 ^{x,b}	97.7±1.1 ^{x,ab}	97.3±1.4 ^{x,ab}	97.3±1.8 ^{x,ab}
Group II	95.2±2.4 ^{xy,a}	98.2±1.1 ^{x,ab}	98.3±0.7 ^{xy,b}	98.6±1.0 ^{x,b}	96.1±3.0 ^{x,ab}	94.9±3.4 ^{xy,a}	94.3±3.2 ^{xy,a}
Group III	94.8±1.6 ^{y,a}	97.9±1.4 ^{x,b}	96.2±3.6 ^{y,ab}	96.0±4.6 ^{x,ab}	90.4±4.1 ^{y,c}	92.8±2.0 ^{y,ac}	95.7±1.8 ^{y,ab}
Surgical Anesthesia/Analgesia Quality*							
Group I	-	2.30±0.5 ^{x,a}	2.10±0.3 ^{x,ab}	1.90±0.3 ^{x,b}	1.90±0.3 ^{x,b}	1.50±0.5 ^{x,c}	1.10±0.3 ^{x,d}
Group II	-	2.20±0.4 ^{x,a}	2.10±0.3 ^{x,a}	1.9±0.3 ^{x,a}	1.9±0.3 ^{x,a}	1.40±0.5 ^{x,b}	1.10±0.3 ^{x,bc}
Group III	-	2.90±0.3 ^{y,a}	2.90±0.3 ^{y,a}	2.90±0.3 ^{y,a}	2.70±0.5 ^{y,ab}	2.30±0.7 ^{y,b}	1.4±0.5 ^{x,c}

The difference between means with different letters in the same row (a,b,c,d) and column (x,y) is statistically significant ($p<0.05$).
Group I: Propofol-Sevoflurane (PS), Group II: Midazolam-Sevoflurane (MS), Group III: Medetomidine-Ketamine-Sevoflurane (MKS).
[1] The 15th, [2] 30th and [3] 60th minute after 30 minutes of sevoflurane application.
* Evaluated according to the criteria in Table 1.

Surgical anesthesia and analgesia quality were significantly better ($p<0.05$) in Group III compared to Groups I and II. Still, no statistically significant differences were observed at the 90th and 120th minutes. Within-group comparisons showed a statistically significant decline in surgical anesthesia/analgesia quality over time in all groups. Group I had the shortest time for anesthesia induction, followed by Groups III and II, with statistically significant differences ($p<0.05$). Regarding anesthesia induction quality, Group II was significantly weak ($p<0.05$). Similarly, Group II showed significantly weaker ($p<0.05$) intubation ease than Groups I and III.

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Chewing reflex onset (extubation) time was significantly earlier ($p<0.05$) in Group I compared to the other groups. The righting reflex duration was considerably longer ($p<0.05$) in Group III than in Groups I and II. Arousal quality was significantly weaker ($p<0.05$) in Group III compared to the other groups. The mucous membrane color remained normal in all rabbits, with no signs of cyanosis observed during anesthesia. Furthermore, no significant complications occurred during or after anesthesia induction, such as apnea or apneustic breathing. No mortality or complications were observed during the 24-h post-anesthesia observation period.

Table 3. Mean clinical anesthesia evaluation parameters values for the groups (Mean±SD).

Parameter	Group I	Group II	Group III
Anesthesia induction time (min)	1.5±0.45 ^{x}	4.06±0.83 ^{y}	2.81±0.40 ^{z}
Anesthesia sedation/induction quality	2.2±0.52 ^{x}	1.50±0.52 ^{y}	2.70±0.48 ^{x}
Ease of intubation	2.10±0.56 ^{x}	1.10±0.31 ^{y}	2.70±0.48 ^{x}
Chewing reflex onset time (Extubating time) (min)	38,70±3.12 ^{x}	52.40±13.48 ^{xy}	65.20±20.64 ^{y}
Righting reflex time (min)	41.40±4.43 ^{x}	51.80±9.38 ^{x}	119.90±15.61 ^{y}
Awakening quality	2.90±0.31 ^{x}	2.60±0.51 ^{x}	1.30±0.48 ^{y}

DISCUSSION

Safe and effective rabbit anesthesia is crucial in experimental studies and clinical applications. Inhalation anesthesia is considered the safest method for achieving balanced and controlled anesthesia, particularly in long-term procedures. Injectable induction agents play a critical role by facilitating endotracheal intubation through easy mouth opening and suppressing the pharyngolaryngeal reflex (Alexander & Clark, 1980). In this study, all anesthetic combinations provided sufficient muscle relaxation and suppression of the pharyngolaryngeal reflex, enabling successful endotracheal intubation. Sevoflurane, a widely recognized anesthetic agent for rabbits, has been reported as safe at concentrations of 3.7% to 4% (Takeda et al., 2000; Taoda et al., 2000; Weinstein et al., 2000). Consistent with the literature, sevoflurane was administered at 4% in this study and was found to be a safe and effective anesthetic agent. Heart rate showed significant decreases in all groups following the induction of anesthesia. It has been reported that propofol, midazolam, and medetomidine cause decreases in heart rate (Cruz et al., 2010; Henke et al., 2005; Kilic, 2004; Mazaheri-Khameneh et al., 2012; Rózańska, 2009). Conversely, sevoflurane and ketamine have been reported to increase heart rate due to their sympathomimetic effects (Mutoh et al., 2001; Sanford & Colby, 1980). Consistent with the literature, the observed decrease in heart rate across all groups in this study was attributed to the dominant depressive effects of propofol, midazolam, and medetomidine on the heart. When comparing groups, Group III exhibited significantly lower heart rate values than Groups I and II after anesthesia induction. The notably lower heart rate in Group III is in line with previous literature (Grint & Murison, 2008; Henke et al., 2005; Rózańska, 2009) and was associated with the dominant parasympathetic effects of medetomidine on the cardiovascular system.

Respiratory rate showed statistically significant decreases in all groups during the anesthesia period compared to baseline values, while increases were observed during the sampling times after the rabbits were disconnected from the anesthesia device. Similar to findings in the literature (Kati et al., 2003), these decreases were attributed to the depressive effects of sevoflurane on the respiratory system and the impact of catecholamines released in response to anesthesia-induced stress in rabbits. The increases in respiratory rate were associated with partial hypoxemia compensation, where stimulation of the respiratory center in the central nervous system led to rapid, shallow, and irregular breathing patterns (Hall et al., 2001). In comparisons between groups, Group III exhibited significantly lower respiratory rates at all sampling times than the other groups. This lower respiratory rate in Group III was attributed to medetomidine's pronounced respiratory depressant effects (Erol et al., 2021; Kilic, 2004; Kim et al., 2004).

General anesthesia disrupts thermoregulation in the central nervous system by inhibiting vasoconstriction and decreasing body temperature (Hall et al., 2001; Wenger, 2012). Studies on general anesthesia in rabbits have reported reductions in body temperature, attributed to impaired thermoregulation, decreased muscle activity, and reduced metabolism during anesthesia (Amarpal et al., 2014; Purohit et al., 2008). Consistent with the literature, the present study observed decreases in body temperature in all groups during the first 60 minutes of anesthesia, followed by increases after the 60th minute. However, body temperature remained below baseline values. Between-group comparisons revealed that Group I had significantly lower body temperatures than the other groups. This was attributed to propofol-induced respiratory depression, which can lead to hypotension, hypoxemia, hypercapnia, bradycardia, respiratory acidosis, and lipemia, all of which contribute to hypothermia (Brammer et al., 1993; Fujii et al., 1999; Mama et al., 1995).

Peripheral arterial hemoglobin oxygen saturation (SpO_2) increased during the anesthesia period. However, after the rabbits were disconnected from the anesthesia device, SpO_2 values decreased across all groups. This observation aligns with the literature (Hall et al., 2001), which indicates that the administration of pure oxygen via the anesthesia device leads to increased peripheral arterial hemoglobin oxygen saturation, while its cessation results in a subsequent decrease. Comparisons between groups revealed that SpO_2 levels in Group III were lower than in the other groups. This was attributed to the depressive effects of medetomidine on the respiratory system.

In order to evaluate the quality of surgical anesthesia and analgesia, no surgical procedures were

performed; instead, anesthesia depth and analgesia quality were assessed based on responses to reflex tests and pain stimuli. The results indicated that Group III demonstrated better anesthesia and analgesia quality than Groups I and II. Propofol is a short-acting, potent hypnotic agent with weak analgesic properties (Henke et al., 2005; Kilic, 2004; Orr et al., 2005). When used at high doses (1–2 mg/kg), midazolam provides excellent muscle relaxation and sedative-hypnotic effects in rabbits (Suckow et al., 2011). In this study, a 0.3 mg/kg midazolam dose was used. Studies on medetomidine and ketamine combinations in various animal species have demonstrated effective surgical anesthesia and analgesia quality (Grint & Murison, 2008; Kästner et al., 2006; Kim et al., 2004). The preference for a low dose of midazolam and the insufficient effects of propofol, consistent with findings in the literature, support the observed results.

The anesthesia sedation/induction duration was observed to be shortest in Group I, followed by Group III and then II. However, regarding quality, the groups were ranked from best to weakest, with Group III, I, and II being the weakest. Propofol, known for its high lipid solubility and rapid onset of action, is a hypnotic agent that induces anesthesia quickly (Allweiler et al., 2010; Campos et al., 2016). Consistent with the literature, Group I showed the shortest induction duration. When both the sedation/induction duration and quality were considered, the significantly lower performance of Group II was attributed to insufficient muscle relaxation at the midazolam dose (0.3 mg/kg) used in this study.

In comparisons of chewing reflex onset time (extubation time) and righting reflex duration between groups, the shortest times were observed in Group I, followed by Group II and then III. Parameters such as chewing reflex onset time, extubation time, and righting reflex duration are considered indicators of good recovery quality in rabbit anesthesia when these durations are shorter (Henke et al., 2005; Wenger, 2012). Regarding recovery quality, the best performance was observed in Group I, followed by Group II, and then III. These findings are consistent with those reported in the literature.

CONCLUSION

None of the anesthesia combinations caused severe complications or mortality. However, relative advantages were identified among the combinations. It was observed that midazolam alone, at the specified doses, was not suitable for achieving smooth and easy intubation. In this context, for both clinical and experimental procedures in rabbits, the propofol-sevoflurane combination is recommended for less painful and short-term interventions. In contrast, the medetomidine-ketamine-sevoflurane combination is more appropriate for more painful and long-term procedures.

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Conflict of Interest
The authors declare no potential conflicts of interest with respect to the research, authorship and/or publication of this article.

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Effects of Climate Changes on Anxiety and Quality of Life in Pregnant Women

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ABSTRACT
Objective: This study aims to examine the effects of climate change on anxiety levels and quality of life among pregnant women. **Materials and Methods:** This descriptive and relational study was conducted with 313 pregnant women who voluntarily agreed to participate and met the inclusion criteria. The study population included pregnant women over 18 who applied to a university hospital. Data were collected using a Pregnancy Diagnosis Form, Climate Change Anxiety Scale (CCAS), and Quality of Life Pregnancy Scale (QLPS). In addition to descriptive statistics, independent groups t test, one-way ANOVA, Pearson correlation analysis and simple linear regression analysis were used to evaluate the data. **Results:** The average age of the 313 pregnant women who participated in the study was 28, with 45% having a university degree or higher and 71.9% not working. It was observed that as the education level of the participants increased, their climate change anxiety scores also increased. A statistically significant and positive correlation was found between the CCAS and the QLPS ($p<0.05$). **Conclusion:** There was a significant relationship between pregnant women's their views on climate change and quality of life during pregnancy. It was found that as climate change anxiety increased, so did the quality of life. Midwives and all other healthcare professionals working in the field should be aware of the effects of climate change on pregnant women, children, and women and develop solutions to raise awareness in society.
Keywords: Climate Change, Pregnancy, Anxiety, Quality of Life.

İklim Değişikliklerinin Gebelerde Kaygı ve Yaşam Kalitesi Üzerine Etkileri

ÖZ
Amaç: Bu araştırmanın amacı, iklim değişikliklerinin gebelerdeki kaygı düzeyi ve yaşam kalitesi üzerindeki etkilerini incelemektir. **Gereç ve Yöntem:** Tanımlayıcı ve ilişkisel nitelikteki bu çalışmanın evrenini, bir üniversite hastanesine başvuran 18 yaş ve üzeri gebe kadınlar oluşturmuştur. Araştırmanın örneklemi, çalışmaya katılmayı gönüllü olarak kabul eden ve dahil edilme kriterlerini sağlayan 313 gebe kadından oluşmaktadır. Veriler, Gebe Tanılama Formu, İklim Değişikliği Kaygı Ölçeği (İDKÖ) ve Gebelikte Yaşam Kalitesi Ölçeği (GYKÖ) kullanılarak toplanmıştır. Verilerin değerlendirilmesinde tanımlayıcı istatistiklerin yanı sıra, bağımsız gruplarda t testi, tek yönlü ANOVA, Pearson korelasyon analizi ve basit doğrusal regresyon analizi kullanılmıştır. **Bulgular:** Araştırmaya katılan 313 gebenin yaş ortalaması 28 olup, %45'inin üniversite ve üzeri mezun olduğu, %71.9'unun herhangi bir işte çalışmadığı belirlenmiştir. Gebenin eğitim düzeyinin artması ile iklim değişikliği kaygı düzeyi puanlarının arttığı gözlemlenmiştir. İDKÖ ile GYKÖ arasında istatistiksel olarak anlamlı ve pozitif bir ilişki bulunmuştur ($p<0.05$). **Sonuç:** Gebe kadınların iklim değişikliğine ilişkin görüşleri ile gebelikteki yaşam kalitesi arasında anlamlı bir ilişki bulunmuştur. Araştırmaya katılan gebelerde iklim değişikliği kaygısı arttıkça yaşam kalitesinin de arttığı sonucuna ulaşılmıştır. Sahada aktif görev alan ebeler ve diğer sağlık profesyonellerinin, toplumu bilinçlendirebilmek adına iklim değişikliğinin gebeler, çocuklar ve kadınlar üzerindeki etkilerini bilmeleri ve çözüm yolları geliştirmeleri önemlidir.
Anahtar Kelimeler: İklim Değişikliği, Gebelik, Kaygı, Yaşam Kalitesi.

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INTRODUCTION

Climate change refers to long-term alterations in the average weather conditions, directly or indirectly influenced by human activities (Hacısalihoğlu & Balcı, 2023; Öztürk & Dönmez, 2023). Humanity has been facing the effects of climate change for many years. The acceleration of industrialization, technological advancements, population growth, deforestation, urbanization, and environmental pollution have all contributed to the problem of global climate change. Due to the influence of geographical factors, the temperature distribution is not uniform across the Earth's surface (Çeçen & Güvenç, 2022). Furthermore, one of the primary causes of climate change is the increased concentration of greenhouse gases in the atmosphere as a result of the burning of fossil fuels by humans (Hacısalihoğlu & Balcı, 2023; WHO, 2024; UNEP, 2024). Over time, the effects of global warming and climate change negatively impact the health and lives of many living beings on Earth, particularly humans (Çeçen & Güvenç, 2022). The World Health Organization (WHO, 2024) defines climate change as a significant global issue that severely threatens human health and life. Climate change, which leads to profound long-term effects, has begun to manifest its impacts noticeably today (Hacısalihoğlu & Balcı, 2023). Global warming and climate change constitute a fundamental threat affecting the lives of all living beings on Earth, particularly human health and the future of the planet (Çeçen & Güvenç, 2022). Furthermore, climate change exerts comprehensive impacts on both natural and human systems, including the physical environment, social and economic conditions, and the functioning of healthcare systems (WHO, 2024).

Climate change predominantly affects pregnant women, children, people with low incomes, the elderly, migrants, and individuals with chronic illnesses. Global warming and climate change can lead to outbreaks of infectious diseases, respiratory disorders, cardiovascular conditions, maternal and infant mortality, and psychological illnesses (CDC, 2024). A review of the literature reveals that Borroni et al. (2022), through their meta-analysis, demonstrated that increased air pollution heightens the risk of anxiety and depression. Similarly, Schwartz et al. (2022) and Reyes et al. (2021) reported a negative relationship between climate change anxiety and mental health (Borroni et al., 2022; Reyes et al., 2021; Schwartz et al., 2022). Pregnancy, being a critical phase in a woman's life, can itself be a source of anxiety. Additionally, another meta-analysis study indicated that elevated air temperatures increase the risk of preterm birth (Chersich et al., 2020). The literature further suggests that pregnant women have insufficient awareness of climate change and needs to be improved (Edis, 2024; Kaya et al., 2024; Toptaş Acar & Gerçek Öter, 2024). The literature indicates “that climate change leads to stress and anxiety in pregnant women, increasing the risk of pregnancy complications such as preeclampsia, gestational diabetes, and intrauterine growth restriction. Consequently, it contributes to adverse pregnancy outcomes, including low birth weight, spontaneous miscarriage, fetal complications, and preterm birth (Bilgiç & Demir, 2024; Chersich et al., 2020; Gök & Ertem, 2022; Ha, 2022; Kaya et al., 2024). Studies have demonstrated that these conditions create stress and anxiety in women, negatively impacting the quality of life of pregnant individuals. In this context, this study aims to examine the effects of climate change on anxiety levels and quality of life among pregnant women.

Research Questions:

- Does climate change affect the anxiety levels of pregnant women?
- Does climate change have an impact on the quality of life of pregnant women?
- Is there a relationship between climate change anxiety and quality of life in pregnant women?

MATERIALS AND METHODS

Type and purpose of the study

This study was conducted using a descriptive and relational study. The study aimed to examine the effects of climate change on anxiety levels and quality of life among pregnant women.

Population and sample of the study

The study population consisted of pregnant women who applied to Samsun Ondokuz Mayıs University Health Practice and Research Center between November 2024 and January 2025. The sample included 313 pregnant women who voluntarily agreed to participate and met the inclusion criteria.

Inclusion criteria:

- Being 18 years of age or older,
- Being literate,
- Being able to speak and understand Turkish,
- Having no mental disabilities,
- Voluntarily agreeing to participate in the study.

Data collection tools

The "Pregnancy Identification Form", "Climate Change Anxiety Scale", and "Quality of Life in Pregnancy Scale" were used as data collection tools in this study.

Pregnancy Identification Form

This form, prepared by the researchers, includes the socio-demographic characteristics (age, education, employment status) of women and their husbands and pregnancy-related information (gestational age, number of pregnancies, planned pregnancy status, etc.). (Çelik,2021; Kaya et al., 2024).

Climate Change Anxiety Scale (CCAS)

This scale was developed by Stewart in 2021, and Özbay and Alcı conducted its Turkish validity and reliability study in the same year. The scale is unidimensional and consists of 10 items. The total

score is obtained by summing the points from each item, and higher scores indicate more significant climate change anxiety. The Cronbach's Alpha coefficient of the scale is 0.98, and in this study, it was found to be 0.92.

Quality of Life in Pregnancy Scale (QLPS)

The Quality of Life in Pregnancy Scale was developed by Vachkova et al. in 2013. Its Turkish validity and reliability study was conducted by Ayan in 2022. The scale, which is in a five-point Likert format, consists of 9 items. The total score obtained by summing up the scores from all items ranges between 9 and 45. According to the total score: 9-18 points: Excellent, 19-27 points: Very good, 28-36 points: Good, 37-45 points: Not very good (Ayan, 2022). The Cronbach's Alpha coefficients of the scale by trimester are as follows: 1. Trimester: α=0.628, 2. Trimester: α=0.727, 3. Trimester: α=0.698. In this study, the Cronbach's Alpha coefficient was 0.83.

Data collection

The researcher administered the data collection tools used in the study face-to-face in a suitable environment where the participants could express themselves, and the process lasted approximately 10-15 minutes.

Data analysis

Data was analyzed using SPSS (Statistical Package for Social Sciences) for Windows 25.0 software. To determine the normality of the data, skewness and kurtosis values were examined (+1, -1). For normally distributed data, parametric tests such as independent samples t-test and One-Way ANOVA were used. To examine the relationship between variables, Pearson Correlation analysis was conducted. A simple linear regression analysis was applied to determine the predictive power. A 95% confidence interval and a significance level of $p<0.05$ were set for all statistical tests.

Ethical considerations

The study's ethical approval was obtained from the Ondokuz Mayıs University Social and Human Sciences Research Ethics Committee (Decision No: 832). Institutional permission was granted by the Ondokuz Mayıs University Rectorate Health Practice and Research Center Directorate (E-15374210-044-2400236414). The participants were informed that the data collected would be used solely for scientific purposes, that the data would remain anonymous, and that they could withdraw from the study at any time. Verbal consent was obtained from the participants. The study adhered to the principles of the Helsinki Declaration throughout the research process."

RESULTS

The average age of pregnant women participating in the study was found to be 28.7±5.89. A comparison of the CCAS and QLPS according to Sociodemographic and some obstetric characteristics of pregnant women is presented in Table 1.

According to the study results, 45% of the pregnant women and 48.9% of their husbands were found to have university or higher education. It was determined that 71.9% of the pregnant women were not working, 93% had social security, 64.5% had income equal to their expenses, and 91.7% were living in nuclear families. Additionally, 72.8% of the pregnant women were in the third trimester, 36.7% were experiencing their first pregnancy, 68.7% had no history of abortion, and 55.6% had at least one living child (Table 1).

A statistically significant difference was found between the average scores of the CCAS and the sociodemographic characteristics of pregnant women, including their education level, their spouse's education level, employment status, social security status, income, family type, pregnancy number, and number of living children ($p<0.05$).

Pregnant women whose education level and their husbands' education level were university or higher had higher average scores on the CCAS compared to others. Employed individuals, those with social security, and those living in nuclear families had higher average scores on the CCAS than unemployed individuals, those without social security, and those living in extended families. Pregnant women with income lower than their expenses had lower average scores on the CCAS compared to others. Those experiencing their first pregnancy and those without living children had higher average scores on the CCAS compared to others (Table 1).

A statistically significant difference was found between the average scores of the QLPS and the sociodemographic characteristics of the pregnant women, including their education level, employment status, social security status, income, family type, gestational week, abortion status, and number of living children ($p<0.05$).

Accordingly, pregnant women with a university or higher education level had higher average scores on the QLPS than others. Those whose husbands had a university or higher education level had higher average scores than those with only primary school education. Employed individuals, those with social security, and those living in nuclear families had higher average scores than unemployed individuals, those without social security, and those living in extended families. Pregnant women whose income was less than their expenses had lower average scores on the QLPS.

Women in the first trimester had higher average scores compared to those in the third trimester, those who had had an abortion had higher scores compared to those who had not, and those without living children had higher scores compared to those with living children (Table 1).

Table 1. Comparison of the average scores of the CCAS and the QLPS Based on the sociodemographic and some obstetric characteristics of pregnant women (n=313).

Variables		n	%	CCAS		QLPS	
				Mean ± SD	Test Statistics	Mean ± SD	Test Statistics
Education Level	Primary School (1)	43	13.8	19.60±4.61	**F=100.539 p=0.000 (1-2;1-3;2-3)**	20.55±5.50	**F=35.432 p=0.000 (1-3;2-3)**
	High School (2)	129	41.2	23.54±4.48		21.23±4.20	
	University and above (3)	141	45.0	30.05±5.35		25.22±4.14	
Husbands Education Level	Primary School (1)	53	16.9	21.56±5.16 (1)	**F=60.885 p=0.000 (1-3;2-3)**	22.73±4.13	**F=4.468 p=0.012 (1-3)**
	High School (2)	107	34.2	23.29±4.94 (2)		23.83±5.22	
	University and above (3)	153	48.9	29.29±5.66 (3)		25.18±5.43	
Employment Status	Yes	88	28.1	30.61±5.40	**t=9.283 p=0.000**	25.60±4.20	**t=6.481 p=0.000**
	No	225	71.9	24.10±5.64		21.89±4.67	
Social Security	Available	291	93.0	26.32±6.25	**t=4.055 p=0.000**	23.17±4.79	**t=3.233 p=0.001**
	Not available	22	7.0	20.81±4.27		19.77±4.33	
Income Status	Income < Expenses	89	28.5	22.82±5.21 (1)	**F=20.277 p=0.000 (1-2;1-3)**	21.32±4.82	**F=8.137 p=0.000 (1-2;1-3)**
	Income = Expenses	202	64.5	26.84±5.98 (2)		23.44±4.56	
	Income > Expenses	22	7.0	30.18±7.95 (3)		24.86±5.75	
Family Type	Nuclear Family	287	91.7	26.24±6.24	**t=2.877 p=0.004**	23.14±4.81	**t=2.539 p=0.012**
	Extended Family	26	8.3	22.57±5.94		20.65±4.53	
Pregnancy Week	1st Trimester (1)	40	12.8	26.65±6.15	F=0.347 p=0.707	26.90±5.53	**F=9.476 p=0.000 (1-3)**
	2nd Trimester (2)	45	14.4	26.11±6.68		25.24±5.83	
	3rd Trimester (3)	228	72.8	25.77±6.25		23.39±4.80	
Number of Pregnancies	1st Pregnancy (1)	115	36.7	27.14±5.89 (1)	**F=5.659 p=0.004 (1-3)**	23.56±4.56	F=2.258 p=0.106
	2nd Pregnancy (2)	91	29.1	26.23±6.28 (2)		23.02±5.01	
	3rd Pregnancy (3)	107	34.2	24.38±6.43 (3)		22.19±4.90	
Abortion	No	215	68.7	26.20±5.99	t=1.119 p=0.264	23.49±4.98	**t=3.168 p=0.002**
	Yes	98	31.3	25.34±6.88		25.46±5.39	
Living Child	No	139	44.4	27.17±6.07	**t=3.172 p=0.002**	23.58±4.80	**t=2.140 p=0.033**
	Yes	174	55.6	24.94±6.30		22.41±4.81	

The comparison of the average scores of the CCAS and the QLPS based on pregnant women's views on climate change is shown in Table 2. A statistically significant difference was found between the average CCAS scores and the QLPS concerning the perception of climate change as a problem and hearing that climate change affects human health ($p<0.05$). Pregnant women who view climate change as a problem and have heard that it affects human health have higher average scores on both the CCAS and the QLPS compared to others (Table 2).

Table 2. Comparison of the mean scores of the the CCAS the QLPS according to the opinions of pregnant women about climate change (n=313).

Variables		n	%	CCAS		QLPS	
				Mean ± SD	Test Statistics	Mean ± SD	Test Statistics
Do you think climate change poses a problem today or in the future?	Yes	266	85.0	26.97±5.94	**t=7.538 p=0.000**	23.53±4.52	**t=5.441 p=0.000**
	No	47	15.0	20.06±4.79		19.55±5.17	
Have you heard that climate change affects human health?	Yes	202	64.5	28.26±5.88	**t=10.173 p=0.000**	24.57±4.25	**t=9.091 p=0.000**
	No	111	35.5	21.70±4.58		19.95±4.38	

The relationship between the mean scores of the CCAS and the QLPS is shown in Table 3. A statistically significant and positive relationship was found between the mean scores of the CCAS and the QLPS ($p<0.05$). Accordingly, as the mean scores of the CCAS increase, the mean scores of the QLPS also increase (Table 3).

Table 3. The relationship between the mean scores of the CCAS and the QLPS.

		Pregnancy Quality of Life Scale
Climate Change Anxiety Scale	r	0.686**
	p	**0.000**
** Correlation is significant at the 0.01 level (2-tailed).		

Table 4 presents the results of the simple linear regression analysis performed to determine the effect of climate anxiety on pregnant women's quality of life scores. Upon examining the table, it is observed that the climate anxiety score has a significant positive effect on the quality of life score of pregnant women ($p=0.000$). According to this result, 47% of the quality of life score is explained by climate anxiety. A 1-unit increase in climate anxiety leads to a 0.538-unit increase in pregnant women's quality of life scores (Table 4).

Table 4: Regression analysis findings on the predictive power of climate anxiety on the quality of life scores of pregnant women

	β	t	p
Climate anxiety	0.538	16.63	**0.000**
			R^2=0.47 F=275.983 **p=0.000**

DISCUSSION

This study aimed to investigate the effects of climate change on anxiety levels and quality of life in pregnant women. The findings of the study are discussed in the existing literature.

According to the results of the study, when examining the sociodemographic characteristics of the participants, it was observed that the majority of the pregnant women had a university degree or higher, lived in a nuclear family structure, had a balanced income and expenditure situation, and were experiencing their first pregnancy. This finding indicates that the participants were highly educated, economically stable, and mostly in their first pregnancy.

This study examined the relationship between education level and climate change anxiety levels. It was found that pregnant women whose education level and their husbands' education level were university graduates or higher had higher average scores on the CCAS compared to other pregnant women. This finding suggests that higher education might enhance an individual's awareness and sensitivity toward climate change, leading to increased anxiety. Additionally, pregnant women who were employed had higher average scores on the CCAS compared to those who were unemployed. This finding could be attributed to the higher exposure to environmental discussions and potential job-related concerns regarding climate change. Pregnant women with income exceeding their expenses also exhibited higher anxiety scores. This finding could indicate that economic stability, while beneficial in some areas, may heighten concerns about the future, especially climate change. Furthermore, pregnant women living in nuclear families had higher scores compared to those living in extended families. This finding might reflect different social dynamics and the support systems available in different family structures, with nuclear families potentially facing more isolation or increased responsibility, thus influencing their anxiety levels. Kaya et al. (2024) conducted a study with 1126 pregnant women. They found that providing climate change education increased the awareness of climate

change among pregnant women. As a result, they experienced more anxiety (Kaya et al., 2024). This result confirms that climate change education can elevate awareness and anxiety. Several studies have shown a positive relationship between climate change anxiety and education level (Bilgiç & Demir, 2024; Borroni et al., 2022; Davoud & Abazari, 2020; Kaya et al., 2024). These findings support the results of the current study. The increase in an individual's awareness and education level, along with age, may contribute to higher anxiety levels. As individuals become more educated, their understanding of climate change and its potential impacts grows, leading to a heightened sense of concern. Moreover, as age increases, so does the sense of responsibility towards future generations, which may amplify anxiety levels.

In this study, when the relationship between the number of pregnancies, the number of living children, and climate change anxiety levels was compared, it was found that the mean scores on the CCAS were higher in pregnant women experiencing their first pregnancy and those without living children compared to others. The higher anxiety levels observed in women experiencing their first pregnancy might be explained by the unknown situations related to pregnancy and the hormonal changes associated with it. Similarly, the increased anxiety levels in women without living children could be attributed to the uncertainty and anxieties related to the prospect of having a child. This finding suggests that anxiety levels may be higher in pregnant women due to the various factors associated with pregnancy. On the other hand, no statistically significant difference was found between the mean scores of the CCAS and abortion status or pregnancy week. This situation indicates that no definitive conclusion can be drawn about whether abortion experiences or pregnancy week affect anxiety levels. Toptaş Acar and Gerçek Öter (2024), in their study investigating climate change awareness in pregnant women, stated that the awareness of pregnant women regarding climate change was not at a sufficient level (Toptaş Acar & Gerçek Öter, 2024). Another study conducted by Edis in 2024 examined the thoughts of pregnant women about the effects of climate change on maternal and child health. It revealed that pregnant women's awareness of climate change was insufficient (Edis, 2024). These results suggest that pregnant women lack adequate awareness of climate change.

In this study, the relationship between education level and quality of life during pregnancy was compared, and it was observed that pregnant women whose education level and their spouses' education level were university or higher had higher mean scores on the QLPS compared to those whose education level or their spouses' education level was primary or secondary school. Similarly, pregnant women who were employed, those with social security, those whose income exceeded their expenses, and those living in nuclear families had higher mean scores on the QLPS compared to their counterparts in different social and economic situations. These findings suggest that higher education levels and improved social conditions positively influence the quality of life during pregnancy.

A review of the literature indicates that studies by Borroni et al. (2022) and Davoud & Abazari (2020) reported that an increase in education level raises anxiety, which negatively affects the quality of life (Borroni et al., 2022; Davoud & Abazari, 2020). However, the findings of this study suggest a positive relationship between education level and quality of life, which contrasts with some of the existing literature.

Looking at the literature on climate change, studies by Toptaş Acar & Gerçek Öter (2024) and Edis (2024) reported that pregnant women's awareness of climate change was insufficient, while studies by Kaya et al. (2024) and Bilgiç & Demir (2024) found that climate change education increased awareness and reduced anxiety among women (Bilgiç & Demir, 2024; Edis, 2024; Kaya et al., 2024; Toptaş Acar & Gerçek Öter, 2024). These findings suggest that increasing education levels and improving social conditions positively impact the quality of life during pregnancy. The development of awareness as education levels rise, the support factor created by the education levels of spouses, the improvement of social conditions, and the enhancement of coping skills are considered important factors in explaining the findings of this study.

In the study, when the relationship between obstetric characteristics of pregnant women and quality of life during pregnancy was compared, it was found that women with a history of abortion had higher average scores on the QLPS compared to those without an abortion history. This may be related to the increased awareness of the women, the strengthening of social support factors, and the development of various coping mechanisms. When the average scores on the QLPS were examined according to gestational week, it was found that the scores of women in the third trimester were lower. This finding may be linked to the impact of air pollution, a result of climate change, on the respiratory system, leading to sleep problems and negatively affecting quality of life (Chersich et al., 2020). Polo-Kantola et al. (2017) indicated in their study that as pregnancy progresses, sleep quality declines, and anxiety symptoms seen in the third trimester are associated with sleep problems (Polo-Kantola et al., 2017). Other studies in the literature have shown that as pregnant women's awareness of climate change increases, they experience more anxiety and encounter sleep problems. As their education and knowledge levels increase, their expectations rise. Consequently, mental health is negatively affected, impacting the quality of life (Bilgiç&Demir, 2024; Borroni et al., 2022; Chersich et al., 2020; Davoud&Abazari, 2020; Kaya et al., 2024; Polo-Kantola et al., 2017; Reyes et al., 2021;

Schwartz et al., 2022). These findings support the results of this research. It is thought that the quality of life of pregnant women is affected by their place of residence and exposure to climate change consequences (residing near industrial areas), along with sleep problems, increased stress, and anxiety as pregnancy progresses.

The study shows that the average QLPS scores varied according to pregnant women's views on climate change. Most participants believed that climate change would pose a problem in the future, and more than half reported hearing that it affects human health. Pregnant women who viewed climate change as a problem and who had heard that it affects human health had higher average scores on both the CCAS and the QLPS compared to others. These findings suggest that environmental awareness and anxiety levels are significant factors affecting quality of life. In particular, as pregnant women's awareness of climate change increases, both their anxiety levels and quality of life are observed to be higher. This finding suggests that factors such as higher education level, social support, and coping strategies likely contribute to the development of these abilities among pregnant women.

The study found a statistically significant positive relationship between the CCAS scores and the QLPS. As a result, as the average scores on the CCAS increase, the average scores on the QLPS also increase. When the literature is examined, studies show that the anxiety of pregnant women increases as their level of education increases, and accordingly, they experience negative psychological processes and their quality of life is affected (Borroni et al., 2022; Davoud&Abazari, 2020; Kaya et al., 2024; Reyes et al., 2021; Schwartz et al., 2022). In a simple linear regression analysis conducted to determine the effect of climate anxiety on pregnant women's quality of life scores, an increase in climate anxiety levels was found to cause an increase in the quality of life scores. This finding suggests that as the educational level and awareness of pregnant women increase, they develop more effective coping strategies, and the increase in social support and social status, along with the development of various measures, help them cope with climate change anxiety and improve their quality of life.

Limitations of the Study

One of the study's limitations is that it was conducted with pregnant women who visited the Health Application and Research Center of Ondokuz Mayıs University in Samsun during a specific period. This limitation may restrict the generalizability of the findings, as studies conducted only on pregnant women from a specific geographical area and time frame may not provide conclusive results for a broader population. Furthermore, limiting the study to a single health center means that the perspectives of pregnant women with different access to healthcare services and varying health conditions are not reflected. Future studies could address this limitation using more extensive and diverse samples from different geographical regions and healthcare centers.

CONCLUSION AND RECOMMENDATIONS

According to the results of the study, it was found that pregnant women have a low level of climate change anxiety, and factors such as education level, employment status, income level, and family type affect climate change anxiety. Pregnant women whose education level and their husbands' education level are university graduates or higher had higher levels of climate change anxiety compared to other groups. Employed pregnant women, those with social security, those whose income is higher than their expenses, and those living in nuclear families were found to have higher climate change anxiety levels than others. When examining obstetric characteristics, pregnant women experiencing their first pregnancy or those who do not have living children were found to have higher levels of climate change anxiety compared to others. It was determined that pregnant women in the first trimester had higher quality-of-life scores than those in the second and third trimesters. It was concluded that as climate change anxiety increased among pregnant women, their quality of life also increased.

Although climate change affects all people, pregnant women are “one of the most vulnerable groups to its negative consequences. Pregnant women should be supported through prenatal education programs that enhance their awareness and help them learn about the impacts of climate change on maternal and infant health and coping mechanisms. More studies are needed to raise awareness about climate change across society. In this regard, climate change should be included in the elementary, high school, and university curricula and educational program contents should be developed accordingly to increase awareness. All healthcare professionals, especially midwives and midwifery students who are actively involved in the field, should be knowledgeable about the effects of climate change on pregnant women, children, and women and should be able to develop solutions and raise public awareness. Academic midwives should research climate change's effects on pregnant women and other vulnerable groups and plan training and interventions to increase women's awareness of climate change. By doing so, it is believed that the adverse effects of climate change on women, maternal-infant health, and children's health can be reduced, contributing to developing a healthy societal structure.

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Conflict of Interest
All authors have adhered to ethical guidelines throughout every phase of the study and declare no financial or personal conflicts of interest.

Author Contributions
Plan, design: SOA, TS; **Material, methods and data collection:** TS; **Data analysis and comments:** SOA; **Writing and corrections:** SOA, TS.

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Investigation of the Effects of Boron Addition to Drinking Water of Rats on Hematologic Parameters and Serum Boron, Calcium, Phosphorus and Magnesium Levels

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ABSTRACT
Objective: In this study, it was aimed to determine the effect of boron added to the drinking water of rats on serum boron levels, calcium, magnesium and phosphorus concentrations and the changes that may occur in hematological parameters. **Materials and Methods:** A total of 12 250-350 g Wistar Albino male rats, 6 in the control group and 6 in the experimental group, were used in the study. The rats were fed ad libitum and 2 mg/day/rat/25 ml borax decahydrate (Sigma) was added to the drinking water. At the end of 14 days, the rats were decapitated. Serum boron analysis by ICP-OES was performed according to Tokay and Bagdat (2022). In addition; Ca, Mg, P concentrations were determined with a biochemical analyzer device. **Results:** When the serum boron levels of the rats were analysed, those in the experimental group were significantly higher (p:0.0107) than those in the control group. However, there was no effect on haematological parameters or serum calcium, magnesium and phosphorus levels. **Conclusion:** As a result of this study, it was determined that boron given to rats with drinking water had no effect on the minerals examined. However, it was concluded that more information could be obtained with more comprehensive studies on this subject.
Keywords: Boron, Drinking Water, Rat.

Sıçanların İçme Suyuna Bor İlavesinin Hematolojik Parametreler ile Serum Bor, Kalsiyum, Fosfor ve Magnezyum Seviyelerine Etkilerinin Araştırılması

ÖZ
Amaç: Bu araştırmada; sıçanların içme suyuna katılan borun, serum bor düzeyleri, kalsiyum, magnezyum ve fosfor konsantrasyonlarına etkisi ve hematolojik parametrelerde oluşturabileceği değişikliklerin belirlenmesi amaçlanmıştır. **Gereç ve Yöntem:** Araştırmada, 6 adet kontrol, 6 adet deney grubu olmak üzere toplam 12 adet 250-350 gr Wistar Albino erkek sıçan kullanıldı. Ad libitum olarak beslenen sıçanların içme suyuna, 2 mg/gün/sıçan/25 ml boraks dekahidrat (Sigma) ilave edildi. 14 günün sonunda sıçanlar dekapite edildi. ICP-OES ile serum bor analizi Tokay ve Bagdat'a (2022) göre yapılmıştır. Ayrıca; Ca, Mg, P konsantrasyonları biyokimyasal analizör cihazı ile belirlendi. **Bulgular:** Sıçanların serum bor düzeyi incelendiğinde deney grubu hayvanların seviyesi kontrol grubuna göre anlamlı bir şekilde yüksek (p:0.0107) bulundu. Ancak, hematolojik parametreler ile serum kalsiyum, magnezyum ve fosfor seviyeleri arasında anlamlı bir ilişki olmadığı tespit edildi. **Sonuç:** Bu çalışmanın sonucunda, sıçanlara içme suyu ile verilen borun, incelenen minerallerin üzerine etkisinin olmadığı tespit edildi. Ancak, bu konu hakkında yapılacak daha kapsamlı çalışmalarla daha fazla bilgi sahibi olunabileceği sonucuna varıldı.
Anahtar Kelimeler: Bor, İçme Suyu, Sıçan.

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INTRODUCTION

Boron (B), first discovered by the French chemist Gay-Lussac in 1808, is a semiconductor substance in group 3A in the periodic table. It is not found alone in nature and forms many compounds. The compounds formed with the elements calcium (Ca), magnesium (Mg) and sodium (Na) are called natural compounds (Oganov and Solozhenko, 2009). It is thought that the combination of metal and non-metal properties, as well as the tendency to bond with oxygen, are the main reasons for the existence of more than two hundred derivatives. This diversity has enabled the usage areas to increase day by day. From past to present, boron has been utilized in different fields such as agriculture, cleaning, metallurgy, insulation and energy, especially in glass and textile industry (Bilgic, 2024; Halvacı et al., 2024). Boron compounds, which are known to be taken mainly through food, intake the living body through air, water and soil, especially in areas where they are extracted and processed (Buluttekin, 2008). Following intake, the substance is converted into boric acid. Thereafter, it is transported via the bloodstream (Buluttekin, 2008).

In terms of animal and human biology, boron is a crucial trace element that is becoming more and more significant. In the body, digestive, respiratory, skin, skeletal, brain and immune systems are affected by boron (Kuru et al., 2019). It has also been reported to have immunomodulatory, anti-inflammatory, antineoplastic, anticoagulant and lipid-lowering effects. However, the mechanism of its effects on human and animal biology has not been clearly established (Kuru et al., 2019).

In recent years, the field of health has seen an increased focus on boron. There are many studies evaluating its use as a biomaterial after surgical operations, its contribution to osteogenesis, its potential for use in burn, wound treatments and weight loss, and its antioxidant and antimicrobial properties (Bitmez ve Balbal, 2024). In addition, research aiming to utilize boron compounds in the treatment of diseases such as cancer and Alzheimer's disease, the treatment of which is still unclear today, are being carried out (Celebi ve ark., 2024). Boron deficiency and excess can have metabolic effects in the body. Especially its effects on hormonal and mineral metabolism are very important. It can cause changes in the concentration of many substances that have important roles in enzyme reactions and cell membrane functions. In deficiency, research has shown that the absorption of minerals such as phosphorus (P), calcium (Ca) and magnesium (Mg) is reduced. These minerals have been shown to play a regulatory role in the metabolism of other minerals, including aluminium (Al), molybdenum (Mo) and others (Abdik et al., 2019; Yünlü, 2016).

Considering the usage areas of boron mineral and its effects on health, the aim of this study was to determine its level in rats. For this purpose, healthy rats were given boron to determine the boron levels in their serum. In addition, when its interaction with many parameters and minerals was evaluated, it was aimed to determine its effect on hematological parameters and serum Ca, P and Mg levels.

MATERIALS AND METHODS

In the study, 12 male, 2-3 months old, male, Wistar albino rats weighing 250-350 grams were used. The rats were obtained from Balıkesir University Experimental Animal Production, Care, Application and Research Centre. Rats were housed in individual cages. In order to determine the amount of water consumed per animal more accurately, 12 rats were housed in a 4-storey system with 3 individual cages on each floor (12 hours light/12 hours dark, 40%-60% relative humidity and 20-24 °C ambient temperature) without any change or restriction (except water) (Figure 1). Rats were fed ad libitum (using pellet feeds) and 2 mg/day/rat/25 ml borax decahydrate (Sigma) was added to the drinking water (Aksoz, 2020; Environmental Protection Agency (EPA), 2004). Rats were decapitated at the end of 14 days. Blood samples were collected in K3EDTA tubes for hematologic analysis and in biochemical gel tubes for Ca, P and, Mg analysis. Hematological parameters were analyzed on hemogram device (HASVET VH3 Veterinary Blood Count Device) without waiting. Blood was centrifuged at 4000 rpm for 5 minutes to obtain serum samples. Serum samples were analyzed on Erba Lachema Biochemical analyzer XL 200. Boron concentrations were measured by ICP-OES device.

ICP-OES analysis

Serum boron analysis by ICP-OES was performed according to Tokay and Bagdat (2022). 0.5 ml serum samples were placed in Teflon containers. 2.5 ml HNO_3 and 1 ml H_2O_2 solution were added. The Teflon containers were placed in a microwave oven set at 150ºC T1 temperature for 15 minutes and 190ºC T2 temperature for 15 minutes. After degradation, 5 ml of ultrapure water was added, and dilution was performed. Following the filtration of the samples through a 0.45 µm filter, they were introduced into the ICP-OES apparatus. For each sample, three repeated measurements were obtained and subsequently averaged.

Before the samples were fed to the ICP-OES device, a calibration graph was drawn using 0.1-5 ppm doses and LOD: 0.979, LOQ: 2.967. (Figure 2).

Statistical analysis

In the study, Kolmogorov-Smirnov test was applied for normality assumptions and $p>0.05$ was determined. Independent t-test, one of the parametric tests, was applied to determine whether there was a significant difference between the groups. The data obtained were analysed using SPSS 25.0 (IBM Corp., Armonk, NY, USA). In case of a significant difference between the groups, post-Hoc test was used to determine between which groups there was a

significant difference. p<0.05 was considered statistically significant.

Ethical considerations

This study was carried out with the permission of the Animal Experiments Local Ethics Committee of Balıkesir University (BAUN-HADYEK) (permission no: 2024/4-5 of April 25, 2024).

Figure 1. Housing conditions of the animals used in the study.

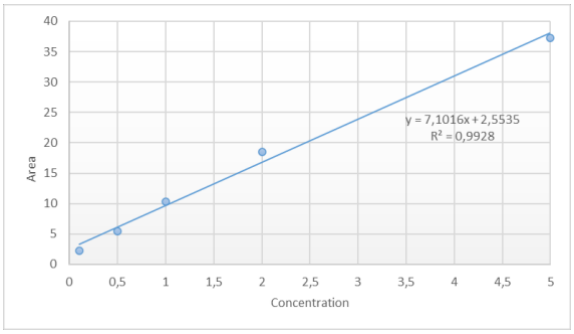

Figure 2. Concentration area plot for the analysis of boron.

RESULTS

It was determined that the administration of 2 mg/day/rat/25 ml borax decahydrate in the drinking water of rats for 14 days did not cause any adverse health effects.

Hematological parameters results are presented in Table 1. According to Table 1, it was determined that there was no statistically significant difference between the control and experimental groups (p>0.05).

Table 1. Results of analysis of hematological parameters of rats.

	Experimental Group		Control Group		U	p
	Mean±SD	Median (Min-Max)	Mean±SD	Median (Min-Max)		
WBC (10^9/L)	13.87±3.87	13.00 (10.33-18.73)	12.35±4.51	10.83 (7.8-18.02)	0.801	0.423
LYM# (10^9/L)	8.07±2.96	7.96 (4.92-11.49)	7.88±3.99	6.90 (4.2-12.94)	0.480	0.631
MID# (10^9/L)	1.93±0.71	1.66 (1.35-3.28)	1.22±0.44	1.17 (0.79-1.91)	1.925	0.054
GRAN# (10^9/L)	3.88±0.88	4.03 (2.39-4.7)	3.24±0.80	3.48 (2.17-4.06)	1.441	0.150
LYM% (%)	0.57±0.07	0.57 (0.46-0.65)	0.61±0.12	0.62 (0.47-0.76)	0.962	0.336
MID% (%)	0.14±0.04	0.14 (0.09-0.2)	0.10±0.03	0.10 (0.07-0.16)	1.761	0.078
GRAN% (%)	0.29±0.07	0.26 (0.23-0.41)	0.28±0.10	0.26 (0.18-0.43)	0.480	0.631
NLR	0.53±0.20	0.43 (0.38-0.88)	0.51±0.28	0.43 (0.23-0.9)	0.480	0.631
PLR	120.18±56.83	104.61 (60.1-223.4)	157.66±98.04	107.40 (79.5-289.3)	0.320	0.749
RBC (10^12/L)	8.99±1.26	9.03 (6.86-10.67)	8.67±0.52	8.73 (8.04-9.2)	0.641	0.522
HGB (g/L)	136.33±16.22	139.00 (106-151)	135.00±6.54	136.50 (127-141)	0.482	0.630
HCT	0.50±0.06	0.51 (0.39-0.56)	0.49±0.03	0.49 (0.46-0.52)	0.722	0.470
MCV (fL)	55.77±1.46	56.40 (52.9-56.7)	56.45±0.90	56.55 (55.3-57.5)	0.484	0.629
MCH (pg)	15.22±0.55	15.45 (14.1-15.5)	15.55±0.23	15.55 (15.2-15.8)	1.309	0.191
MCHC (g/L)	272.83±3.31	273.00 (268-278)	275.67±3.39	276.00 (270-279)	1.532	0.126
RDW-CV (%)	0.16±0.00	0.16 (0.15-0.16)	0.16±0.01	0.16 (0.15-0.17)	1.046	0.295
RDW-SD (fL)	32.03±0.57	32.20 (30.9-32.5)	33.07±1.19	33.05 (31.8-34.7)	1.143	0.253
PLT (10^9/L)	861.00±202.39	897.00 (599-1099)	989.50±258.74	1022.00 (533-1245)	0.961	0.337
MPV (fL)	5.95±0.30	5.90 (5.6-6.4)	5.72±0.15	5.70 (5.6-6)	1.398	0.162
PDW-CV (%)	0.13±0.00	0.13 (0.13-0.14)	0.13±0.00	0.13 (0.13-0.13)	0.966	0.334
PDW-SD (fL)	9.38±0.97	9.35 (8.2-10.9)	8.60±0.53	8.45 (8.2-9.6)	1.457	0.145
PCT (%)	5.12±1.07	5.40 (3.4-6.2)	5.65±1.45	5.80 (3-7)	0.722	0.470
P-LCC (10^9/L)	68.83±13.11	69.00 (49-88)	69.67±17.21	74.00 (37-88)	0.486	0.627
P-LCR (%)	0.08±0.02	0.08 (0.06-0.11)	0.07±0.01	0.07 (0.06-0.08)	1.125	0.261

SD: Standart deviation, Min: Minumum, Max: Maximum, WBC: White blood cell, LYM: Lenfosite, MID: Monosite, GRAN: Granulosite, NLR: Neutrophil lymphocyte ratio, PLR: Platelet-lymphocyte ratio RBC: Red blood cell, HGB: Haemoglobin, HCT: Hematocrit, MCV: Mean corpuscular volume, MCH: Mean corpuscular hemoglobin, MCHC: Mean corpuscular hemoglobin concentration, RDW-CV: Red blood cell distribution width, PLT: Platelet count, MPV: Mean platelet volume, PDW: Platelet distribution width, PCT: Procalcitonin, P-LCR: Platelet large cell ratio, P-LCC: Platelet large cell coefficient

Serum Ca levels

Figure 3 shows mean levels of serum Ca for the experimental and control groups. The results showed no obvious statistically significant difference between the experimental and control groups (p:0.7991).

Serum Mg levels

Figure 4 shows the average levels of serum Mg for the experimental and control groups. There was not observed statistically significant difference between the experimental and control groups (p:0.3137).

Serum P levels

Figure 5 shows the average serum levels of P for the control and experimental groups. There was not observed distinction between the experimental and control groups that was statistically significant. (p:0.5430).

Serum Boron levels

The mean serum boron levels of the control and experimental groups are given in Figure 6. A statistically significant difference was observed between the control and experimental groups (p:0.0107).

Figure 3. Mean Serum Ca Levels.
Values are given as mean±standard error (n=6, p<0.05).

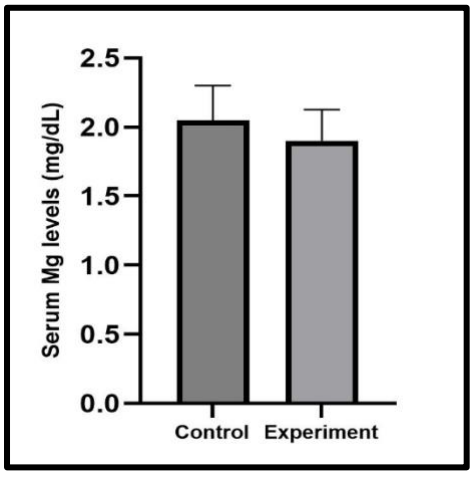

Figure 4. Mean Serum Mg Levels.
Values are given as mean±standard error (n=6, p<0.05).

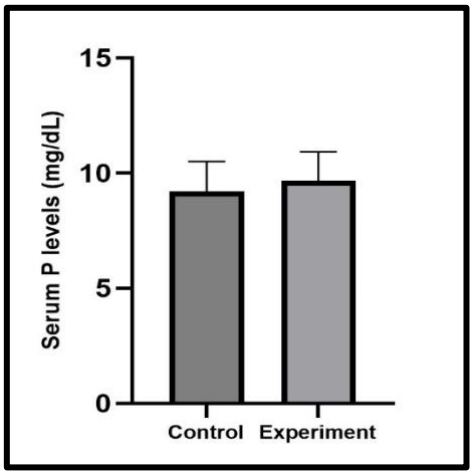

Figure 5. Mean Serum P Levels.
Values are given as mean±standard error (n=6, p<0.05).

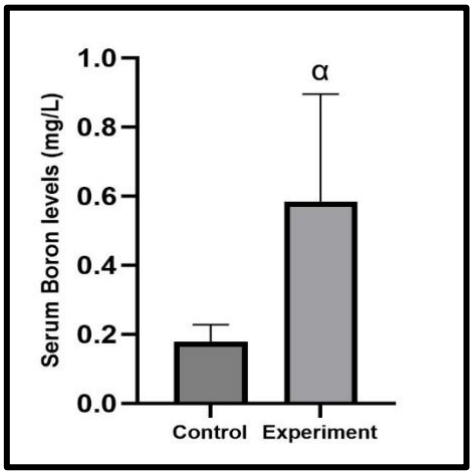

Figure 6. Mean serum boron levels.
α: Indicates significance according to the control.
Values are given as mean±standard error (n=6, p<0.05).

DISCUSSION

In this study, the effect of boron-supplemented drinking water on serum calcium, phosphorus and magnesium levels in rats was investigated and no statistically significant difference was found between the experimental and control groups (p:0.7991 for Ca, p:0.5430 for P, p:0.3137 for Mg).

These results indicate that boron intake does not cause a direct change in serum mineral levels. This may be due to the fact that boron is an element that may affect the storage and mobilisation processes of these minerals in bone, rather than having a direct regulatory role in mineral metabolism (Kurtoğlu et al., 2001).

A statistically significant difference was found between the experimental group and the control group

(p:0.0107 for B) when the serum boron levels of rats drinking boron-supplemented water were evaluated. This finding was due to boron intake.

Hematological and biochemical parameters are routinely measured in cases such as disease, metabolic disorders and detection of side effects of drugs, and changes in the physiological process can be determined by the results. Changes in hematological and biochemical parameters are important sources of information for physicians in the differential diagnosis of clinical and subclinical diseases, their severity, follow-up of the course and success of treatment. When boron is taken as a dietary or food supplement, 84-85% of it is excreted from the body through urine and the amount of boron in plasma is mainly kept under control by renal excretion (Kuru and Yarat, 2017; NseAbasi et al. 2014). Durmuş et al., (2018) investigated the effects of boron administration on hematological parameter levels in rats given gentamicin. They found that only 20 mg/kg boron administration decreased the leukocyte count at a statistically significant level, but other low boron levels had no effect on the parameters examined. They found that gentamicin-induced decrease in leukocyte count could not be corrected by any of the boron levels, decrease in HCT level was prevented by B, and boron applications had no effect on erythrocyte count and hemoglobin levels. Hoffman et al. (1991), a decline in blood haemoglobin levels and haematocrit values was observed in ducks fed a diet that was deficient in protein and rich in boron. Conversely, Sisk et al. (1990) reported an increase in haemoglobin levels in goats afflicted with experimental boron toxicity. Yildirim et al., (2018) in the study investigating the protective effects of lithium borate on blood and histopathological parameters in rats acutely administered cadmium, erythrocyte count, white blood cell (WBC), neutrophil % and C-reactive protein (CRP) levels increased statistically significantly in cadmium and lithium borate + cadmium groups compared to the control group, while lymphocyte % and monocyte % levels decreased. Başoğlu et al., (2010) stated that erythrocyte count, hemoglobin amount, hematocrit value and platelet count were not affected in rabbits given borax. Kuru et al., (2018) conducted a retrospective study on the evaluation of dietary boron intake in terms of health. They stated that they did not find a significant relationship between daily boron intake and biochemical and hematological parameters. The fact that there was no difference in hematological parameters between the experimental and control groups in the study is similar to the studies in the literature. The reasons for obtaining different results may be due to the difference in the level and source of boron mineral used in the studies and the animal species used in the experiment. Considering that people are exposed to boron even with daily diet, it is important that there is no negative effect (Durmuş et al., 2018; Kuru et al., 2018).

Studies have shown that boron interacts with various minerals. It affects transmembrane signaling and alters cell membrane integrity in experimental animals deficient in K, Ca, Mg and cholecalciferol. Boron deficiency may increase stress due to vitamin deficiency (Kurtoğlu et al., 2001; Bakken and Hunt, 2003). Karabulut, (2006) found that boron added to quail feed at different doses decreased serum Ca, P and Mg levels in the experimental groups compared to the control after 35 days of feeding. Armstrong and Spears, (2001) reported that the addition of boron to pig feed and King et al., (1993) reported that in ovo injection of boron into turkey eggs did not affect serum Ca, P and Mg levels. Chapin et al., (1997) found that boron added to the diets of rats decreased serum Ca, P and Mg levels, while Dupre et al., (1994) found that it increased them. In the present study, the fact that there was no statistically significant difference in serum Ca, P and Mg levels is consistent with the studies in the literature. It is thought that the different results may be related to the amount of boron given to the animals.

Boron is one of the trace elements for animals and is generally reported as essential in very small amounts in their diet. Living organisms usually ingest boron through food and/or water (Uçkun, 2013; Yakıncı and Kök, 2016).

Yiğit et al., (2013) administered 31.25, 62.5, 125 mg/kg boric acid to rabbits. It was stated that serum boron levels of animals in the experimental groups 31.25 mg/kg (1.80±0.19 mg/L), 62.5 mg/kg (2.71±0.25 mg/L), 125 mg/kg (4.36±0.30 mg/L) increased compared to the control group (1.25±0.10 mg/L). Bintaş, (2013) reported that when laying hens were fed with 555 mg boric acid/kg, serum boron levels were 509.90 µg/L, which increased serum boron levels compared to the control group. Korkmaz et al., (2007) conducted a study to determine the amount of boron in the urine of males living in a region rich in B in those who used water containing at least 2 mg/l boron and those who did not. They calculated the mean daily B exposure value as 6.77 mg in the study group and 1.26 mg in the controls. Başaran et al., (2012) conducted a study on reproductive toxicity in workers exposed to boron in Bandırma, Turkey. They found that the average blood boron concentration of the workers in the high exposure group was higher than the control. In this study, the fact that the amount of boron in the blood serum of rats receiving B-containing water was higher than those who did not is in accordance with the studies in the literature.

CONCLUSION

Boron is an essential trace element for humans and animals. Studies have shown that it should be taken in certain amounts daily. It was concluded that boron mineral, which was stated to have many benefits in the studies, did not have a negative effect on

hematological and biochemical parameters, serum Ca, P and Mg levels. In order to obtain more detailed information on the health parameters of boron, it was concluded that studies should be carried out in different animal species and doses.

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None.

Conflict of Interest
The author declares no potential conflicts of interest with respect to the research, authorship and/or publication of this article.

Author Contributions
Plan, design: HS, CC, MC, OR, PD, IK; **Material, methods and data collection:** HS, CC, MC, OR, PD, IK; **Data analysis and comments:** HS, CC, MC, OR, PD, IK; **Writing and corrections:** HS, CC, MC, OR, PD, IK

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The Effect of Internet Information Resources on Maternal Confidence and Breastfeeding Self-Efficacy

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ABSTRACT
Objective: Breastfeeding is a natural and beneficial practice; however, many women experience various challenges. These challenges are influenced by factors such as maternal self-confidence. The aim of this study was to evaluate the relationship between the use of parenting-related internet information resources, maternal self-confidence, and breastfeeding self-efficacy. **Materials and Methods:** The population of the descriptive and analytical study consisted of all women who breastfed between September 2022 and February 2023. Purposive sampling was used and 318 women were selected. Data were collected by the researchers with an online survey between September 2022 and February 2023. **Results:** The mean age of the mothers participating was 30.94±4.51 years. The total score mean of the Karitane Parenting Confidence Scale (KPCS) was 35.38±4.06 (min=21.00, max=42.00). The total score mean of the Breastfeeding Self-Efficacy Scale was 58.14±9.46 (min=19.00, max=70.00). A significant positive correlation was found between KPCS and breastfeeding self-efficacy (r=0.467, p<0.01). **Conclusion:** It was determined that the use of Internet sources of information about parenting increased mothers' self-confidence about infant care, but mothers with a high perception of breastfeeding self-efficacy rarely consulted Internet sources about breastfeeding.
Keywords: Internet Information Resources, Breastfeeding, Parenting, Self-confidence.

İnternet Bilgi Kaynaklarının Annelik Özgüveni ve Emzirme Öz-Yeterliği Üzerine Etkisi

ÖZ
Amaç: Emzirme, doğal ve faydalı bir uygulama olmasına rağmen birçok kadın çeşitli zorluklar yaşamaktadır. Bu zorluklar, annenin kendine güveni gibi faktörlerden etkilenmektedir. Bu çalışmanın amacı, ebeveynlikle ilgili internet bilgi kaynaklarının kullanımı ile annenin kendine güveni ve emzirme öz yeterliliği arasındaki ilişkiyi değerlendirmektir.
Gereç ve Yöntem: Tanımlayıcı ve analitik çalışmanın evrenini Eylül 2022 ile Şubat 2023 tarihleri arasında emziren tüm kadınlar oluşturmuştur. Amaçlı örnekleme yöntemi kullanılmış ve 318 kadın seçilmiştir. Veriler araştırmacılar tarafından Eylül 2022 ve Şubat 2023 tarihleri arasında çevrimiçi bir anket ile toplanmıştır. **Bulgular**: Çalışmaya katılan annelerin yaş ortalaması 30.94±4.51'dir. Karitane Ebeveynlik Güven Ölçeği (KEKGÖ) toplam puan ortalaması 35.38±4.06 olarak bulunmuştur (min=21.00, max=42.00). Emzirme Öz-Yeterlilik Ölçeği toplam puan ortalaması ise 58.14±9.46'dır (min=19.00, max=70.00). KEKGÖ ile emzirme öz yeterliliği arasında anlamlı pozitif korelasyon bulundu (r=0.467, p<0.01).
Sonuç: Ebeveynlikle ilgili internet bilgi kaynaklarının kullanımının annelerin bebek bakımı konusunda kendilerine olan güvenlerini artırdığı, ancak emzirme öz yeterlilik algısı yüksek olan annelerin emzirme konusunda internet kaynaklarına nadiren başvurdukları belirlenmiştir.
Anahtar Kelimeler: İnternet Bilgi Kaynakları, Emzirme, Ebeveynlik, Özgüven.

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INTRODUCTION

Mothers often seek information during the postpartum period to understand the causes of changes they experience and address health or physical concerns (Batman, 2018; Slomian et al., 2017). They gather information and support from friends, family, online networks, and health professionals to ease the transition into motherhood (Aston et al., 2018). Many parents increasingly use Internet resources—such as websites, forums, and apps—for round-the-clock support, especially on breastfeeding and infant care (Haluza & Böhm, 2020). However, limited studies explore the impact of online sources (consultations, apps, social media, telemedicine, etc.) on parental well-being, attachment, parenting behaviors, and breastfeeding (Batman & Şeker, 2019; Crossland et al., 2020).

Maternal self-confidence reflects women's perceptions of their ability to effectively undertake their maternal role. Becoming a mother is a significant developmental transition in adulthood, and change is an inevitable part of this process (Esmaelzadeh Saeieh et al., 2017). Low maternal self-confidence is common during the first year postpartum (Khajehei and Lee, 2019). Maternal self-confidence is also a critical factor in predicting various outcomes for both parents and children, including depression, stress, and child development (Pontoppidan et al., 2019). Strategies to enhance maternal self-confidence should not only focus on the individual but also consider the broader family context (Yang et al., 2020). In Turkey, research exists on the use of online information by pregnant women and mothers (Batman, 2018; Çobanoğlu, 2020), yet studies examining its effect on maternal self-confidence and breastfeeding efficacy are lacking. The Internet offers a broad parenting support network, including peer and professional advice (Salonen et al., 2014), especially valuable in underserved areas where it can reduce postnatal costs and foster positive breastfeeding attitudes (Qian et al., 2021). Online interventions can better meet maternal health needs by providing specific, evidence-based information and a wider reach than traditional methods, positively impacting exclusive breastfeeding (Chivers et al., 2021). However, the overwhelming information online complicates quality control, highlighting a need for curated, reliable platforms to prevent misinformation risks (Wu et al., 2021). In the present study, the aim was to evaluate the relationship between the use of Internet information sources on parenting and maternal self-confidence and breastfeeding self-efficacy.

MATERIALS AND METHODS

Study design and participants

This study employed both descriptive and analytical methodologies. It was conducted using an online questionnaire with participants from different cities in Turkey between September 2022 and February 2023. The universe of the study comprised all breastfeeding mothers in Turkey with Internet access between September 2022 and February 2023, who met the inclusion criteria. Specifically, mothers were required to be 18 years or older, still breastfeeding, literate in Turkish, and active users of online platforms, such as social media, to ensure accessibility for participation. Purposive sampling was employed, and 318 women who satisfied the inclusion criteria were selected for participation. In order to calculate the sample size to be included in the study, the sample calculation formula in cases where the number of elements in the universe is not known was used and for the minimum sample size, 95% confidence interval, 5% margin of error, and 71.7% incidence [71.7% incidence of women using the Internet in Turkey to seek information about health (TUİK Household Information Technology Use Survey, 2021)], it was calculated that 312 participants should be included.

Dependent and independent variables

The independent variables were the use of Internet information sources related to parenting and sociodemographic and personal characteristics of the mothers who met the inclusion criteria such as age and employment and educational status. The dependent variables were Postpartum Breastfeeding Self-Efficacy Scale and Karitane Parenting Confidence Scale scores.

Procedures

Data were gathered through an online survey. The questionnaire was designed using Google Forms, with the study's purpose, participation terms, and guidelines provided at the start. The URL link required to access the questionnaire was sent to mothers who met the conditions of participation on social media, forums, etc. on the Internet. The link was sent by the researcher to Facebook and WhatsApp mother groups and Instagram pages. Before responding to the research questions and statements, the participants read the purpose of the research and the voluntary consent form and ticked the box declaring that they were willing to participate. The participants were able to access the data collection forms after giving their consent. They were informed that they could withdraw at any time and that their participation was entirely voluntary. The obstetric features (such as the number of cesarean deliveries, the number of pregnancies, etc.) in the introductory information form were examined by cross-referencing participants' responses regarding breastfeeding status and inconsistent data were excluded. The researcher responded to the questions and problems of the participants who completed the questionnaire regarding the subjects they needed information about in the next stage.

Introductory information form

This data collection form, developed by the researcher through a review of the literature, was utilized for gathering information. It was composed of 44 questions concerning the sociodemographic details and obstetric and parenting knowledge of the mothers

and the Internet information sources from which they obtained this information (Karaçam & Sağlık, 2018).

Postpartum Breastfeeding Self-Efficacy Scale

This 33-item scale was developed by Dennis in 1999. In 2003, she developed the Breastfeeding Self-Efficacy Scale - Short Form by reducing it to 14 items. The scale is a 5-point Likert-type, with items rated from 1 = 'not at all confident' to 5 = 'always confident.' Scores on the scale vary from a minimum of 14 to a maximum of 70, with higher scores reflecting increased self-efficacy in breastfeeding. In their 2010 study, Aluş Tokat et al. assessed the reliability and validity of the Turkish adaptation of the Breastfeeding Self-Efficacy Scale - Short Form, reporting a Cronbach's alpha of 0.86, which supported its suitability for Turkish culture. The scale takes an average of 5-7 min to administer (Aluş Tokat et al., 2010). In our study, the scale demonstrated a Cronbach's alpha value of 0.89, indicating an acceptable level of reliability. This scale has been widely used in studies involving breastfeeding mothers, and its validity has been supported across different populations, including full-term mothers.

Karitane Parenting Confidence Scale (KPCS)

This 15-item scale was developed by Crncec et al. in 2008. It was designed by health professionals to measure parenting-related competence and self-efficacy in early parenthood. It is suitable for parents with babies between 0 and 12 months old. It was reported that although the sample group was mothers during the development of the scale, it could also be used to evaluate the self-confidence of fathers regarding parenting. Each item in the scale is scored as 0: No, hardly ever; 1: No, not very often; 2: Yes, some of the time; 3: Yes, most of the time. There are two subscales and only Item 11 is reverse scored. Reverse scoring means 0=3; 1=2; 2=1; 3=0. The score range is 0-42, and high scores are positive, indicating that the parent has high self-confidence regarding parenting. Yılmaz and Oskay (2021) assessed the validity and reliability of the Turkish version of the scale, finding a Cronbach's alpha of 0.93 for the overall scale, 0.96 for the 'infant care' subscale, and 0.71 for the 'parenting role' subscale. Their findings indicate that the scale is appropriate for assessing maternal self-confidence within Turkish culture. The scale takes an average of 15 min to complete (Yılmaz & Oskay, 2021). In our study, the Cronbach's alpha value was 0.78 for the "infant care" subscale, 0.53 for the "parenting role" subscale, and 0.71 for the total scale reliability, showing it has an acceptable level of reliability. The KPCS can be applied to a broad group of mothers and has been used in various studies involving mothers of full-term infants (Avşin and Can 2022). In our study, the scale was specifically applied to breastfeeding mothers with infants aged 0-12 months, in line with the scale's target population. This scale is suitable for our study since it measures overall parenting confidence, and its use is consistent with prior research. Furthermore, the inclusion criteria ensured that all participants met the necessary conditions for using the KPCS, supporting the validity and applicability of the scale in this context.

Statistical analysis

Data analysis was conducted using IBM SPSS Statistics 22 (IBM SPSS, Turkey). Descriptive statistical methods, including frequency, percentage, minimum and maximum values, median, mean, and standard deviation, were employed. The Mann–Whitney U test and the Kruskal–Wallis test were utilized for comparisons. For significant results from comparisons involving more than two groups, post-hoc analyses were carried out using the pairwise Mann–Whitney U test with Bonferroni correction. The significance level was set at $p<0.05$.

Ethical considerations

Ethical permission for the research was granted by the Istanbul University-Cerrahpaşa Social and Human Sciences Research Ethics Committee (Date: 04.10.2022; Decision No: 2022/284). At the beginning of the questionnaire, statements regarding the conditions of participation, the instructions, the purpose of the research, and the fact that the information provided would be kept confidential and not be shared with other individuals were included. Permission was obtained by email from Merlinda Aluş Tokat to use the Postpartum Breastfeeding Self-Efficacy Scale and from Yılmaz to use the KPCS in the study. Written consent was obtained from the participants included in the sample through the Informed Voluntary Consent Form.

RESULTS

The demographic and obstetric characteristics of the mothers are given in Table 1. The distribution of the mothers according to their information needs and resources during pregnancy, infant care, and breastfeeding is given in Table 2. When the distribution of the mothers according to their Internet use characteristics is examined, it is shown in Table 3, along with other characteristics, that 80.8% used Instagram and 62.3% used YouTube as Internet information sources, and many of them have used the Internet for 10 years or more.

The total mean score of the KPCS was 35.38±4.06 (min=21.00, max=42.00) and the total mean score of the Breastfeeding Self-Efficacy Scale was 58.14±9.46 (min=19.00, max=70.00). Correlation analysis revealed a significant and positive correlation between the scores of the two scales ($r=0.46$, $p<0.01$).

Breastfeeding self-efficacy scores were evaluated based on obstetric factors, current baby characteristics, and Internet usage, with significant findings presented in Table 4. No significant differences were found in relation to other demographic, obstetric, baby-related, or Internet use characteristics. The KPCS was examined in terms of mothers' demographic, obstetric, and Internet use characteristics and the significant ones are shown in Table 5. No differences were

observed in terms of other demographic, obstetric, or Internet use characteristics.

Table 1. Demographic and obstetric characteristics of the mothers (n=318).

		n	%
Age ($\bar{X}$±SD, 30.94±4.51)	21-25	26	8.2
	26-30	137	43.1
	31-35	111	34.9
	36 or older	44	13.8
Education	Primary school	6	1.9
	Bachelor's degree	238	74.8
	Postgraduate degree	74	23.3
Employment status	Working	179	56.3
	Not working	139	43.7
Socioeconomic status	Low (expenses exceed income)	17	5.3
	Middle (expenses equal to income)	198	62.3
	High (income exceeds expenses)	103	32.4
Number of living children	1	222	69.8
	2	76	23.9
	3 or more	20	6.3
Time between last pregnancies	First pregnancy	190	59.7
	0-2 years	33	10.4
	More than 2 years	95	29.9
Planned pregnancy	Yes	267	84.0
	No	51	16.0
Gestational week at birth	36+6 days or before	54	17.0
	37 or after	264	83.0
Type of birth	Vaginal	110	34.6
	Cesarean section	208	65.4
Weight of baby at birth	3000 g or below	93	29.2
	Above 3000 g	225	70.8

n: Count, **%:** Column percentage.

Table 2. Mothers' information needs and sources during the pregnancy, infant care, and breastfeeding periods.

(N=318)		n	%
Frequency of obtaining information from those around them during pregnancy	Rarely	113	35.5
	Sometimes	94	29.6
	Often	77	24.2
	Very often	34	10.7
Frequency of obtaining information from the Internet during pregnancy	Rarely	27	8.5
	Sometimes	72	22.6
	Often	118	37.1
	Very often	101	31.8
Frequency of obtaining information about infant care from those around them after birth	Rarely	96	30.2
	Sometimes	129	40.6
	Often	68	21.4
	Very often	25	7.9
Frequency of obtaining information about infant care from the Internet after birth	Rarely	38	11.9
	Sometimes	86	27.0
	Often	129	40.6
	Very often	65	20.4
Frequency of obtaining information about breastfeeding from those around them after birth	Rarely	128	40.3
	Sometimes	122	38.4
	Often	53	16.7
	Very often	15	4.7
Frequency of obtaining information about breastfeeding from the Internet after birth	Rarely	64	20.1
	Sometimes	93	29.2
	Often	114	35.8
	Very often	47	14.8

n: Count, **%:** Column percentage.

Table 3. General characteristics of mothers' internet use.

(N=318)			n	%
Reasons for needing internet research during pregnancy and after	I don't have enough knowledge about infant care, breastfeeding, etc.	Yes	152	47.8
		No	166	52.2
	I can immediately access the information I want	Yes	268	84.3
		No	50	15.7
	I do not find the health personnel's answers satisfactory/sufficient	Yes	43	13.5
		No	275	86.5
	I cannot contact health personnel immediately when I need to	Yes	164	51.6
		No	154	48.4
	I am reluctant to ask people around me	Yes	24	7.5
		No	294	92.5
	I am reluctant to ask health personnel	Yes	13	4.1
		No	305	95.9
	Other (enjoying researching, sharing experiences, etc.)	Yes	5	1.6
		No	313	98.4
The extent to which Internet research meets their needs during pregnancy and after		Not at all	2	0.6
		A little	122	38.4
		A lot	148	46.5
		Very much	46	14.5
Believing in the accuracy of information found on the Internet		Sometimes	203	63.8
		Often	109	34.3
		Never	6	1.9
Consulting health personnel about the accuracy of information on the Internet		Yes	242	76.1
		No	12	3.8
		Sometimes	64	20.1
Concern about using information obtained from the Internet		Yes	144	45.3
		No	174	54.7
Feelings when sharing on the Internet or social media with strangers who have pregnancy/birth experience		Reluctance	28	8.8
		Comfortable because of having experienced it before	204	64.2
		Distrust/caution	86	27.0

n: Count, **%:** Column percentage.

Table 4. Comparison of participants' breastfeeding self-efficacy scale scores by characteristics (n=318).

		Breastfeeding Self-Efficacy Scale Scores		
		$\bar{X}$±SD	**Min.-Max.**	**Median (Q1-Q3)**
Planned pregnancy	Yes	58.82±8.98	19.00-70.00	61.00 (55.00-65.00)
	No	54.60±11.06	23.00-70.00	55.00 (50.00-64.00)
Z/p				-2.77/**0.01**[2*]
Gestational week at birth	≤36+6 days	55.70±9.11	30.00-70.00	56.00 (50.75-62.25)
	≥37	58.64±9.46	19.00-70.00	61.00 (55.00-66.00)
Z/p				-2.51/**0.01**[2*]
Had trouble breastfeeding her last baby immediately after birth	No	60.95±7.25	39.00-70.00	62.00 (55.25-67.00)
	Yes	55.30±10.54	19.00-70.00	57.00 (50.00-63.00)
Z/ p				-4.90/**0.00**[2*]
Currently having trouble breastfeeding her latest baby	No	60.11±8.09	19.00-70.00	62.00 (55.00-67.00)
	Yes	51.29±10.64	23.00-70.00	55.00 (45.00-58.00)
Z/p				-6.50/**0.00**[2*]

Table 4. (Continued). Comparison of participants' breastfeeding self-efficacy scale scores by characteristics (n=318).

Frequency of obtaining information from the Internet during pregnancy	Rarely (A)	62.37±6.61	48.00-70.00	63.00 (57.00-68.00)
	Sometimes (B)	56.70±9.39	23.00-70.00	56.50 (52.25-64.00)
	Often (C)	58.21±9.32	19.00-70.00	59.00 (53.00-66.00)
	Very often (D)	57.97±10.07	27.00-70.00	61.00 (54.00-65.00)
Bonferroni				**A>B, A>C, A>D**
X^2_{KW}/p				8.24/**0.04**[1*]
Frequency of getting information about infant care from the Internet after birth	Rarely (A)	62.00±6.38	50.00-70.00	62.50 (56.00-68.00)
	Sometimes (B)	59.18±8.58	30.00-70.00	60.00 (55.00-65.00)
	Often (C)	57.13±9.75	19.00-70.00	58.00 (52.5-64.5)
	Very often (D)	56.53±10.80	27.00-70.00	58.00 (50.00-64.00)
Bonferroni				**A>D, A>C**
X^2_{KW}/p				9.09/**0.03**[1*]
Obtained information about breastfeeding before	Yes	57.71±9.61	19.00-70.00	59.00 (53.00-65.00)
	No	62.77±6.01	50.00-70.00	63.00 (57.00-69.00)
Z/p				-2.68/**0.01**[2*]
Frequency of getting information about breastfeeding from those around them after birth	Rarely (A)	60.39±7.89	34.00-70.00	62.00 (56.00-67.00)
	Sometimes (B)	57.38±10.23	19.00-70.00	58.00 (53.00- 65.25)
	Often (C)	54.71±10.72	29.00-70.00	58.00 (48.00-63.00)
	Vey often (D)	57.26±5.63	49.00-65.00	56.00 (53.00-63.00)
Bonferroni				**A>C, A>B**
X^2_{KW}/p				14.08/**0.00**[1*]
Frequency of getting information about breastfeeding from the Internet after birth	Rarely (A)	62.23±7.41	30.00-70.00	64.00 (56.00-68.00)
	Sometimes (B)	58.17±8.32	34.00-70.00	59.00 (53.00-64.00)
	Often (C)	56.31±10.31	19.00-70.00	58.00 (50.75-64.00)
	Very often (D)	56.97±10.41	27.00-70.00	58.00 (52.00-65.00)
Bonferroni				**A>B, A>C, A>D**
X^2_{KW}/p				17.91/**0.00**[1*]

* p<0.05, 1 Kruskal–Wallis test used, 2 Mann–Whitney U test used, Z: Wilcoxon signed rank test statistic, X^2_{KW}: Kruskal–Wallis test.

Table 5. Comparison of participants' karitane parenting confidence scale scores by characteristics (n=318).

		Karitane Parenting Confidence Scale Score		
		$\bar{X}$±SD	**Min.-Max.**	**Median (Q1-Q3)**
Frequency of obtaining information from the Internet during pregnancy	Rarely (A)	25.40±4.05	13.00-30.00	27.00 (23.00-29.00)
	Sometimes (B)	26.04±3.35	17.00-30.00	27.00 (23.25-29.00)
	Often (C)	26.56±3.25	14.00-30.00	27.50 (25.00-29.00)
	Very often (D)	27.15±3.18	15.00-30.00	28.00 (25.50-30.00)
Bonferroni				**D>A, D> B**
X^2_{KW}/p				9.24/**0.03**[1*]
Frequency of getting information about infant care from those around them after birth	Rarely (A)	31.21±4.29	24.00-39.00	32.00 (28.00-35.00)
	Sometimes (B)	32.50±4.66	19.00-39.00	34.00 (30.25-36.00)
	Often (C)	32.95±4.00	25.00-39.00	32.00 (30.50-36.50)
	Very often (D)	31.14±3.76	26.00-37.00	32.00 (28.00-34.00)
Bonferroni				**B>A, C>A**
X^2_{KW}/p				8.45/**0.04**[1*]
Obtained information about breastfeeding before	Yes	5.88±1.80	0.00-9.00	6.00 (5.00-7.00)
	No	4.58±1.97	2.00-8.00	5.00 (3.00-6.00)
Z/p				-2.23/**0.03**[2*]

*p<0.05, 1 Kruskal–Wallis test used, 2 Mann–Whitney U test used, Z: Wilcoxon signed rank test statistic, X^2_{KW}: Kruskal–Wallis test.

DISCUSSION

In our study, 50% of mothers experienced breastfeeding issues immediately after birth, with 25.2% reporting cracks/pain in their breasts and 13.2% reporting insufficient milk. Karaçam and Sağlık's (2018) review identified frequent issues such as breast
redness (28.8%) and cracks/wounds (26.1%). Literature shows that postpartum individuals often seek information from social networks, including family, healthcare professionals, and online sources (Batman, 2018; Kahraman et al., 2016). In our study, most mothers (68.9%) frequently obtained pregnancy-related information online (Table 2).

Various factors influence mothers' choices of infant care information sources. For example, Van der Gugten et al. (2016) noted that some parents avoid seeking help from relatives, favoring the accessibility and vast information offered online. Similarly, mothers in our study mainly received infant care

information from the Internet after birth. Online forums were valuable for many breastfeeding mothers, allowing them to quickly receive answers from others with similar experiences (Lebron et al., 2020). However, traditional information sources may offer more structured insights (Jang et al., 2015).

Mothers in our study frequently used Instagram, YouTube, and informational websites. Prior research highlights how both highly educated and less educated parents use social media for guidance (Shoup et al., 2019). Our sample largely had bachelor's degrees, which may explain the prevalence of online information sources (Table 3). However, Internet sources can lead to heightened anxiety due to exposure to worst-case scenarios, concerns about content quality, and feelings of judgment (Kim & Hawkins, 2020).

The KPCS total mean score in our study was 35.38±4.06, reflecting high self-confidence among mothers, which is consistent with the findings of (Kristen et al., 2018). This suggests that parental self-confidence is positively influenced by information and education about the postpartum period. Notably, mothers who frequently used Internet information sources during pregnancy reported higher KPCS scores, aligning with findings that Internet information supports decision-making and caregiving confidence (Nicholl et al. 2022).

Higher self-confidence levels were observed in mothers who regularly received postpartum support from their social circles, echoing studies that highlight the importance of social support in enhancing maternal self-confidence (Zheng et al., 2018). Similarly, obtaining breastfeeding information also positively impacted self-confidence, reinforcing that knowledge enhances readiness for motherhood (Gozali et al., 2020).

The mean score on the Breastfeeding Self-Efficacy Scale was 58.14±9.46, reflecting high breastfeeding self-efficacy. This aligns with the literature, where self-efficacy scores frequently correlate with maternal readiness for breastfeeding (Amini et al., 2019). We also observed a significant correlation between self-efficacy scores and planned pregnancies, consistent with studies suggesting that prepartum preparation boosts maternal confidence (Gökçeoğlu & Küçükoğlu, 2017).

Mothers in our study who breastfed without issues post-birth had significantly higher self-efficacy scores ($p<0.001$), aligning with findings that discomfort during breastfeeding, such as nipple pain, negatively affects self-efficacy (Poorshaban et al., 2017). Additionally, mothers currently breastfeeding without difficulties showed increased self-efficacy, as ongoing breastfeeding experience reinforces maternal confidence.

Interestingly, mothers who rarely accessed Internet sources for breastfeeding information had higher self-efficacy scores, suggesting that direct experience and selective information-seeking may enhance confidence. Literature shows mixed results on the impact of Internet sources on breastfeeding self-efficacy, with some studies citing increased self-efficacy due to structured online support, while others cite lower confidence due to unregulated information (Gallegos et al., 2014). Finally, mothers' self-efficacy and need for information appear inversely proportional, as high self-confidence reduces the desire to seek external information.

Study Limitations and Strengths

The generalizability of the results we obtained is limited to the study sample. The results cannot be used to directly evaluate the rate of Internet use among all breastfeeding mothers, since the data were collected by online questionnaire, but the relationship between the use of Internet information sources on parenting by mothers who are Internet users and their maternal self-confidence and breastfeeding self-efficacy can be assessed.

CONCLUSION

The use of Internet information sources related to parenting increases mothers' self-confidence, but those with high breastfeeding self-efficacy perception rarely resort to Internet information sources for breastfeeding. Therefore, health professionals should support parents in terms of access and guidance regarding reliable Internet information sources and provide assistance, counseling, and education on such matters. Strategies should be developed to enable the organization and monitoring of health-related material on Internet information sources by a multidisciplinary team.

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Conflict of Interest

The author declare no potential conflicts of interest with respect to the research, authorship and/or publication of this article.

Author Contributions

Plan, design: EA; **Material, methods and data collection:** EA, IGS; **Data analysis and comments:** EA, IGS; **Writing and corrections:** EA, IGS.

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Institution: Istanbul University-Cerrahpaşa Social and Human Sciences Research Ethics Committee
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Bibliometric Analysis and Publication Status of Public Health Specialization Theses in Turkey

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ABSTRACT

Objective: The purpose of this study is to determine in which fields of public health specialists conduct medical specialty thesis and to examine the status of theses turned into articles in national and international journals**. Materials and Methods:** Databases of National Thesis Center of the Council of Higher Education was used for the study examining the bibliometric analysis and publication status of medical specialty theses conducted in Public Health Departments until the end of 2022. **Results:** Approximately 40% of the theses were centered around three main topics, namely occupational health, non-communicable diseases-disability-cancer, and child-adolescent health. More than 60% of theses were planned as cross-sectional study. 29.2% of the theses have been published, and this rate increases to 47.3% in studies receiving project support; 41.6% in studies conducted using laboratory findings; 36.1% in studies using examination findings data; and 33.3% in studies using radiological imaging data. Less than 30% of the published theses were published in SCI, SCI-E, Scopus group journals. **Conclusion:** While the rate of publication for public health theses has demonstrated an upward trend over the years, it remains relatively low. Solutions should be devised to foster the publication of specialty theses. Spreading thesis studies across the duration of education, as opposed to a condensed timeframe, and augmenting financial support from universities for scientific research can enhance studies in terms of data collection methods and outreach.
Kevwords: Public Health. Publications. Academic Dissertations.

Türkiye'de Halk Sağlığı Uzmanlık Tezlerinin Bibliyometrik Analizi ve Yayın Durumu

ÖZ

Amaç: Bu çalışmanın amacı, halk sağlığı uzmanlarının hangi alanlarda tıpta uzmanlık tezi yaptıklarını belirlemek ve tezlerin ulusal ve uluslararası dergilerde makaleye dönüşme durumunu incelemektir**.Gereç ve Yöntem:** Halk Sağlığı Anabilim Dallarında 2022 yılı sonuna kadar yapılan tıpta uzmanlık tezlerinin bibliyometrik analizi ve yayın durumlarının incelendiği çalışma için Yükseköğretim Kurulu Ulusal Tez Merkezi veri tabanları kullanılmıştır. **Bulgular:** Tezlerin yaklaşık %40'ı iş sağlığı, bulaşıcı olmayan hastalıklar-engellilik-kanser ve çocuk-ergen sağlığı olmak üzere üç ana konu etrafında toplanmıştır. Tezlerin %60'ından fazlası kesitsel çalışma olarak planlanmıştır. Tezlerin %29,2'si yayınlanmış olup, bu oran proje desteği alan çalışmalarda %47,3'e; laboratuvar bulguları kullanılarak yapılan çalışmalarda %41,6'ya; muayene bulguları verileri kullanılarak yapılan çalışmalarda %36,1'e; radyolojik görüntüleme verileri kullanılarak yapılan çalışmalarda ise %33,3'e yükselmektedir. Yayımlanan tezlerin %30'undan azı SCI, SCI-E, Scopus grubu dergilerde yayımlanmıştır. **Sonuç:** Halk sağlığı tezlerinin yayınlanma oranı yıllar içinde artış eğilimi gösterse de, nispeten düşük kalmaya devam etmektedir. Uzmanlık tezlerinin yayınlanmasını teşvik etmek için çözümler geliştirilmelidir. Tez çalışmalarının yoğun bir zaman dilimi yerine eğitim süresine yayılması ve bilimsel araştırmalar için üniversitelerden alınan mali desteğin artırılması, veri toplama yöntemleri ve erişim açısından çalışmaları geliştirebilir.
Anahtar Kelimeler: Halk Sağlığı, Yayınlar, Akademik Tezler.

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INTRODUCTION

Writing a thesis is one of the essential stages that a medical specialization student must complete to become a specialist in Turkey (Resmi Gazete, 2022). Activities such as research planning, data collection, data interpretation and discussion during thesis writing contribute to learning how to evaluate and interpret existing literature and access information sources. The ability to interpret literature and learn to access information sources empowers individuals to keep their knowledge up-to-date and stay abreast of new developments throughout their professional lives.

The study should be shared with other researchers to contribute to the global realm of science and research. Theses need to be published in order to share the work with other researchers. The most well-known of these sharing methods are presenting the work at scientific meetings or publishing in the journals. This sharing not only has the potential to inspire fellow researchers but also serves to enhance the existing literature and facilitate widespread access to the knowledge generated through the thesis. Similar to other forms of scientific research, theses often encounter obstacles during the publication process. Key challenges include a lack of comprehensive guidance on article writing within undergraduate and graduate programs, inadequacies in foreign language skills, and a shortage of incentives to encourage publication. Addressing these issues is vital to facilitate the dissemination of valuable research findings and promote active participation in the scholarly publishing domain (Çökmüş, 2010).

Although public health is one of the oldest fields of medicine, it is open to improvement, new knowledge and new areas of research because it cannot be separated from social events (TUKMOS, 2016). New health policies, the discovery of a new source of environmental pollution, a new natural disaster, a new political event in neighbouring countries, the discovery of a new oncogene, a new infectious disease, and many other events cause social consequences and can be one of the main research topics of public health. In this respect, public health research areas are dynamic and open to innovations.

The purpose of this study is to determine in which fields of public health specialists conduct medical specialty thesis and to examine the status of theses turned into articles in national and international journals.

MATERIALS AND METHODS

Databases of National Thesis Center of the Council of Higher Education was used for the study examining the bibliometric analysis and publication status of medical specialty theses conducted in Public Health Departments until the end of 2022. All theses that were available on the database website and had full-text access were examined (https://tez.yok.gov.tr/UlusalTezMerkezi/giris.jsp)

From the database, it was found that the first specialization thesis in public health in Turkey was conducted in 1973. It is seen in the database that this first thesis was written by Mehmet Erdoğan (M.D) on infectious diseases in children at the Department of Public Health, Faculty of Medicine, Dicle University. All 854 medical specialty theses were included in the study. Theses in 2023 were not included in the study, considering the process of publication. The year of publication, Turkish and English titles, the university where the thesis was conducted, the province of the university, the province where the research was carried out, the number of advisors, the academic title of the advisor, the subject of the thesis, research type, sample size, data collection method, total number of pages, number of pages of the discussion section, number of sources and the status of project support received were recorded. In the second stage, the study scrutinized the status of theses transformed into articles. Within this framework, the publication status of the thesis, the year of publication, the duration between thesis writing and publication, the database where the journal was indexed and the total number of authors were meticulously recorded.

Twenty-four National Public Health Congress Books were analyzed and 30 main subjects were identified. These subjects are women's and reproductive health, inequalities, non-communicable diseases-disability-cancer, communicable diseases and vaccination, child and adolescent health, occupational health, health management-health policies-health systems, health promotion, health education, environmental health, school health, mental health, nutrition, migrant health, health service research, health economics, demography, oral and dental health, accident-injury-poisoning, elderly health, tourism health, anthropometric measurement studies,rational drug use, alcohol and substance use disorder, violence, quality of life, medical education, health worker training, disaster-emergencies and scale development. Based on the titles and abstracts for each thesis, the most appropriate one of these topics were selected by two researchers, first separately, then by comparison and joint decision-making. Research type was grouped as descriptive, cross-sectional, case-control, cohort, methodological, qualitative, interventional, systematic review-meta-analysis, ecological and bibliometric. In theses in which more than one research type was used, the research type that was higher in the evidence pyramid in terms of evidence value was recorded.If there is more than one thesis advisor, the title of the advisor with the higher degree was recorded.

While researching the publication status of theses, Google (https://www.google.com/), Google Scholar (http://scholar.google.com.tr/), PubMed (https://www.ncbi.nlm.nih). gov/pubmed/), TR Index TÜBİTAK ULAKBİM (https://trdizin.gov.tr/) and Dergipark (https://dergipark.org.tr/tr/) were used. The search was made by entering the names and surnames of the thesis authors and advisors, the Turkish/English

title of the thesis and keywords into the search fields. The publication status of theses is grouped as published/not published.It was checked in which group database the publications were indexed. Indexes are categorized as SCI / SCI Expanded/Scopus, other international indexes, national indexes and national non-refereed journals.If a journal is indexed in both national and international indexes, the language of the publication was taken into consideration and the international index was accepted if it was published in English and the national index was accepted if it was published in Turkish.

Statistical Analysis: Statistical analyses were conducted using the Statistical Package for Social Sciences (SPSS) version 26 (IBM Corp, Armonk, NY, USA). Descriptive findings are presented in percentage distributions for categorical variables, and in mean±standard deviation or median (minimum value-maximum value) for continuous variables.

RESULTS

From 1973, the first year of public health specialty thesis in Turkey, to the end of 2022, a total of 854 medical specialty theses were conducted. The first three years in which the most theses were made were 2017, 2022 and 2020, respectively. Figure 1 shows the number of public health specialty theses by year.

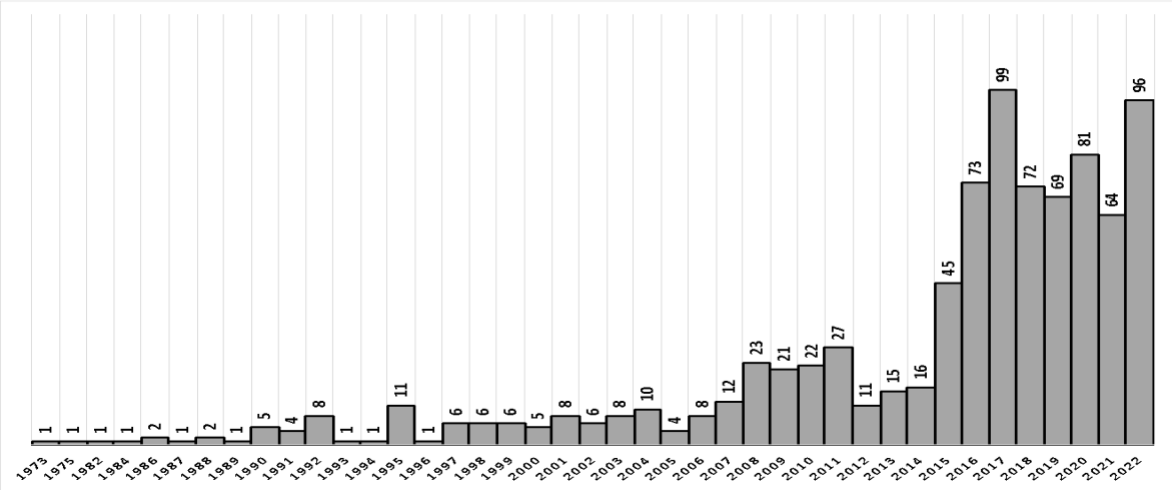

Figure 1. Change in the number of thesis by year

It was determined that 57.6% (n=484) of the theses were conducted by women. It has been observed that more than 50% of the theses were conducted in 12 departments. The top five universities with the highest number of theses were Istanbul University (n=53), Hacettepe University (n=48), Çukurova University (n=48), Dokuz Eylül University (n=43), and Gazi University (n=34). The first five provinces with the highest number of theses are Ankara (n=125), Istanbul (n=97), Izmir (n=82), Adana (n=48), and Samsun (n=33).

When the theses were analyzed according to the provinces where the data were collected, it was seen that they were mostly conducted in Ankara, Istanbul and Izmir, respectively, in parallel with the provinces where the universities are located. While 2.5% (n=21) of the theses were carried out using national data, 1.9% (n=16) were conducted in more than one province. While almost 95% of theses were carried out with a single advisor, the title of the advisor in nearly 70% was professor (Table 1).

Table 1. Information on thesis advisors.

		n	%
Number of thesis advisors (n=854)	Non-specified	21	2.5
	One	808	94.6
	Two	24	2.8
	Three	1	0.1
The academic title of the advisor (n=833)	Professor	573	68.8
	Associate professor	165	19.8
	Assistant professor	62	7.4
	Lecturer	33	4.0

Approximately 40% of the theses were centered around three main topics, namely occupational health, non-communicable diseases-disability-cancer, and child-adolescent health. More than 60% of theses were planned as cross-sectional study. The median sample size was 380 (minimum:6 - maximum:416,707). In more than 90% of theses, data was collected by survey (Table 2).

Table 2. Distribution of main subject, research type and data collection methods.

		n	%
Main subject (n=854)	Occupational health	144	16.9
	NCD-disability-cancer	115	13.5
	Child and adolescent health	66	7.7
	Women's and reproductive health	65	7.6
	Communicable diseases and vaccination	65	7.6
	Environmental health	52	6.1
	Alcohol and substance use disorder	48	5.6
	Mental health	47	5.5
	Health services research	40	4.7
	Elderly health	27	3.2
	Other	185	21.6
Research type (n=854)	Cross-sectional	528	61.8
	Descriptive	135	15.8
	Interventional	49	5.7
	Methodological	43	5.0
	Qualitative	30	3.5
	Case-control	26	3.0
	Cohort	17	2.0
	Other	26	2.9
Data collection method* (n=854)	Survey	771	90.3
	Records	122	14.3
	Examination	97	11.4
	Laboratory	77	9.0
	Environmental measurement	50	5.9
	Interview	35	4.1
	Radiologic imaging	3	0.4

NCD: Non-communicable diseases
**Row percentage is calculated*

Figure 2 presents the distribution of topics by gender. While the first two places are occupational health and non-communicable diseases-disability-cancer for both genders, women's and reproductive health comes third for women and environmental health comes third for men. While women and reproductive health was the ninth most frequently chosen topic by men, environmental health was the seventh most frequently chosen topic by women.

19.8% of the theses (n=169) received project support. The median number of pages for the theses is 117 (with a minimum of 18 and a maximum of 684), the median number of pages for the discussion section is 13 (ranging from 0 to 72), and the median number of references used is 117 (with a minimum of 0 and a maximum of 467). 29.2% of the theses (n=249) have been published, and this rate increases to 31.2% in studies conducted by men; 47.3% in studies receiving project support; 41.6% in studies conducted using laboratory findings; 36.1% in studies using examination findings data; and 33.3% in studies using radiological imaging data. The median number of authors in publications is three (minimum number of authors: 1 - maximum number of authors: 11), and the median order of the thesis author's name in publications is one (minimum order: 1 - maximum order: 4). In 7.6% of the publications (n=19), the thesis author is not the first author. Approximately 5% of the 249 theses that were published did so in the same year, and it was observed that theses were published on average within 3.2±2.3 years. Less than 30% of the published theses were published in SCI, SCI-E, Scopus group journals (Table 3).

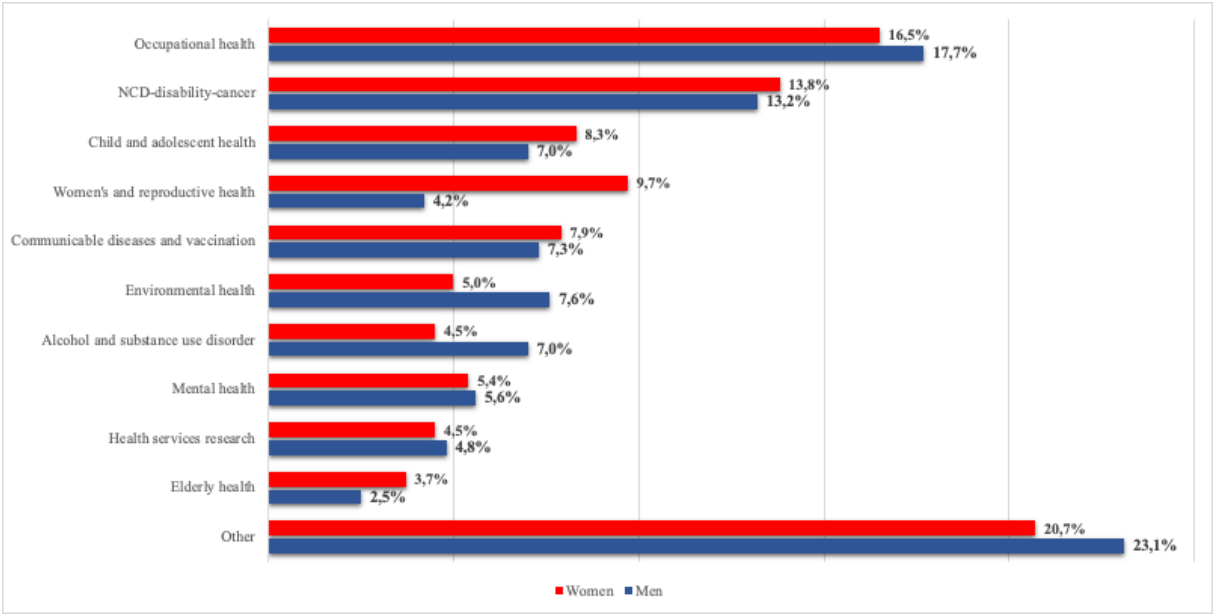

Figure 2. Distribution of main subject by gender.

Table 3. Publication period of public health theses and the indexes in which they were published (n=249).

		n	%
The duration between thesis writing and publication	In the same year	13	5.2
	One year later	50	20.1
	Two years later	42	16.9
	Three years later	54	21.7
	Four years later	34	13.7
	Five to ten years later	50	20.0
	After ten years	6	2.4
Index	SCI, SCI-E, Scopus	74	29.7
	Other international indexes	45	18.1
	National indexes	128	51.4
	National, non-peer-reviewed journals	2	0.8

The first three years with the highest number of theses turning into publications were, respectively, 2017 (n=37), 2016 (n=36), and 2018 (n=22). When looked at proportionally, it is observed that 75% of the theses conducted in 2001 and 2005 were published; however, there is a gradual decrease after the year 2016. Figure 3 illustrates the publication rates of public health specialty theses over the years.

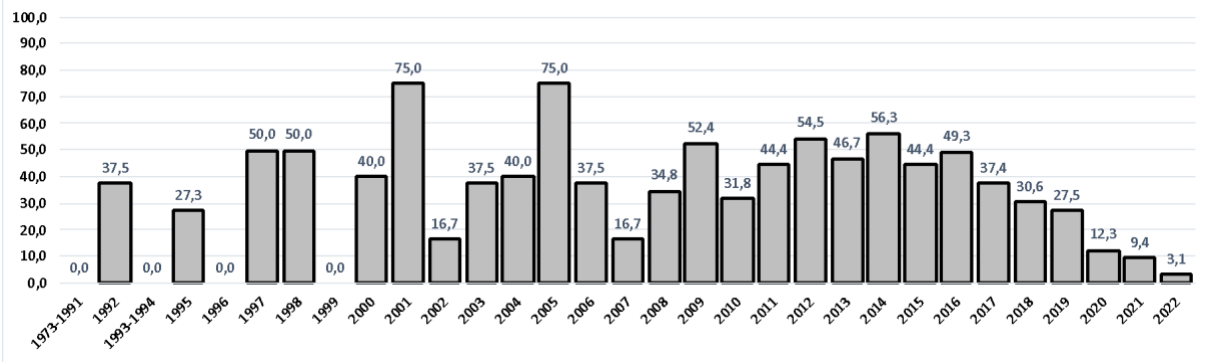

Figure 3. Publication rate of public health specialization theses over the years.

It was observed that more than 50% of the published theses were conducted in ten universities. These universities are, in order, Dokuz Eylül University (n=21), Çukurova University (n=18), Gazi University (n=15), Erciyes University (n=13), Hacettepe University (n=11), Ege University (n=10), Marmara University (n=10), Ondokuz Mayıs University (n=10), Istanbul University (n=9), and Pamukkale University (n=9). The publication rates of the top ten most researched topics are presented in Table 4. According to this, among the top ten most researched topics, the top three topics with the highest publication rates were health service research, alcohol and substance use disorder, and elderly health. Three topics with high publication rates stand out among the thesis topics, even though they are less studied. Specifically, 80.0% (n=4) of health education studies, 57.1% (n=12) of scale development studies, and 57.1% (n=4) of migrant health studies were published as an article.

Table 4. Publication rates of the top ten most researched topics.

Topic	n	%
Health service research (n=40)	18	45.0
Alcohol and substance use disorder (n=48)	16	33.3
Elderly health (n=27)	9	33.3
Non-communicable diseases-disability-cancer (n=115)	34	29.6
Women's and reproductive health (n=65)	19	29.2
Child and adolescent health (n=66)	19	28.8
Mental health (n=47)	13	27.7
Communicable diseases and vaccination (n=65)	17	26.2
Occupational health (n=144)	37	25.7
Environmental health (n=52)	13	25.0

In Table 5, the publication rates of the theses according to the research type are presented. Accordingly, it is observed that the publication rate is significantly higher than the average for theses conducted in cohort, methodological, and case-control types.

Table 5. Rates of publication of theses according to research type.

		n	%
Research type	Cohort (n=17)	8	47.1
	Methodological (n=43)	16	37.2
	Case control (n=26)	9	34.6
	Cross-sectional (n=528)	157	29.7
	Descriptive (n=135)	35	25.9
	Interventional (n=49)	12	24.5
	Qualitative (n=30)	7	23.3

DISCUSSION

In the study, which examined 854 medical speciality theses conducted between 1973, when the first public health thesis that can be accessed digitally was conducted, and the end of 2022, it was observed that more than 90% of the theses were conducted in the province where the university was located, more than 90% used questionnaires as data collection method, less than 20% received project support and less than 30% were published as an article. It was observed that the publication rate of theses receiving project support, as well as those based on laboratory examinations, radiological findings, and cohort, methodological, and case-control study designs, was higher than the average.

Although public health is related to many areas affecting the society, it is seen that almost half of the studies are focused on more traditional issues such as occupational health, non-communicable diseases, child health, women's health. Studies on a new infectious disease, which remains on the public agenda and in the media for a certain period of time and whose negative health consequences may appear years later tend to decrease over time. Similarly, research on migrants following a wave of migration or on disaster victims after a natural disaster also declines over time.

On the other hand occupational health, non-communicable diseases, child health and women's and reproductive health are the topics that always

concern a large percentage of the society and it is more possible and easier to reach the determined population.

In our study, it was seen that more than 75% of the theses were descriptive and cross-sectional. In a study examining all public health theses (medical specialization, master's, doctorate) conducted in our country between 2009 and 2019, it was seen that more than 80% of the theses were cross-sectional descriptive (Uzun, Baysan & Bekar, 2021). Although this rate is similar to our study, subgroup rates were also examined in the relevant study and it was seen that cross-sectional-descriptive type studies decreased and experimental studies increased in the doctoral group. This situation may be related to the greater economic needs for experimental research and the availability of more financial support in doctoral programs.

In our study, it was observed that approximately 70% of public health theses were conducted under the supervision of a professor. This rate was reported as 49.7% in orthopedics theses, 48.1% in psychiatry theses, and 45.8% in anesthesiology and reanimation theses in previous studies (Baysan, Yapar, Tokgöz, Yapar, Baysan & Tolunay, 2021; Erim & Petekkaya, 2020 ; Güç Z, 2020). The reason for this decrease in clinical branches may be that clinician professors prefer to work in private health institutions.

It is believed that the low rate of theses turning into articles is attributed to various reasons, primarily including lack of time, financial burden, and excessive workload. In particular, the process of getting used to a new environment and a different workflow from the university may prevent the early conversion of the thesis into a publication, especially for physicians who are appointed with compulsory service after speciality education. The desire to turn the thesis into a publication may be associated with the desire to become an academician and may be ignored for those who do not plan to become academicians. The low rate of international publications may also be related to the language barrier and possible economical problems. Another reason for the low publication rates especially in SCI, SCI-E, Scopus group journals may be that international journals reject some study results as being related to local problems.

In a study conducted by Özgen et al. in 2011, analyzing all medical specialty theses conducted in Turkey between 1980 and 2008, a total of 22,625 theses were examined and it was determined that the rate of publish as an article for all branches was 6.2%. In the study, it was determined that the rate of publish as an article for medical specialty theses in the field of public health is 1.5% (Özgen, Eğri & Aktaş, 2011). In our study, it was observed that this rate increased to nearly 30%. This shows that the trend of converting theses to publication has increased over the years. In our study, it was observed that 29.7% of the public health specialty theses converted into an articles. In a study investigating the publication rate of specialty theses in the field of anesthesia and reanimation, it was found that 25.7% of the theses were published and 44.3% of those published were in the SCI and SCI-E groups. (Güç, 2020). Although a low rate of 11.5% of the theses in the Department of Family Medicine were published as articles, 34.1% of these published theses were found to be indexed in the SCI and SCI-E journals (Üçer&Keten, 2016).

In our study, it was determined that the average publication year of the theses published as an article was over three years. When compared with other studies examining theses conducted over 30 years, this average is observed to be 3.1 years for specialty theses in the field of anesthesia and reanimation, 3 years for specialty theses in the field of ecology and hydroclimatology, and 2.8 years for specialty theses in the field of psychiatry (Güç, 2020; Kardeş, 2019; Erim&Petekkaya, 2020). The median duration of over three years for publication, as found in our study, may explain why the publication rate of theses in 2021 and 2022 is below 10%, as these theses might not yet have had sufficient time to be converted into publications.

As of 2011, there has been a significant increase in the number of public health positions in the Medical Specialization Examination in Turkey, with a further acceleration in 2012. This may help explain the upward trend in the number of theses between 2015 and 2017, following the four-year training period in public health (Kılıç, Şahan &Bahadır, 2014). In our study, it was observed that almost all researchers collected data solely from the city where the university was located, with few studies conducted in other provinces or across multiple provinces. This might be attributed to rising transportation and accommodation costs, challenges in obtaining permission, or a reluctance to venture beyond one's familiar surroundings. Furthermore, the limited number of examination/laboratory/imaging studies could be linked to the escalating costs of such studies and the challenges in obtaining ethics committee permissions. The prolonged duration required for the interview and analysis stages of qualitative studies may explain why they are less preferred in thesis studies that must be completed within a limited timeframe.

CONCLUSION

While the rate of publication for public health theses has demonstrated an upward trend over the years, it remains relatively low. Solutions should be devised to foster the publication of specialty theses. Spreading thesis studies across the duration of education, as opposed to a condensed timeframe, and augmenting financial support from universities for scientific research can enhance studies in terms of data collection methods and outreach. This could ensure that the research derived from specialty theses in the field of public health in Turkey gains greater

prominence on the international stage. It is crucial to delve into the reasons behind the low publication rates and develop solutions. A comprehensive case-control study, conducted through professional organizations to reach all public health specialists in the country, would offer valuable insights and contribute to addressing this issue.

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Conflict of Interest
The author declare no potential conflicts of interest with respect to the research, authorship and/or publication of this article.

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It is not within the scope of the study requiring ethics committee approval.

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Herbalists' Approaches to the Use of Herbal Products During Pregnancy: A Qualitative Study

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ABSTRACT
Objective: The aim of this study was to determine herbalists' approaches to the use of herbal products during pregnancy. **Materials and Methods**: A descriptive, phenomenological design, one of the qualitative research methods, was used. The study was conducted with 16 individuals working as herbalists in Samsun province, located in the north of Turkey, between January and June 2023. The experiences of herbalists about herbal product use during pregnancy were examined using the individual in-depth interview technique, and the data analysis was performed using the thematic analysis method. The results obtained from the research were reported in accordance with the SRQR criteria. **Results**: As a result of the analysis, four main themes were identified: (1) presenting complaints of pregnant women; (2) herbal products that pregnant women purchase from herbalists; (3) the person(s) recommending the herbal product; (4) herbalists' approach to herbal products. Pregnant women mostly presented to herbalists to increase breast milk or with nausea-vomiting and constipation complaints. It was determined that they often purchased fennel, ginger, and anise for these complaints and got advice from herbalists about using herbal products. Herbalists mostly recommended rose of Jericho (*Anastatica hierochuntica* L.), linden, and fennel thinking that they were beneficial during pregnancy but they did not recommend yarrow as they thought it was harmful. **Conclusion**: It was concluded that pregnant women received advice from herbalists about herbal products and that some herbalists recommended herbal products that were not normally recommended for use during pregnancy.
Keywords: Herbalist, Herbal Medicine, Herbal Product, Pregnancy.

Gebelik Döneminde Bitkisel Ürün Kullanımına Yönelik Aktarların Yaklaşımları: Nitel Bir Çalışma

ÖZ
Amaç: Bu çalışmanın amacı, gebelik döneminde bitkisel ürün kullanımına yönelik aktarların yaklaşımını belirlemektir. **Gereç ve Yöntem:** Bu çalışmada, nitel araştırma yöntemlerinden tanımlayıcı fenomenolojik desen kullanıldı. Çalışma, Ocak-Mayıs 2023 tarihleri arasında Türkiye'nin kuzeyinde yer alan Samsun ilinde aktarlarda çalışan 16 bireyle yürütüldü. Aktarda çalışan bireylerin gebelerin bitkisel ürün kullanımı ile ilgili deneyimleri bireysel derinlemesine görüşme tekniği kullanılarak incelendi ve verilerin analizi, tematik analiz yöntemi kullanılarak yapıldı. Araştırmadan elde edilen sonuçlar ise SRQR kriterleri doğrultusunda rapor edildi. **Bulgular:** Analizin sonucunda dört ana tema belirlendi: (I) gebelerin başvurduğu şikayetler; (II) gebelerin aktardan aldığı bitkisel ürünler; (III) bitkisel ürün tavsiye eden kişi/kaynak; (IV) aktarların bitkisel ürün ile ilgili yaklaşımı. Gebelerin daha çok anne sütünü arttırmak, bulantı-kusma ve kabızlık şikayetleri için aktara başvurdukları, bu şikayetler için en fazla rezeneyi, zencefili ve anasonu satın aldıkları, bitkisel ürün kullanımı ile ilgili aktardan da tavsiye aldıkları, aktarlar meryem ana otunu, ıhlamuru ve rezeneyi gebelik döneminde yararlı olduğu düşüncesiyle tavsiye ederken civan perçemini zararlı olduğu düşüncesiyle tavsiye etmediği saptanmıştır. **Sonuç:** Gebelerin bitkisel ürün ile ilgili aktarlardan tavsiye aldığı, bazı aktarların gebelik döneminde kullanılması önerilmeyen bitkisel ürünleri tavsiye ettiği sonucuna varılmıştır.
Anahtar Kelimeler: Aktar, Bitkisel Tıp, Bitkisel Ürün, Gebelik.

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INTRODUCTION

Herbal products are applications to prevent diseases and support treatment implemented using plants with scientifically proven medical effects, their parts containing active ingredients, and pharmaceutically processed forms such as tablets and capsules (World Health Organization, 2019). In a systematic review, the rate of herbal product use during pregnancy was reported as 34% (Xiong et al., 2023). This rate varies between 33% and 48% in developing and underdeveloped countries (Abdollahi et al., 2018; Aljofan and Alkhamaiseh, 2020; Ayhan and Akalım, 2021; Kıssal et al., 2017). The rate of these herbal product use varies according to the region of residence, ethnicity, education, and socioeconomic status, and therefore problems arise in their scientific evaluation and management (El Hajj and Holst, 2020; Jahan et al., 2022).

Physiological, psychological, and hormonal changes occur during pregnancy and these changes cause nausea, vomiting, pain, anxiety, or constipation (Anteneh et al., 2022; John and Shantakumari, 2015; Kıssal et al., 2017). Pregnant women tend to use herbal products that are easily accessible and do not require a prescription to cope with these problems. This tendency is based on the belief that herbal products are more natural and safer for both the woman and her baby (Kıssal et al., 2017; Jahan et al., 2022; John and Shantakumari, 2015; Illamola et al., 2020). However, herbal products used during pregnancy cause serious side effects by interacting with medications and even lead to fetal death, preterm birth, uterine bleeding, abortion, and mental retardation (Eid et al., 2020; Xiong et al., 2023). For these reasons, the United States Food and Drug Agency, the European Medicines Agency, and the German Commission E do not recommend the use of herbal products during pregnancy (John and Shantakumari, 2015).

Herbal products commonly used during pregnancy are sage, raspberry, Aloe Vera, anise, thyme, cranberry, mint, chamomile, garlic, green tea, and ginger (Dafam et al., 2021). Pregnant women receive advice about these products from family, relatives, friends, and social media (such as the Internet, and television) in addition to health personnel (Kıssal et al., 2017). It has even been reported that pregnant women who use herbal products by taking advice from non-health personnel hide this information from healthcare professionals (John and Shantakumari, 2015; Nyeko et al., 2016). This situation delays the treatment that the pregnant woman should receive, decreases the effect of the prescription drug used, and endangers the health of the mother and baby (Nyeko et al., 2016).

The World Health Organization emphasizes that those who will recommend or supervise the use of herbal products should have education about them (World Health Organization, 2013). Some studies on the use of herbal products during pregnancy have indicated that pregnant women receive advice from family, relatives, friends, neighbors, and social media in addition to health personnel (Demirci Kayıran and Kırıcı, 2019; Leke et al., 2022; Jahan et al., 2022). A review of the literature has shown that there is no study on the investigation of pregnant women's status of receiving advice from herbalists about herbal products and herbalists' approaches. This formed the starting point of this study. It is thought that the data to be obtained in the present research will contribute to the legal regulations on traditional and complementary medicine practices, education of herbalists, regulations about starting a business, increasing maternal and fetal health, and health personnel.

This study was conducted to examine herbalists' approaches to the use of herbal products during pregnancy.

MATERIALS AND METHODS

Type of the study

A descriptive phenomenological design, one of the qualitative research approaches, was used, and the results were reported in line with the SRQR criteria.

Setting and time of the study

The research was conducted with individuals working as herbalists in Samsun province, located in the north of Turkey, between January and June 2023.

Population and sample of the study

The population of the research consisted of 16 individuals working in herbalist shops located in the Atakum district of Samsun province. The sample size of the study was determined using the criterion sampling method, one of the purposive sampling methods. According to the literature, the sample size of qualitative studies can be determined according to the saturation point of the responses given to the research questions, and generally, 5-25 people are considered enough (Aksayan and Emiroğlu, 2002; Başkale, 2016). Accordingly, interviews with individuals in the study continued until the data saturation point was reached. Individuals who sold herbal products to pregnant women during the study and agreed to participate were included, and individuals with a total work experience of less than one month were not included in the study.

Data collection tools

Research data were collected with a semi-structured interview form prepared by the researchers following a review of the literature (Anteneh et al., 2022; John and Shantakumari, 2015; Kıssal et al., 2017). The semi-structured interview form consisted of questions to determine herbalists' approaches to herbal product use during pregnancy (Table 1). The semi-structured interview form was piloted to two individuals to evaluate its intelligibility and applicability, and these individuals were not included in the study.

Data collection

In this process, the purpose of the research was explained to the individuals, taking into account the

inclusion criteria of the research, they were informed that the interviews would be audio recorded, and their informed consent was obtained. The data were collected by the researchers using the in-depth interview technique. Each interviewee was given a number. The interviews were held at the participants' convenience and continued until the data saturation point was reached. Each interview lasted about an hour.

Table 1. Interview questions.

- What complaints (nausea-vomiting, heartburn, cramps, etc.) do pregnant women usually present to you with?
- What herbal products do they prefer for certain complaints?
- Could you tell us who or where pregnant women (health personnel, relatives, close circles, social media, etc.) get advice from for herbal products?
- Do pregnant women ask you for advice about herbal products?
- Could you tell us about herbal products that you think are beneficial during pregnancy?
- What herbal products do you think are harmful to use during pregnancy?

Data analysis

The audio recordings of the interviews were transcribed verbatim, and participants were given codes. Study data were thematically analyzed by both researchers using the inductive approach cited by Braun and Clarke (Yıldırım and Şimşek, 2018). The raw data were read line-by-line. Categories and themes were created by open coding in the first stage and typological coding in the second stage. In case of an inconsistency between the researchers' comments, the case was discussed and a consensus was reached. As a result, four themes and sixteen sub-themes were elicited from the data. The reliability of the findings was supported based on four basic criteria: reliability, transferability, reliability, and confirmability. All data were stored on a password-protected computer that only the research team had access to.

Ethical considerations

This research was conducted in accordance with the principles of Helsinki Declaration. The approval of the Ondokuz Mayıs University Social and Human Sciences Ethics Committee (Approval no.: 2022/1143; Date: 30.12.2022) was obtained. Considering the inclusion criteria of the study, individuals were informed about the purpose of the study, and written consent was obtained from those who volunteered to participate.

RESULTS

Seven of the participants in the study were high school graduates, three had an associate degree, and six had an undergraduate degree. Only two of them had attended a phytotherapy course about herbal products, and most of them were willing to receive education on them (Table 2).

Table 2. Participants' descriptive characteristics.

Code name	Age	Sex	Total work experience	Education	Status of liking the profession	Status of having received training on herbal products	Willingness to receive education on herbal products
P1	20	Female	3 months	Associate degree	Yes	No	Yes
P2	18	Female	9 months	High school	Yes	No	Yes
P3	25	Female	1.5 years	High school	Yes	No	Yes
P4	20	Female	2 years	High school	Yes	No	Yes
P5	49	Male	12 years	High school	Yes	Yes	No
P6	42	Male	2 years	Undergraduate degree	Yes	No	No
P7	28	Male	5 years	Undergraduate degree	Yes	No	No
P8	35	Male	20 years	Associate degree	Yes	Yes	Yes
P9	26	Male	6 years	Undergraduate degree	Yes	No	Yes
P10	33	Male	3 years	High school	Yes	No	Yes
P11	28	Male	6 years	Undergraduate degree	Yes	No	Yes
P12	51	Male	2 years	Undergraduate degree	Yes	No	Yes
P13	32	Male	12 years	High school	Yes	No	Yes
P14	24	Female	2 years	Associate degree	Yes	No	Yes
P15	36	Female	8 months	High school	Yes	No	Yes
P16	31	Male	4 years	Undergraduate degree	Yes	No	Yes

Following the data analysis, four themes and sixteen sub-themes were obtained (Table 3).

Theme 1. Presenting complaints of pregnant women

Participants stated that pregnant women often presented with complaints, such as low milk supply, nausea, vomiting, and constipation. Their statements about pregnant women's presenting complaints were as follows.

"Pregnant women come to find out what tea or what other products they can use to reduce nausea and relax." (P1)

"They come to us with complaints of bloating and edema." (P3)

Theme 2. Herbal products that pregnant women purchase from herbalists

Herbal products purchased to increase breast milk

Almost all of the herbalists stated that women came to increase breast milk during pregnancy and they mostly preferred fennel, nettle, and anise. Their statements regarding this theme were as follows:

"Fennel as it makes milk ... so that they can produce more milk." (P1)

"To increase milk, they can consume dates, fennel, cumin, or anise. They can consume the tea form of the products. They can also consume nettle in the form of tea. They can mix and consume all of what I've said. Anise and cumin can be mixed and brewed in the form of tea and consumed." (P2)

"There are products such as nettle and fennel for increasing milk." (P5)

"There are herbal tea products which are blends of several herbs that increase breast milk. They contain allspice, cloves, turmeric, ginger, cinnamon, and fennel." (P6)

"We generally recommend nettle, fennel, anise, or fibrous foods to increase breast milk." (P9)

Herbal products for nausea and vomiting

Some participants stated that pregnant women mostly preferred ginger for nausea and vomiting and that linden, yarrow, mint, and fennel were also preferred. Their statements regarding this topic were as follow.

"We usually give peppermints for nausea and vomiting, and echinacea for coughs." (P6)

"Ginger is purchased for nausea and vomiting; it can be used for nausea. Physicians, too, recommend it." (P8)

"They usually present with nausea and the flu. They mostly prefer ginger and linden." (P9)

"For nausea and vomiting, I only recommend fennel and ginger." (P10)

Herbal products purchased for easy vaginal delivery

Participants stated that pregnant women preferred rose of Jericho as an herbal product for easy vaginal delivery, and one participant mentioned bay leaf. Their statements on this subject were as follows.

"Rose of Jericho is considered to facilitate childbirth; they put it directly into hot water. They drink its water after brewing for10 minutes." (P2)

"They purchase rose of Jericho to brew and drink to give birth easily." (P11)

"They make rose of Jericho tea for easy childbirth." (P14)

"For easy childbirth, we give rose of Jericho and bay leaf. They consume the bay leaf tea starting one week before the birth. Half a glass in the morning and evening accelerates and facilitates childbirth." (P16)

Theme 3. The person(s) recommending the herbal product

Participants stated that pregnant women usually received advice from social media (television, the Internet), family, and herbalists apart from health personnel. Their statements on this subject were as follows.

"There are a lot of people who get advice from their relatives, while the number of those who get advice from doctors, midwives, and nurses is less." (P1)

"They come here after they get information from the Internet, their families, and close circles. More than 50% of them come after learning about products from television." (P11)

"They usually come with advice from grandma or mom. There are more and more people who learn about herbal products from the Internet and television. (P16)

"Many pregnant women come to consult us because they do not want to take medication or they are not given medication. After getting a diagnosis from the doctor, they come to consult us before going to the pharmacy. In cases where the physician cannot prescribe medicine, we are the first address." (P16)

Theme 4. Herbalists' approach to herbal products

Status of giving advice

More than half of the herbalists stated that they did not recommend herbal products to pregnant women or that they gave them products recommended by physicians. Four of the herbalists stated that they recommended herbal products to pregnant women, and it was determined that these herbalists had not received phytotherapy training. Some of the participants' views on this issue were as follows.

"Since pregnancy is a troublesome process, we cannot recommend herbal products to any pregnant women, even though we have received training on this subject. We recommend that a pregnant woman consult her doctor when she wants to purchase an herbal product." (P3)

Table 3. Themes, sub-themes and meaning units obtained as a result of data analysis.

Themes	Sub-themes	Meaning units
Presenting complaints of pregnant women		Increasing breast milk Nausea and vomiting Constipation Easy vaginal delivery Gas pain Edema Cold, and the flu Anemia Anxiety Infection Weight loss Insomnia
Herbal products that pregnant women purchase from herbalists	Increasing breast milk	Fennel, Nettle, Anise, Cumin, Fenugreek, Chamomile, Ginger, Okra flower, Dill, Clove, Lemon balm, Sugar beet, Cinnamon, Allspice, Green tea, Turmeric
	Nausea and vomiting	Ginger, Linden, Yarrow, Mint, Fennel
	Constipation	Alder buckthorn, Senna, Sage
	Easy vaginal delivery	Rose of Jericho, Bay leaf
	Gas pain	Fennel, Anise, Nettle, Cumin
	Edema	Cherry stalks, Corn silk, Avocado, Chamomile, Green tea
	Cold and the flu	Sage, Linden, Ginger, Anise, Quince leaf, Echinacea, Chamomile, Fennel
	Anemia	Bitter melon, Fennel
	Anxiety	Sage, Anise, Nettle, Cumin, Lemon balm, Chamomile, Fennel
	Infection	Sage, Dried mulberry, Echinacea, Cherry stalks, Ginger
	Losing weight	Senna
	Insomnia	Sage
The person(s) recommending the herbal product		Health personnel Social media (television, the Internet) Family Herbalists Relatives Friends Neighbors
Herbalists' approach to herbal products	Status of recommending herbal products	I would definitely not recommend. I would recommend only using the medicines the physician prescribes. I recommend some herbs when pregnant women ask for them.
	Recommended usage	Herbal products recommended because they are considered beneficial: Rose of Jericho, Linden, Fennel, Anise, Nettle, Cumin, Corn silk, Cherry stalks, Avocado, Sage, Echinacea, Peppermint, Cinnamon, Chamomile, Lemon balm, Ginger, Alder buckthorn
		Herbal products not recommended because they are considered harmful: Yarrow, Sage, Echinacea, Ginger, Mallow , St. John's wort
	Recommendations for the usage of herbal products	Drinking as tea Eating plant powders mixed with milk or honey Mouthwash
	Recommendations for the frequency of herbal product consumption	Once a day Twice a day Four times a day

"We can't recommend pregnant women any products when they have pain or something else. The only thing they can use is linden." (P7)
"They usually come with information from their physician or an authorized person. They are conscious. There is no plant that we can recommend other than specialist advice because pregnancy is a very special period." (P8)
"When asked, I don't usually mention herbal mixtures; I recommend fennel, linden, ginger, and anise, which are known as the least harmless." (P9)

Way of giving advice

Some participants stated that they recommended some herbal products such as rose of Jericho, linden, fennel, anise, nettle, and cumin to pregnant women because they thought that they were beneficial during pregnancy. Some of the views on this issue were as follows;

"Edema complaint is really common; we recommend a mixture of these three plants: corn silk, cherry stalks, and avocado leaf." (P4)
"I usually recommend fennel, linden, ginger, and anise, which are known to be harmless." (P9)
"They come with nausea and vomiting complaints and to increase milk. I only recommend fennel and ginger for nausea and vomiting." (P10)

Only three participants stated that some herbal products, such as sage, yarrow, hibiscus, echinacea, St. John's Wort, and ginger, were harmful during pregnancy. Other participants did not make any comments on this issue. Some of their views on this issue were as follows.

"Sometimes they come with constipation complains; sage is a bit risky in this case. We also have alder buckthorn for constipation, but we do not recommend it to pregnant women as it may be risky." (P6)
"Yarrow relieves nausea in a normal person, but pregnancy is a very different situation. Normally, we can use echinacea, ginger, or hibiscus for the flu, but we cannot give them to pregnant women." (P8)
"For example, we do not give yarrow or St. John's Wort tea because it has blood thinning properties." (P13)

It was determined that participants advised pregnant women to use herbal products in the following ways: making tea; mixing herbal powders with milk or honey; mouthwashing with their juice. Some of their views on this issue were as follows.

"They use it as tea; they put it into boiling water, brew for five minutes, and consume it. It can be consumed in the morning and evening or once a day." (P4)
"They can consume ginger powder mixed with honey. They usually consume linden as tea." (P9)
"Mix ginger with honey for a sore throat or a cold. Use sage with milk for coughs and sore throats." (P13)

It was determined that herbalists mostly advised pregnant women to consume herbal products twice a day. Some of their views on this issue were as follows;

"It is usually consumed twice a day; morning and evening. Some teas are not recommended more than twice a day because their excessive consumption is harmful and risky." (P6)
"Consume one to two times a day; more than twice a day creates problems." (P9)
"How many times a day each herb will be consumed varies; usually they are consumed twice a day. Herbs such as linden can be consumed four times a day." (P14).

DISCUSSION

In this study, conducted to determine herbalists' approaches to the use of herbal products during pregnancy, it was determined that pregnant women mostly presented to herbalists to increase breast milk and facilitate vaginal childbirth and with nausea, vomiting, and constipation complaints. Similar to our study findings, in a study conducted in Uganda, it was reported that pregnant women used herbal products for initiation of labor, pain, nausea, and vomiting complaints (Nyeko et al., 2016). In a study conducted in Saudi Arabia, it was stated that pregnant women used herbal products to increase breast milk and facilitate vaginal childbirth (Aljofan and Alkhamaiseh, 2020). Contrary to our study findings, some studies in the literature have shown that pregnant women use herbal products to increase energy, eliminate gastrointestinal system-related problems, and reduce cold and flu symptoms (Ibanda et al., 2021; John and Shantakumari, 2015). It was determined in a systematic review that pregnant women used herbal products for pain, anxiety, nausea, and vomiting complaints (Kam et al., 2019). It was also found in our study that pregnant women mostly purchased fennel, ginger, and anise for these complaints. Similar to our study finding, it was reported that pregnant women from Bangladesh, Palestine, and Uganda mostly preferred fennel, nettle, anise, ginger, alder buckthorn, black cumin, chamomile, sage, and thyme (Jahan et al., 2022; Nyeko et al., 2016). Contrary to our findings, it was stated that pregnant women from Australia, Norway, and Tuscany usually preferred raspberry, fennel, and St. John's Wort (John and Shantakumari, 2015). This shows that the complaints that cause the use of herbal products by pregnant women and the herbal products they use for these complaints are different in every culture. Therefore, it can be said that there is a need to determine the complaints that cause the use of herbal products by pregnant women in every society and the herbal products applied for these complaints. Individuals who will recommend or supervise the use of herbal products should have education on them (World Health Organization, 2013). However, some studies in the literature have shown that pregnant women get information about the use of herbal products primarily from their families (Jahan et al.,

2022; Leke et al., 2022). Similarly, in our study, it was determined that pregnant women received advice primarily from social media, family, and herbalists, apart from health personnel, regarding the use of herbal products. Similar to our study finding, in the literature have indicated that pregnant women receive advice from herbalists about herbal products (Leke et al., 2022). These results are important in terms of revealing that pregnant women receive advice from herbalists for the use of herbal products, which shows that legal regulations regarding opening an herbal shop and working in these shops should be put into effect.

Women use ginger, an antiemetic agent, for nausea and vomiting during pregnancy (Kul Uçtu et al., 2018). According to a report published by the American Society of Obstetrics and Gynecology, ginger is effective in reducing nausea during pregnancy but not vomiting (Committee on Practice Bulletins Obstetrics, 2018). Fennel, anise, linden, sage, and nettle have been reported to be effective in stimulating, initiating, and maintaining milk production (Ghasemi et al., 2015; Romm, 2017). Anise is safe to use during pregnancy; it is used to treat genital infections and reduce the risk of preterm birth (Almoayad et al., 2021). Although sage is safe to use after 37 weeks of gestation, high doses may cause miscarriages (Almoayad et al., 2021). In our study, herbalists stated that they recommended rose of Jericho, linden, fennel, anise, nettle, cumin, corn silk, cherry stalks, avocado, sage, echinacea, mint, cinnamon, chamomile, lemon balm, ginger, and alder buckthorn because they thought they were beneficial. Of these herbal products, rose of Jericho, fennel, nettle, cumin, cherry stalks, lemon balm, ginger, and alder buckthorn can be used during pregnancy (Chevallier, 2016). However, anise, corn silk, avocado, sage, echinacea, peppermint, cinnamon, and chamomile are not recommended to be used during pregnancy as they may cause abortion, premature birth, and low birth weight (Chevallier, 2016, Sarecka-Hujar and Szulc-Musiol, 2022). It is thought that herbalists' recommendation of these herbal products to pregnant women may be due to the lack of information about herbal products that can be used during pregnancy.

In our study, herbalists who had education on herbal products stated that they did not recommend yarrow, sage, echinacea, ginger, hibiscus, and St. John's Wort because they thought they were harmful during pregnancy. Of these plants, yarrow, sage, hibiscus, St. John's wort, and echinacea are not recommended during pregnancy as they may cause abortion, stillbirth, and fetal malformations (Chevallier, 2016; Schafer et al., 2021; European Medicines Agency, 2018). High doses of sage may cause abortions (Almoayad et al., 2021). This shows that giving education to herbalists about herbal products will be effective, and it is necessary to increase public health.

Study strengths and limitations

The strengths of this qualitative research were that interviews were conducted by the same person, study data were reported according to the SRQR criteria, and the reliability of the findings was achieved based on four criteria. The limitation of the study was that since the study data were obtained through interviews, they can only represent herbalists who participated in the research.

CONCLUSION

In conclusion, it was determined that pregnant women mostly presented to herbalists with complaints of increasing breast milk, nausea-vomiting, and constipation. They usually purchased fennel, ginger, and anise for these complaints. In addition, they got advice from herbalists about using herbal products. Some herbalists recommended consuming rose of Jericho, linden, and fennel during pregnancy as these were thought to be beneficial. They did not recommend yarrow because it was considered harmful. They also recommended consuming herbal products usually in the form of tea twice a day. In line with these results, it is necessary to enact some regulations on opening an herbalist shop or receiving training on herbal products to work as an herbalist; otherwise, herbal products should only be sold in pharmacies. It may be recommended that pregnant women should be given qualified training on herbal products, especially in prenatal care services. In addition, it may be recommended to carry out quantitative and qualitative studies on the use of herbal products during pregnancy and experimental studies on the examination of their effects on pregnancy.

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Conflict of Interest

No conflict of interest has been declared between the authors.

Author Contributions

Plan, design: YS, EK; **Material, methods and data collection:** YS, EK; **Data analysis and comments:** YS; **Writing and corrections:** YS, EK.

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Ethical Approval

Institution: Ondokuz Mayıs University Social and Human Sciences Ethics Committee
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Relationship Between Spiritual Care Needs and Sleep Quality in Older Patients with Cancer

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ABSTRACT
Objective: To investigate the spiritual care needs and sleep quality of older patients with cancer and determine the relationship between these variables. **Materials and Methods:** Research was conducted with 174 older patients with cancer. Data were collected using Introductory Information Form, Spiritual Care Needs Inventory, Pittsburgh Sleep Quality Index. Data were analyzed using Independent Two Sample T, Mann Whitney U, One-Way Analysis of Variance and Pearson Correlation Tests. **Results:** The spiritual care needs of those who were married, never used caffeine, used traditional treatment, and who could not fulfill their religious activities during cancer process were higher. Participants with additional chronic diseases had poor sleep quality. 71.8% of participants had poor sleep quality, 58.3% of those had high spiritual care needs. According to mean scores of the scales, participants had moderate spiritual care needs, poor sleep quality. No significant relationship (r= -0.026; p=0.733) was found between spiritual care needs and sleep quality. **Conclusion:** Although there was no relationship between spiritual care needs and sleep quality of older patients with cancer, they had spiritual care needs and their sleep quality was poor. The spiritual care needs of this population should be met and interventions to improve sleep quality should be planned.
Keywords: Nursing, Cancer Care, Spiritual, Sleep, Older Health.

Yaşlı Kanser Hastalarında Spiritüel Bakım Gereksinimi ile Uyku Kalitesi Arasındaki İlişki

ÖZ
Amaç: Yaşlı kanser hastalarında spiritüel bakım gereksinimlerinin ve uyku kalitelerinin belirlenmesi ve değişkenler arasındaki ilişkinin saptanması amaçlanmaktadır. **Gereç ve Yöntem:** Araştırma 174 yaşlı kanser hastası ile yürütüldü. Veriler, Tanıtıcı Bilgi Formu, Spiritüel Bakım Gereksinimleri Ölçeği ve Pittsburgh Uyku Kalitesi Ölçeği ile toplandı. Veriler Bağımsız İki Örnek T, Man Whitney U, Tek Yönlü Varyans Analizi ve Pearson Korelasyon Testleri ile analiz edildi. **Bulgular:** Evlilerin, hiç kafein kullanmayanların, geleneksel tedavi kullananların, kanser sürecinde dini aktivitelerini hiç yerine getiremeyenlerin spiritüel bakım gereksinimlerinin daha yüksek olduğu belirlendi. Ek kronik hastalığı olanların uyku kalitesinin daha kötü olduğu saptandı. Katılımcıların %71.8'inin uyku kalitesinin zayıf ve %58.3'nün bakım gereksinimlerinin yüksek olduğu bulundu. Katılımcıların genel ölçek puan ortalamalarına göre spiritüel bakım gereksinimlerinin orta düzeyde ve uyku kalitelerinin kötü olduğu belirlendi. Yaşlı kanser hastalarında spiritüel bakım gereksinimleri ile uyku kalitesi arasında anlamlı bir ilişki (r: -0.026; p: 0.733) olmadığı ortaya çıktı. **Sonuç:** Yaşlı kanser hastalarının spiritüel bakım gereksinimleri ve uyku kaliteleri arasında ilişki bulunmamasına rağmen, spiritüel bakım gereksinimleri olduğu ve uyku kalitelerinin kötü olduğu belirlenmiştir. Bu hastaların spiritüel bakım gereksinimleri karşılanmalı, uyku kalitesini arttırmaya yönelik girişimler planlanmalıdır.
Anahtar Kelimeler: Hemşire, Kanser Bakım, Spiritüel, Uyku, Yaşlı Sağlığı.

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INTRODUCTION

According to the World Health Organization's GLOBACAN (Global Cancer Observatory) 2020 data, 12,355,723 individuals aged 60 years and over worldwide had cancer; 13.6% of these older patients had lung cancer, 11.4% had colorectal cancer, 9.8% had prostate cancer, 8.3% had breast cancer, and 6.4% had stomach cancer (World Health Organization, 2024). Both age-related physiological changes and cancer have a negative impact on quality of life. In addition, due to cancer and its treatment, physical and cognitive aging accelerates biologic aging with DNA damage, energy decrease, frailty, sleep disturbances, and stress increase (Carroll et al., 2022). Older individuals have to cope with the cancer treatment process and its effects. In this sense, National Comprehensive Cancer Network (NCCN) "Older Adult Oncology" version 1.2023 guide recommends comprehensive care needs to be provided for older patients (National Comprehensive Cancer Network, 2024).

It is important to evaluate spirituality, which is overlooked in older patients with cancer but is a part of the holistic approach. On the other hand, spiritual care plays a role in strengthening patients' communication, accelerating recovery, reaching peace, giving meaning to lives, and developing stress coping strategies (İsmailoğlu et al., 2019). In a study, it was stated that the pain and anxiety of patients with cancer who received spiritual care decreased (Ratshikana-Moloko et al., 2020). In another study, it was determined that almost all patients with cancer needed spiritual care, and it was reported that those who received less spiritual care experienced less peace and more depression (Pearce et al., 2012).

Another situation that should be evaluated in older patients with cancer is sleep, which is a natural process in which the body rests for a certain period and brain activity changes and consciousness decreases (Carroll et al., 2022). It has been reported that many factors such as pain, fatigue, and anxiety cause sleep disorders in older patients with cancer (Loh et al., 2017), and insomnia is observed at a rate of 25% to 69%, depending on the type of cancer (National Comprehensive Cancer Network, 2024). A study reported that 89.7% of patients with cancer aged over 65 years had poor sleep quality. It has also been stated that sleep quality worsens 1.04 times with aging (Endeshaw et al., 2022). Insufficient sleep causes many negative effects such as delay in the elimination of metabolic wastes, stress, fragility, development of inflammation, pain, negative emotions, depression, fatigue, and memory problems (Carroll et al., 2022).

Although no significant results were found in a study evaluating the relationship between sleep quality and mental well-being in women with breast cancer, it was stated that there was a significant relationship between sleep transition and sleeping pill use and religious activities (Khoramirad vd., 2015).

A review has shown that a wide variety of techniques such as mantra, yoga, mindfulness, prayer/meditation, daily spiritual experiences, psycho-religious education, and intervention are used to treat insomnia or insomnia-related mental disorders in adults, and as a result, spirituality has a direct and indirect positive effect on insomnia (de Diego-Cordero et al., 2022). Therefore, because it is thought that there is a relationship between sleep and spiritual care, it is important to evaluate this relationship in older patients with cancer.

Older patients with cancer need to be evaluated for both insomnia and spiritual care needs to strengthen their ability to cope with their symptoms. Research has shown that spiritual care increases sleep quality in patients with cancer (Wang & Lin, 2016). However, no studies have been found in the literature that determine the relationship between the need for spiritual care and sleep quality in older patients with cancer. The NCCN guideline also recommends providing spiritual care to older patients with cancer and evaluating patients for sleep disorders (National Comprehensive Cancer Network, 2024). For this reason, it was aimed to determine the spiritual care needs and sleep quality of older patients with cancer and establish the relationship between them.

Research questions

• What is the level of spiritual care needs in older patients with cancer?
• How is the sleep quality in older patients with cancer?
• Is there a correlation between spiritual care needs and sleep quality in older patients with cancer?

MATERIALS AND METHODS

Research type

This research was descriptive and correlation-seeking. The STROBE guideline was used in reporting the research.

Research sample

Approximately 450 older patients with cancer are admitted to the Training and Research Hospital oncology outpatient clinic and inpatient clinic per month. The sample was determined using the sampling formula with a known population. The acceptable error was 5%, the population size was 450, and the confidence interval was 90%. According to the data, it was calculated that a minimum of 170 patients would be required for the research. The research was completed with 174 patients.

Inclusion criteria

- 65 years of age or older
- Being diagnosed with cancer and knowing that you have been diagnosed with cancer
- To agree to participate in the research
- No communication problems (hearing, vision, speech, etc.)

Data collection

Data were collected in face-to-face interviews with patients between June and July 2023. Data were collected from older patients coming to the oncology outpatient clinic and inpatient clinic with 10–15-minute interviews at 08.00 am until 17.00 pm on weekdays. Preliminary research was performed on 10 patients to evaluate the suitability of the questionnaires, and these data were not included in the data analysis.

Data collection tools

The data were collected using an Introductory Information Form, the Spiritual Care Needs Inventory, and the Pittsburgh Sleep Quality Index.

Introductory information form

This form, which was developed by the researchers through a literature review, consisted of 15 questions including sociodemographic and medical characteristics (Wang & Lin, 2016; Loh et al., 2017; Ratshikana-Moloko et al., 2020). The form included age, sex, education level, marital status, employment status, income status, smoking status, alcohol consumption status, caffeine (coffee) consumption status, type of cancer, cancer treatment, chronic diseases, information about non-medical treatment practices, the status of performing religious activities before the disease process, and the status of performing religious activities during the disease process.

Spiritual Care Needs Inventory (SCNI)

The SCNI was developed by Wu et al. (2016) and the Cronbach's α = 0.96. The Turkish validity and reliability study was conducted by Günay İsmailoğlu et al. (2022), and the Cronbach alpha value was found as 0.94 (İsmailoğlu et al., 2019). The scale consists of 21 items with a 5-point Likert type measuring the potential spiritual care needs of patients. The scale has two sub-scales: "meaning and hope" and "caring and respect." In the meaning and hope subscale, there have been expressions regarding the self, nature, and environmental factors of spiritual well-being, and in the caring and respect component, there are expressions regarding relationships with other people. Higher scores indicate that individuals need more spiritual care (İsmailoğlu et al., 2019). Cronbach's α value of the current research= 0.87.

Pittsburgh Sleep Quality Index (PSQI)

The PSQI was developed by Buysse et al. (1989). Turkish validity and reliability were established by Ağargün et al. (1996), and the Cronbach's α= 0.80. The PSQI consists of a total of 24 questions, 19 questions are answered by the participant and five questions are answered by the patient's sleeping companion, but only the questions answered by the person are evaluated. The scale evaluates sleep quality in the last month; subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency (sleep time/time in bed), sleep disturbance, use of sleeping pills, and daytime dysfunction. Sleep quality is defined as "good" in those whose total score is 5 points or less, and sleep quality is defined as "bad" in those whose score is more than 5 points (Agargun, 1996). Cronbach's α value of the current research= 0.78.

Ethical considerations

Permission for the research was obtained from the Clinical Research Ethics Committee (HRÜ/23.10.27). Permission to use the scale was obtained from the owners of SCNI and PSQI. The patients included were informed about the research aim and that participation was voluntary. Written informed consent was obtained from each participant.

Data analysis

Data were analyzed using the IBM Statistical Package for the Social Sciences (SPSS) V23. Data are presented with number, percentage, mean, standard deviation, median, minimum and maximum. Normality distribution was evaluated using Kolmogrow-Smirnov and Skewness Kurtosis values, and independent two-sample t-test, Mann-Whitney U test, one-way analysis of variance (ANOVA) analyses were used. The correlation between SCNI and PSQI was evaluated using Pearson's correlation analysis. The significance level=$p<0.05$.

RESULTS

The majority (89.7%) of the patients were aged 65-74 years. The majority were women (60.3%), married (91.9%), illiterate (67.8%), had lower income (54.6%), had never smoked (92.5%) or used alcohol (45.4%), used caffeine (55.2%), and were unemployed (97.1%). In addition, the majority of the patients had additional chronic diseases (53.4%), did not use traditional treatment (87.4%), performed religious activities regularly before developing cancer (96.0%), and did not perform religious activities at all during the cancer process (43.7%) (Table 1).

Older patients with cancer who were married had more spiritual care needs than those who were single ($t=8.208$, $p<0.001$), those who never used caffeine had more spiritual care needs than those who used and had quit (Welch=15.279, $p<0.001$), those who used traditional treatment had more spiritual care needs than those who did not use it ($t=2.338$, 0.021), and those who could never perform religious activities during the cancer process had more spiritual care needs than those who did them occasionally or regularly (Welch=15.588, $p<0.001$). In addition, it was found that the sleep quality of patients with additional chronic disease was worse than those without ($t=4.35$, $p<0.001$) (Table 1).

Table 1. Sociodemographics and scale scores of participants (n=174).

Sociodemographic characteristics	n	%	Spiritual care needs inventory			Pittsburgh sleep quality index		
			M±SD	Test statistics	p value	M±SD	Test statistics	p value
Age								
65-74	156	89.7	63.28±13.52	t=0.881	0.379	8.13±4.85	t=-0.027	0.979
75 and over	18	10.3	60.39±9.64			8.17±4.63		
Gender								
Man	69	39.7	63.88±12.27	t=0.73	0.466	8.03±4.55	t= -0.241	0.810
Women	105	60.3	62.39±13.77			8.21±5.00		
Marital status								
Married	160	91.9	63.91±13.31	t=8.208	**p<0.001**	7.96±4.84	t=-1.633	0.104
Single	14	8.1	52.36±3.50			10.14±4.20		
Education status								
Literate	118	67.8	61.77±13.10	F=1.585	0.208	8.06±4.75	F=2.651	0.078
Primary/Secondary school	42	24.1	65.31±14.02			9.14±5.14		
High school/University	14	8.05	66.21±10.15			5.79±3.53		
Income								
Income <Expense	95	54.6	64.51±12.59	t=1.68	0.095	8.31±4.57	t=0.502	0.617
Income≥Expense	79	45.4	61.15±13.71			7.94±5.12		
Alcohol								
Never used	161	92.5	62.57±13.35	t=-1.476	0.142	8.11±4.81	t=-0.251	0.802
Quit	13	7.5	68.15±9.70			8.46±5.01		
Smoking								
Uses	35	20.1	64.40±11.95	F=0.256	0.774	9.40±4.49	F=1.768	0.174
Never used	79	45.4	62.72±13.93			7.57±4.82		
Quit	60	34.5	62.50±12.99			8.15±4.92		
Caffeine								
Uses	96	55.2	64.02±13.33	Welch= 15.279	**p<0.001**	8.29±4.84	F=0.387	0.680
Never used	47	27.0	66.28±13.63			7.62±5.18		
Quit	31	17.8	54.77±7.99			8.45±4.23		
Employment status								
Employment	5	2.9	48(42-77)	U=539.5	0.292	11 (1-13)	U=410.5	0.914
Unemployment	169	97.1	65(21-98)			8 (0-21)		
Additional chronic disease								
Yes	93	53.4	62.44±13.34	t= -0.58	0.563	9.55±4.84	t=4.35	**p<0.001**
No	81	46.6	63.60±13.04			6.52±4.27		
Methods of used outside of medical treatment								
Yes	22	12.6	69.05±10.75	t=2.338	**0.021**	8.86±4.25	t=0.755	0.451
No	152	87.4	62.11±13.29			8.03±4.9		
Attending religious activities before the cancer								
None	3	1.7	68.67±14.01	F=0.397	0.673	4.00±4.00	F=1.711	0.184
Occasional	4	2.3	59.75±15.11			10.75±5.38		
Regular	167	96.0	62.96±13.18			8.15±4.79		
Attending religious activities during the cancer								
None	76	43.7	67.17 ±12.59	Welch= 15.588	**p<0.001**	8.79 ± 4.51	F=2.878	0.059
Occasional	44	25.3	64.50 ±13.34			8.59 ± 5.08		
Regular	54	31.0	55.85 ±10.93			6.85 ± 4.84		

t: Independent two-sample t test, U: Man Whitney u test F: One-way analysis of variance, M: Mean, SD: Standard Deviation, Min: Minimum, Max.: Maximum

The mean age of the patients was 65.95±5.64 (min. 60, max. 82) years and the most common cancer types were breast (31.0%), lung (14.9%), colorectal (9.2%), prostate (5.8%), and stomach (5.8%), respectively. The patients received chemotherapy treatment (98.9%), radiotherapy (27.6%), and immunotherapy treatments (3.4%) (Table 2).

Table 2. Clinical characteristics of participants (n=174).

Type of Cancer	**n**	**%**
Breast	54	31.0
Lung	26	14.9
Colorectal	16	9.2
Prostate	10	5.8
Stomach	10	5.8
Thyroid	2	1.1
Others*	56	32.2
Chemotherapy treatment	**n**	**%**
Yes	172	98.9
No	2	1.1
Radiotherapy treatment	**n**	**%**
Yes	48	27.6
No	126	72.4
Immunotherapy treatment	**n**	**%**
Yes	6	3.4
No	168	96.6

M: Mean, SD: Standard Deviation, Min: Minimum, Max.: Maximum, * Soft tissue, lymphoma, bone, ovary, gallbladder, bladder, leukemia, uterus, skin, multiple myeloma, pancreas, kidney, liver

The majority (71.8%) of the older patients with cancer had poor sleep quality (Table 3). According to the mean scores of the scales, the patients were found to have moderate spiritual care needs (62.98±13.18) and poor sleep quality (8.14±4.81). Additionally, no significant correlation (r= -0.026; p=0.733) was found between spiritual care needs and sleep quality in older patients with cancer (Table 4).

Table 3. Sleep quality and spiritual care levels of participants (n=174).

		Spiritual Care Needs Inventory			
		Low needs	**High needs**	**Total (n)**	**Total (%)**
Pittsburgh Sleep Quality Index	**Good sleep quality**	22	27	49	28.2
	Poor sleep quality	61	64	125	71.8
	Total (n)	83	91	174	-
	Total (%)	47.7	52.3	-	100

Table 4. Relation between spiritual care need and sleep quality in older patients with cancer.

Scales	**M±SD**	**Median (Min-Max)**	**Correlation analysis**
Spiritual Care Needs Inventory	62.98±13.18	65 (21-98)	r: -0.026; p: 0.733
Pittsburgh Sleep Quality Index	8.14±4.81	8 (0-21)	

Pearson Correlation, M:Mean, SD: Standard Deviation, Min: Minimum, Max.: Maximum

DISCUSSION

In the present study, more spiritual care needs were found among married patients compared with those who were single, those who never used caffeine, those who used traditional treatment, and patients who could not perform religious activities during the cancer process. It is thought that married older patients with cancer have more spiritual needs because they give meaning to both themselves and their spouses in terms of life, existence, and hope. Caffeine provides positive emotions such as peace, joy, and energy, thus it is thought that patients who have never used caffeine have more spiritual care needs because they do not experience these positive emotions through caffeine use. Patients may prefer to use traditional treatment because they are looking for spiritual care content such as increasing hope, reducing stress, and accelerating healing, in addition

to treatment. It is thought that those who cannot perform religious activities due to symptoms during the cancer process need spiritual care and may need this care more than ever.

No study has been found in the literature examining the relationship between the sleep quality characteristics of older patients with cancer with similar population characteristics. The study found that the sleep quality of patients with additional chronic diseases was worse than those without. It is thought that the sleep quality of older patients with cancer with additional chronic diseases is negatively affected due to polypharmacy and its adverse effects. It is predicted that regular sleep is difficult for such patients owing to the challenge of coping with the symptoms of many chronic diseases. For this reason, it is recommended to evaluate the sleep quality of older patients with cancer with additional chronic diseases.

The average age of patients with cancer in the present study was 65.95±5.64 years and the most common cancer types were breast, lung, colorectal, prostate, and stomach, respectively. Similar to our findings, according to the World Health Organization's GLOBACAN (Global Cancer Observatory) 2020 data, it was reported that the most common cancer types experienced by individuals aged 60 years and over worldwide were lung, colorectal, prostate, breast, and stomach, respectively (World Health Organization, 2024). Even though the order was different, the same types of cancers were seen. It is thought that the reason for the difference in frequencies is due to culturally specific lifestyle differences. In addition, because breast cancer is most common in women and women are more cancer aware in this regard, it is normal for the hospital admission rate to be high in this type of cancer. Furthermore, the fact that the study group was predominantly female (60.3%) may also have had an effect.

In the study, it was determined that the majority of older patients with cancer had medium-level spiritual care needs. Similar to our results, a study found that 97.8% of patients with cancer, 73.8% of whom were aged 50 years or older, reported that they needed spiritual care. In addition, it was reported that pain and family concerns decreased significantly by 0.33 times and family concerns by 3.43 times when those who had previously received spiritual care in end-of-life care continued their care. It was reported that the anxiety of those who did not receive spiritual care decreased after receiving this care (Ratshikana-Moloko et al., 2020). In another study, it was reported that almost all older patients with cancer, 40% of whom were aged over 65 years, had spiritual needs (91%). It was also stated that patients with cancer who received less spiritual care than desired had 1.20 times higher depressive symptoms and 2.37 times lower levels of meaning and peace (Pearce et al., 2012). In the NCCN "Older Adult Oncology" version 1.2023 guideline, it was emphasized that providing spiritual care as social support to older patients with cancer and their families reduced stress, anxiety, and depression psychosocially (National Comprehensive Cancer Network, 2024). It is recommended to determine the spiritual needs of older patients with cancer according to their values and beliefs. Older patients with cancer should be supported to receive spiritual care through methods such as giving meaning to life, existential well-being, positive thinking, having a positive attitude towards life, receiving and giving love, prayer, and worship (Palmer Kelly et al., 2022).

Sleep disorders are common in older patients with cancer (Pang et al., 2019). In a prevalence study, it was stated that the rate of sleep disorders in older patients with cancer was 40%. Additionally, 39.6% of older patients with cancer experienced sleep disturbance (Loh et al., 2017). Another study stated that the prevalence of sleep disorders in patients with cancer aged 65 years and over who were treated in the hospital was 60% (Cheng & Lee, 2011). In another study, the prevalence of sleep disorders in patients with cancer was reported as 58.6% between the ages of 60-69 years and 43.8% between the ages of 70-79 years (Al Maqbali et al., 2022).

The majority of older patients with cancer had poor sleep quality in our study, and this was similarly reported by Zhang et al. (2023). In one study, it was reported that 89.7% of patients with cancer aged over 65 years had poor sleep quality. It has been reported that sleep quality worsens by 1.04 times with aging (Endeshaw et al., 2022). Disturbances in sleep patterns may occur due to a decrease in melatonin levels due to age-related degenerative changes in the suprachiasmatic nucleus in the hypothalamus. In the NCCN "Older Adult Oncology" version 1.2023 guideline, it is recommended that benzodiazepines or other sedative-hypnotics should not be used as first-line treatment for sleep disorders in older patients with cancer, and that non-pharmacologic methods such as cognitive behavioral therapy and lifestyle changes should be preferred (National Comprehensive Cancer Network, 2024). In this sense, patients' sleep quality should be improved through methods such as sleep hygiene education, distraction, reflexology, and music therapy.

No significant relationship was found between spiritual care needs and sleep quality in older patients with cancer in our study. Different from our results, it was reported that 88.9% of patients with cancer aged between 65 and 84 years experienced sleep disturbances, and 85.4% of those aged 85 years and over experienced sleep disturbances. It was also stated that they experienced stress, called spiritual pain, at a rate of 36.1% in those aged 65-84 years and in 26.3% of those aged 85 years and over (Cheng & Lee, 2011). In another study performed to determine the symptom severity of older patients with cancer with an average age of 60 years, it was reported that

these patients experienced the most severe sleep disturbance and that increasing spiritual well-being significantly reduced the severity of all symptoms by 3.29 times (Wang & Lin, 2016). These studies were not conducted on specific older patients with cancer, rather they were performed to determine sleep disorders and spiritual care needs. Additionally, these studies did not evaluate the relationship between patients' sleep quality and spiritual care needs. Meeting the spiritual care needs of older patients with cancer can help them relax by reducing stress and depression (Kutlu et al., 2011), but improving sleep quality may not always be a direct result of this process. This is because patients' sleep quality can be affected by many different factors and may not improve immediately by simply reducing stress and depression.

Limitations

Among cancer types, only primary cancer types were considered, and metastases were not taken into account. The research was not homogeneous because there were different types of cancer. Future studies may ensure a homogeneous distribution of groups by stratifying cancer types. The research data pertains only to this sample group and cannot be generalized to all older patients with cancer. The research data were collected based on patients' self-reports.

CONCLUSION

No significant relationship was found between spiritual care needs and sleep quality in older patients with cancer. However, the majority of the patients had poor sleep quality and, according to the scale score averages, moderate spiritual care needs. In addition, it was found that the spiritual care needs were higher in patients who were married, those who never used caffeine, those who used traditional treatment, and patients who could not fulfill their religious activities during the cancer process. At the same time, it was determined that among these patients, those with additional chronic diseases had poor sleep quality. It is recommended to increase specific studies on older patients with cancer and evaluate their spiritual care needs and sleep quality. It is recommended that the spiritual care needs of older patients with cancer be met on a patient-specific basis, with guidance. At the same time, training should be given to improve the sleep quality of these patients, and non-pharmacologic methods should be taught to patients and their families.

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Conflict of Interest

The authors have no conflicts to report.

Author Contributions

Plan, design: AU, FZG; **Material, methods:** AU, FZG; **Data collection:** AU; **Data analysis and comments:** AU, FZG; **Writing and corrections:** AU, FZG.

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Ethical Approval

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Evaluation of Eating Behavior in Adolescents

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ABSTRACT
Objective: This study aimed to examine eating behaviors and related factors in adolescents. **Materials and Methods:** The population of the research, planned as a cross-sectional descriptive type, consists of adolescents between the ages of 12 and 18. The sample of the study was 506 adolescents reached using the snowball sampling strategy. Research data were collected online using the Sociodemographic and Behavioral Data Form and Eating Behavior Scale**. Result:** The average age of the participants is 17.38±0.13, and the average of the Eating Behavior Scale is 255.33±2.57. A significant difference was found between father's education (p=0.021), family attitude (p=0.015), number of meals (p=0.001) and screen time (p=0.005) and Eating Behavior Scale score. A significant difference was detected between the scale score and characteristics such as eating habits at night, dieting, using food supplements, doing sports, having a special friend of the opposite sex, and having knowledge about eating disorders (p<0.05). A weak positive relationship was detected between the participants' weight (p=0.006) and BMI (p=0.005) values and the total Eating Behavior Scale score. **Conclusion:** The average score of eating behavior among adolescents is at a moderate level. Father's education, family attitude, number of meals, screen time, night eating habits, dieting, using food supplements, doing sports, having a special friend of the opposite sex, and knowledge about eating disorders are associated with eating behavior. There is a significant positive relationship between adolescents' eating behavior and weight and body mass index.
Keywords: Adolescent, Eating Habits, Body Weight, Body Mass Index.

Adölesanlarda Yeme Davranışlarının Değerlendirilmesi

ÖZ
Amaç: Bu araştırma adölesanlarda yeme davranışlarının ve ilişkili faktörlerin incelenmesi amacıyla yapılmıştır. **Gereç ve Yöntem:** Kesitsel tanımlayıcı tipte planlanan araştırmanın evrenini, 12-18 yaş arası adölesanlar oluşturmaktadır. Araştırmanın örneklemi kartopu örnekleme stratejisi kullanılarak ulaşılan 506 adölesandır. Araştırma verileri Sosyodemografik ve Davranışsal Veri Formu ve Yeme Davranışları Ölçeği ile internet ortamında toplanmıştır. Veriler SPSS (Statistical Package for Social Sciences) for Windows 25.0 programı kullanılarak analiz edilmiştir. **Bulgular:** Katılımcıların yaş ortalaması 17.38±0.13, Yeme Davranışları Ölçeği ortalaması 255.33±2.57'dir. Baba eğitimi (p=0.021), aile tutumu (p=0.015), öğün sayısı (p=0.001) ve ekran süresi (p=0.005) ile Yeme Davranışları Ölçeği puanı arasında anlamlı fark bulunmuştur. Gece yemek yeme alışkanlığı, diyet yapma, gıda takviyesi kullanma, spor yapma ve karşı cinsten özel bir arkadaşa sahip olma ve yeme bozuklukları hakkında bilgi sahibi olma gibi özellikler ile ölçek puanı arasında anlamlı fark tespit edilmiştir (p<0.05). Katılımcıların kilo (p=0.006) ile Beden Kütle İndeksi (p=0.005) değerleri ile toplam Yeme Davranışları Ölçeği puanı arasında pozitif yönde zayıf bir ilişki tespit edilmiştir. **Sonuç:** Adölesanlar arasında yeme davranışı puan ortalamalarının orta düzeydedir. Baba eğitimi, aile tutumu, öğün sayısı, ekran süresi, gece yemek yeme alışkanlığı, diyet yapma, gıda takviyesi kullanma, spor yapma, karşı cinsten özel bir arkadaşa sahip olma ve yeme bozuklukları hakkında bilgi sahibi yeme davranışı ile ilişkilidir. Adölesanların yeme davranışı ile kilo ve beden kütle indeksi arasında anlamlı pozitif ilişki vardır.
Anahtar kelimeler: Adölesan, Yeme Alışkanlığı, Vücut Ağırlığı, Beden Kütle İndeksi

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INTRODUCTION

Optimal nutrition is defined as the concept of consuming the necessary nutrients for the body in adequate and balanced amounts (Alexander, 2020). However, this ideal can be impeded by various factors, including socioeconomic constraints and the prevalence of detrimental dietary practices. Nutrition can be influenced by personal characteristics, chronic illnesses, the presence of allergies, the structure and culture of the society in which one lives, climate and geographical features, purchasing power, economic adequacy, and social reasons such as familial factors (Uyanık, 2019).

During adolescence, the developmental and physiological changes that occur can lead to deviations from healthy eating habits. This period is marked by an increased preoccupation with physical appearance, particularly among females, driven by the desire to attract the attention and approval of the opposite sex. Additionally, as the importance of social interactions grows, adolescents spend more time outside the home, which correlates with an increased consumption of fast food (Günaydın & Kumcağız, 2020). This shift often leads to the disruption of regular dietary patterns and the adoption of unhealthy snacking behaviors. Adolescents who perceive themselves as overweight may engage in unendorsed weight loss practices, such as unhealthy dieting, or the use of herbal or chemical substances, without professional guidance (Altay et. al., 2018).

Eating behaviors emerge as an integral part of life, influenced by cultural and environmental factors. These behaviors are characterized by practices such as delaying meals, rapid consumption of food, and unbalanced, unconscious eating habits (Uyanık, 2019). Literature on the subject identifies disordered eating behaviors as those that fail to meet the nutritional requirements of the individual, including meal skipping, frequent consumption of unhealthy snacks, avoidance of eating with family or friends, selective eating of specific food groups, adherence to vegetarian diets, excessive use of dietary supplements, compulsive exercise, binge eating, and purging. While these behaviors may not fulfill the diagnostic criteria for clinical eating disorders, they can nonetheless have detrimental effects on the physical and psychological well-being of adolescents (Acar, 2020).

Cultural, social, developmental, familial, individual, economic, and psychological factors can all influence eating behaviors. Individuals may use eating as a coping mechanism to manage emotions such as stress, boredom, anxiety, or to prolong feelings of joy. While this may provide temporary emotional relief, it is believed to lead to negative emotions such as regret and guilt, potentially exacerbating distress over time (My Cleveland Clinic, 2023) A study conducted among high school seniors found that students with disordered eating behaviors exhibited significantly higher body weight and Body Mass Index (BMI) values, along with lower self-esteem scores and higher anxiety levels (Çakır, 2018).

Excessive eating, food refusal, the disposal of food without digestion, and nighttime eating behaviors are included within the concept of eating disorders. Eating disorders are characterized by a constant preoccupation with body weight, a growing increase in negative thoughts about body shape, and the emergence of mood disorders. 1Eating disorders are observed in 3-10% of the general population, with varying prevalence rates among adolescents. According to DSM-5 data, the prevalence of eating disorders in adolescents ranges from 5.7% to 15.2% in females and from 2.9% to 1.2% in males (Dinç & Koçhan, 2016).

The establishment of healthy eating behaviors during adolescence is of paramount importance for the preservation of both physical and psychosocial health, as well as for the improvement of public health indicators. The interventions conducted by nurses working in the field of pediatric health, particularly those focused on nutrition, are recognized as critically valuable from a societal perspective in fostering the development of healthy generations and preventing nutrition-related issues (Alexander, 2020). In the study by Leme et al. a systematic review of research aimed at preventing obesity in adolescents revealed that energy calculation systems did not have a long-term impact on weight maintenance or diet. However, awareness training on obesity, risk factors, diet, and body dissatisfaction resulted in behavior change. The study also emphasized the need for further research in this area to achieve more effective outcomes. The implementation of awareness training, screenings, and the development and utilization of diverse assessment tools within the scope of preventive healthcare services and school nursing will contribute to enhancing the outcomes in this field (Leme et. al., 2020).

Therefore, this study aims to investigate the eating behaviors and associated factors among adolescents. Gaining an in-depth understanding of the factors influencing adolescent eating behaviors is of paramount importance for advancing research, informing clinical practice, and enhancing health promotion and development initiatives.

MATERIALS AND METHODS

Study type

This cross-sectional descriptive study was conducted using a structured questionnaire administered online between October 2021 and February 2022.

Study Population and Sample

The study population consisted of adolescents aged 12-18 years living in a provincial center in the Western Black Sea region of Turkey. The sample size was calculated using the sample size formula for known population size (14,103,881) with the "G. Power-3.1.9.2" program, at a 95% confidence level, with a α = 0.05 margin of error and 0.95 theoretical

power. The minimum sample size was determined to be 470. A total of 506 individuals were included in the study

Data Collection Tools

In this study, data were collected using the Sociodemographic and Behavioral Data Form and the Eating Behaviors Scale.

Sociodemographic and behavioral data form: ,

The form, developed by the researchers, consists of 32 questions covering adolescents' sociodemographic characteristics and eating behaviors.

Eating Behaviors Scale

The scale was developed by Özdoğan. It consists of 58 questions and is a Likert-type metric scale used to assess eating behaviors. Participants are asked to evaluate their eating behaviors on a scale from "never" (0) to "always" (Özdoğan, 2013). The response scale for positive items begins from the left (0), while for negative items, it starts from the right (10), with scores not being assigned between 0 and 10. Scores obtained from the Eating Behaviors Scale are interpreted as follows: ≤145 points is classified as poor, 146-290 points as moderate, 291-435 points as good, and ≥436 points as very good. The reliability coefficient of the Eating Behaviors Scale was calculated to be $\alpha = 0.85$.

Data Collection

The participants of this study were 506 adolescents living in a provincial center in the Western Black Sea region of Turkey. A snowball sampling strategy was used, focusing on creating a pool of adolescents aged 12-18 years from the Western Black Sea region of Turkey. Prior to the main study, a pilot study was conducted with 20 individuals who were not part of the sample. Based on their feedback, necessary adjustments were made to the survey, and data collection proceeded thereafter. The online survey, created via Google Forms, was distributed to willing participants through email and online platforms such as Facebook, WhatsApp, and LinkedIn. Initially, the survey was distributed to adolescents aged 12-18 years, who were encouraged to share it with their peers. No incentives or financial support were provided to participants for completing the survey. The survey was conducted with specific instructions and flow guidelines. It was clarified that participants could continue to the next question if they did not respond to a particular item. To increase participation, the survey link was shared four times at different intervals on social media platforms to encourage greater involvement.

Statistical analysis of data

The data obtained in the study were analyzed using the SPSS (Statistical Package for Social Sciences) for Windows 25.0 program. Descriptive statistical methods were used to evaluate the data. The normality of the data distribution was assessed using the Kolmogorov-Smirnov and Shapiro-Wilk tests. For normally distributed data, differences between two independent groups were tested using the independent samples t-test, while analyses for three or more groups with normally distributed measurements were performed using repeated-measures ANOVA. In cases of statistically significant differences, Bonferroni analysis was used to determine which specific time points differed. Reliability analysis of the scales and subscales used in the study was conducted using Cronbach's Alpha.

Ethical considerations

Ethical approval for the study was obtained from the Ethics Committee of the Human Research Ethics Board of Zonguldak Bülent Ecevit University on January 14, 2021, with approval number 2021/11. The study was conducted in accordance with the principles of the Helsinki Declaration. After the research objectives were clearly explained in writing to the participants, informed consent was obtained. Participants who provided consent and completed the survey were included in the research group. No descriptive information related to this study has been included in any reports or publications. Informed consent was provided by all participants.

RESULTS

The mean age of the participants was found to be 17.38 ± 0.13, the mean Body Mass Index (BMI) was 21.70 ± 4.04, and the mean score on the Eating Behaviors Scale was 255.33 ± 2.57 (Table 1).

Table 1. Distribution of Participants Based on Descriptive Characteristics (n=506).

Characteristics	Min	Mean	Max	Ss	Median
Age (years)	11.00	15.38	18.00	0.13	15.00
Height (cm)	130.00	165.65	193.00	0.39	165.00
Weight (kg)	30.00	59.82	141.00	0.58	57.00
Number of Siblings	1.00	2.43	9.00	0.04	2.00
Child Order	1.00	1.69	7.00	0.04	1.00
BMI	12.49	21.70	61.84	4.04	21.22
Eating behaviour scale	86.00	255.33	511.00	2.57	255.00

BMI: Body Mass Index, **Min**: Minimum, **Mean**: Average, **Max**: Maximum, **SD**: Standard Deviation

The analysis revealed that 23.7% of the participants were male, 29.2% of their mothers had attained a primary school education, 28.5% of their fathers had completed high school, 81.6% of the participants belonged to nuclear families, and 64.2% reported that their household income was equal to their expenses.

Table 2. Distribution of participants based on some eating characteristics (n=506).

Characteristics	Options	n	%
Breakfast	Yes	443	87.5
	No	63	12.5
Number of Meals	None	18	3.6
	One	231	45.7
	Two	229	45.3
	Three	28	5.5
Snacking Time	Never	5	1.0
	When Sad	25	4.9
	When Excited	2	0.4
	When Happy	22	4.3
	In Social Settings	47	9.3
	When Bored	111	21.9
	Multiple Situations	294	58.1
Night Eating	Yes	270	53.4
	No	236	46.6
Preferred Snack	Chocolate	54	10.7
	Chips	23	4.5
	Fast Food	15	3.0
	Nuts	1	2.6
	Pastries	11	2.2
	Sugary Desserts and Cakes	14	2.8
	Carbonated Drinks	8	1.6
	Multiple Types	368	72.7
Satisfaction with Physical Appearance	Yes	299	59.1
	No	207	40.9
Satisfaction with Body Weight	Yes	260	51.4
	No	246	48.6
Weight Tracking	Yes	304	60.1
	No	202	39.9
Dieting	Yes	103	20.4
	No	403	79.6
Exercise	Yes	220	43.5
	No	286	56.5
Taking Supplements	Yes	111	21.9
	No	395	78.1
Family's Satisfaction with Physical Appearance	Yes	127	25.1
	No	379	74.9
Comparison with Others	Yes	388	76.7
	No	118	23.3
Academic Success	Successful	228	45.1
	Average	255	50.4
	Unsuccessful	23	4.5
Having a Special Friend of the Opposite Sex	Yes	191	37.7
	No	315	62.3
Acceptance by Friends	Yes	478	94.5
	No	28	5.5
Screen Time	None	5	1.0
	1-2 hours	91	18.0
	3-4 hours	197	38.9
	5-6 hours	132	26.1
	7 hours	81	16.0
	Total	506	100.0
Physical Disability	Yes	48	9.5
	No	458	90.5
Knowledge of Eating Disorders	Yes	232	45.8
	No	274	54.2
Eating Behavior Scale	Poor	15	3.0
	Average	362	71.5
	Good	128	25.3
	Very Good	1	0.2
	Total	**506**	**100.0**

n: Count, **%:** Column percentage.

Moreover, 87.5% of the participants reported consuming breakfast, 45.7% adhered to a single-meal pattern per day, and 53.4% exhibited nighttime eating habits. Additionally, 40.9% expressed dissatisfaction with their physical appearance, 60.1% actively monitored their weight, 56.5% did not engage in physical exercise, 38.9% had a screen time of 3-4 hours per day, and 71.5% demonstrated moderate eating behaviors (Table 2). Father's education (p=0.021), family attitude (p=0.015), number of meals, and screen time were found to have a significant difference with the Eating Behavior Scale score. Further analysis revealed that this difference was due to middle school graduates scoring higher than primary school graduates (p<0.0001). Regarding family attitudes, the difference between democratic families and overprotective or authoritarian family attitudes was found to be the source of the difference (p<0.0003). A statistically significant difference was found between participants' screen time (p=0.005) and the number of meals (p=0.001) with the Eating Behavior Scale score. Further analysis showed that those who ate 2 or 3 meals a day had higher Eating Behavior Scale scores than those who ate none or 1-2 meals (p<0.0007). Additionally, those with shorter screen time had higher Eating Behavior Scale scores compared to those with 3 or more hours of screen time (p<0.0001) (Table 3). No significant difference was found between mother's education, gender, academic achievement, or income level and the Eating Behavior Scale score (p>0.05).

Table 3. Comparison of participants' eating behavior assessment scale scores based on certain characteristics (n=506).

Characteristic		n	Mean	SD	Test Statistic	p	Bonferroni
Father's Education	literate	7	241.00	25.72	2.511	0.021	Middle School> Elementary
	Elementary school	112	244.64	61.79			
	Middle school	78	270.37	59.91			
	High school	144	269.61	56.59			
	University	165	262.65	53.53			
Family Attitude	Neglectful	11	254.81	48.19	2.855	0.015	Democratic> Overprotective Democratic> Authoritarian
	Tolerant	308	255.00	54.48			
	Overprotective	76	247.88	58.00			
	Authoritarian	41	255.90	80.77			
	İnconsistent	36	251.94	49.88			
	Democratic	34	259.44	57.14			
Number of Meals	None	18	214.05	68.35	6.865	0.0001	None <2-3, 1 <3
	1	231	249.46	63.00			
	2	229	261.24	58.32			
	3	28	282.07	70.26			
Screen Time	None	5	261.20	79.62	3.744	0.005	1-2> 3-4, 5-6, 7 and more
	1-2 hours	91	234.66	59.27			
	3-4 hours	197	258.31	56.90			
	5-6 hours	132	259.85	54.82			
	7 hours and more	81	263.63	58.31			

Test Statistic: One-way ANOVA, $p < 0.05$

A significant difference was found between the Eating Behavior Scale scores and characteristics such as late-night eating habits, dieting, use of dietary supplements, physical activity, having a special friend of the opposite sex, and knowledge of eating disorders (p<0.05). Those with late-night eating habits (p=0.001), individuals who dieted (p=0.006), those who used dietary supplements (p=0.003), participants who engaged in physical activity (p=0.001), individuals with a special friend of the opposite sex (p=0.016), and those knowledgeable about eating disorders (p=0.018) were found to have higher average Eating Behavior Scale scores (Table 4). As a result of the correlation analysis conducted to determine the relationship between the participants' quantitative data, a weak positive correlation was found between age (p=0.006), weight (p=0.005), and the total Eating Behavior Scale score. It was also observed that as age increased, height, weight, and BMI score also increased (Table 5).

Table 4. Comparison of participants' Eating Behavior Scale scores with some characteristics (n=506).

Behavior		n	Mean	SD	Test Statistic	p
Night Eating	Yes	270	267.17	58.90	5.036	0.001
	No	236	241.80	53.66		
Dieting	Yes	103	269.26	55.09	2.754	0.006
	No	403	251.78	58.08		
Taking Supplements	Yes	111	269.69	61.70	2.981	0.003
	No	395	251.30	56.16		
Exercise	Yes	220	265.92	57.65	3.652	0.001
	No	286	247.19	56.79		
Having a Special Friend of the Opposite Sex	Yes	191	263.26	61.00	2.409	0.016
	No	315	250.53	55.42		
Knowledge of Eating Disorders	Yes	232	261.87	53.25	2.349	0.018
	No	274	249.80	61.05		

n: number**, SD:** Standard Deviation

Table 5. Correlation between numerical variables (age, height, weight, number of siblings, BMI) and the total score of the Eating Behavior Scale (n=506).

Variable		Age	Height	Weight	BMI	Eating Behavior Scale
Age	**r**	1.000	.168**	.261**	.210**	-.004
	p	.	.000	.000	.000	.932
Height	**r**	.168**	1.000	.571**	.110*	.010
	p	.000	.	.000	.013	.814
Weight	**r**	.261**	.571**	1.000	.852**	.122**
	p	.000	.000	.	.000	.006
BKİ	**r**	.210**	.110*	.852**	1.000	.126**
	p	.000	.013	.000	.	.005
Eating Behavior Scale	**r**	-.004	.010	.122**	.126**	1.000
	p	.932	.814	.006	.005	.

***BMI:** Body Mass Index**, *p < 0.01**

DISCUSSION

Adolescence is a critical period for the establishment of healthy eating behaviors, as these behaviors significantly influence overall well-being and health outcomes. Adopting healthy dietary habits during this stage can reduce the risk of chronic diseases in adulthood and improve health-related quality of life. (Costarelli et. al., 2013) Furthermore, extensive global evidence indicates that behaviors formed during adolescence frequently persist into adulthood, highlighting the long-term impact of adolescent eating patterns. (Rachmi et. al 2021) Therefore, in this study, adolescent eating behaviors were examined, and eating behaviors were compared with certain socio-demographic and dietary characteristics. The study found that factors such as father's education, family attitude, number of meals, and screen time significantly influenced the participants' eating behavior scores. Tanrıverdi et al. (2011) identified that snacking while watching TV, studying, and the consumption of fast food influenced eating attitudes. Similarly, studies by Gülesce et al. (2023) and Melvin (2023) highlighted that screen time, particularly social media usage, affected eating habits. In another comparable study, skipping meals was found to have a negative impact on eating attitudes (Ulaş et. al., 2013). The study found that adolescents with democratic family attitudes had higher average Eating Behavior Scale scores compared to adolescents with overprotective and authoritarian family attitudes. Supporting this finding, Byrne et al. (2023) linked family attitude to eating attitude, while Günaydın and Kumcağız (Günaydın & Kumcağız, 2020) determined that family functionality affects eating attitudes. Based on these findings, it is suggested that primary prevention, which aims to improve risk factors while considering individual differences through a multidisciplinary approach, could provide beneficial support. According to the research findings, no significant difference was found between the average Eating Behavior Scale scores and gender. However, other studies have reported that gender influences eating behaviors. (Günaydın & Kumcağız, 2020; Yıldırım et. al., 2017) Some research has suggested that, particularly during adolescence, girls place more importance on their appearance and body measurements, which in turn affects their eating behaviors. (Özvurmaz et. al.,

2018) However, in recent years, this perception is being challenged, and studies have shown that males are also changing their lifestyle, including eating behaviors, in order to increase muscle mass. (Pope et. al., 2020) Additionally, it is suggested that adolescent boys and girls should be evaluated separately, as there are significant differences between them in terms of disordered eating attitudes and behaviors. (Murray et.al., 2017). The study found that participants' habits of eating at night, dieting, using dietary supplements, exercising, having a special friend of the opposite sex, and knowledge of eating disorders all influenced the average Eating Behavior Scale scores. In the literature, it is suggested that individuals with obesity who successfully follow a diet develop a healthy relationship with food and eating attitudes (Wadden et. al., 2024). Additionally, it has been argued that young people who engage in exercise are less exposed to screen-related activities, which reduces snacking behaviors and promotes healthier meal choices, leading to healthier eating habits (Soltero et.al.,2021). Furthermore, some studies suggest that the absence of emotional emptiness decreases the risk of snacking and eating disorders (Ambwani & Strauss, 2007). It is also thought that adolescents who share emotional connections with a special friend pay attention to their appearance due to their desire for approval and attention, leading them to maintain a regular and balanced diet. The study found that participants' weight and BMI values have a very weak positive influence on the average Eating Behavior Scale scores. While it is expected that eating behaviors would be related to weight status, Rodriguez et al. (2009) and Tanrıverdi et al. (2011) did not find a relationship between BMI and eating attitudes. However, Arslan (2020) identified a significant difference between BMI and eating attitudes. In another study, a positive connection was observed between BMI and eating behaviors, as BMI was found to predict more measured eating (Snoek et. al., 2008). Marques et al. (2018) demonstrated that individuals with healthy eating behaviors (realistic positive) had significantly higher normal weight proportions compared to those with unhealthy eating behaviors (realistic negative). This suggests that adolescents are highly concerned about their body image and that there is a connection between body weight, BMI perception, and eating behaviors.

Study Limitations and Strengths

The study has several limitations as well as strengths. First, the cross-sectional design of the study limits any causal inferences. Second, the study was conducted in a provincial center in the Western Black Sea region of Turkey and involved adolescents aged 12-18, with data collected via an online survey. In this context, the sample is limited to individuals who use social networks and agreed to participate in the study. Third, eating habits and practices based on self-reporting may be subject to recall bias. However, self-reporting is considered a suitable method for population-based or epidemiological studies due to its ease of use and low cost. Additionally, height and weight were self-reported by participants and are subject to bias. Nevertheless, in epidemiological research, self-reported height and weight are considered a valid tool for estimating BMI.

CONCLUSION

In conclusion, the average Eating Behavior Scale scores among adolescents aged 12-18 in the Western Black Sea region of Turkey were found to be at a moderate level, with only one-quarter of the adolescent students classified as having good eating behaviors. In this study, significant relationships were found between eating behavior and factors such as father's education, family attitude, number of meals, screen time, late-night eating habits, dieting, use of dietary supplements, physical activity, having a special friend of the opposite sex, and knowledge of eating disorders. There is a significant positive relationship between adolescents' eating behaviors and their weight and BMI. When addressing eating behaviors, weight and BMI should be considered. Efforts should be made to increase adolescents' awareness of risk factors associated with eating behaviors and to reduce the prevalence of non-communicable diseases resulting from these behaviors. Recommendations include a health education program that emphasizes lifestyle changes and behavioral modifications. In general, positive environmental interventions in schools could be effective in promoting healthy eating behaviors among adolescents as part of a broader set of actions. School curricula in Turkey should include lessons that encourage healthy eating habits, regular exercise, and physical activity. Furthermore, more research is needed to investigate other potential influencing factors related to eating behaviors that were not addressed in this study.

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Conflict of Interest

The authors declare no conflict of interest.

Author Contributions

Plan, design: MS, NT, FÜT, TAK; **Material, methods and data collection:** MS, NT, TAK**; Data analysis and comments:** MS, NT, FÜT, TAK FD, AK; **Writing and corrections:** MS, NT, FÜT, TAK.FD, AK, AP.

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The Relationship of Gender Role Attitudes Towards Men with Depression, Anxiety, Stress

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ABSTRACT

Objective: This research was designed to examine the relationship between gender role attitudes toward men and depression, anxiety, and stress. **Materials and Methods**: This research was conducted between October 2023 and March 2024 using the snowball method with 450 participants among males aged 18 and over living in Istanbul. Before conducting the research, permission was obtained from the authors of the scales used, ethical permission from the ethics committee of Istanbul Gedik University, and consent to participate from the participants. The research data were collected using the Introductory Information Form, Men Oriented Gender Roles Attitudes Scale, and Depression Anxiety Stress Scale-21 (DASS-21) developed by the researchers. **Results:** The average age of the participants participating in the study was 23.36, 83.1% were single, 60.9% had equal income and expenses, 68.4% were high school graduates, 62.4% were employed, and 51.8% had been working for 0-1 years. The participants' mean DASS-21 depression sub-dimension score was 8.22±4.81, the mean stress sub-dimension score was 8.25±4.73, and the mean anxiety sub-dimension score was 6.39±4.99. The participants' total mean score for Gender Role Attitudes Towards Men was 82.82±15.49. A positive and weakly significant relationship was found between the DAS-21 Anxiety Dimension score and the Gender Role Attitude Towards Men Sexist Social Violence Dimension score ($p<0.05$). No relationship was found between the other sub-dimensions of DASS-21 and Gender Role Attitude Towards Men ($p>0.05$). **Conclusion:** As a result of the research, a positive weak relationship was found between sexist social violence and individuals' anxiety. Future research can be conducted using probability sampling method, not only with people in one province but also with a larger universe.

Keywords: Gender Role, Men's Health, Mental Health.

Erkeğe Yönelik Toplumsal Cinsiyet Rolleri Tutumunun Depresyon, Anksiyete, Stres İle İlişkisi

ÖZ

Amaç: Bu çalışma, erkeklere yönelik toplumsal cinsiyet rolü tutumları ile depresyon, anksiyete ve stres arasındaki ilişkiyi incelemek amacıyla tasarlandı. **Gereç ve Yöntem:** Bu araştırma İstanbul'da yaşayan 18 yaş ve üzeri erkeklerde 450 katılımcı ile kartopu yöntemi kullanılarak Ekim 2023-Mart 2024 tarihleri arasında yürütülmüştür. Araştırma yürütülmeden önce kullanılan ölçeklerin yazarlarından izin, İstanbul Gedik Üniversitesi'nin etik kurulundan etik izin ve katılımcılardan katılım onam izni alındı. Araştırma verileri araştırmacılar tarafından geliştirilen Tanıtıcı Bilgi Formu, Erkeğe Yönelik Toplumsal Cinsiyet Rolleri Tutumu Ölçeği ve Depresyon, Anksiyete ve Stres Ölçeği-21 (DASÖ-21) kullanılarak toplandı. **Bulgular:** Araştırmaya katılan katılımcıların yaş ortalaması 23.36, %83.10'unun bekar olduğu, %60.90'ının gelir gidere denk olduğu, %68.40'ının lise mezunu olduğu, %62.40'ının çalışıyor olduğu, %51.80'inin 0-1 yıldır çalıştığı saptanmıştır. Katılımcıların DASÖ-21 depresyon alt boyu puan ortalaması 8.22±4.81, stres alt boyut puan ortalaması 8.25±4.73, anksiyete alt boyut puan ortalaması 6.39±4.99 olarak bulundu. Kişilerin Erkeğe Yönelik Toplumsal Cinsiyet Rolleri Tutumu toplam puan ortalamaları ise 82.82±15.49 olarak saptanmıştır. DASÖ-21 Anksiyete Boyut puanı ile Erkeğe Yönelik Toplumsal Cinsiyet Rolleri Tutumu Cinsiyetçi Sosyal Şiddet Boyut puanı arasında pozitif yönde ve zayıf düzeyde anlamlı ilişki bulundu ($p<0.05$). DASÖ-21 ve Erkeğe Yönelik Toplumsal Cinsiyet Rolleri Tutumu diğer alt boyutları arasında ilişki bulunmadı ($p>0.05$). **Sonuç:** Araştırma sonucunda cinsiyetçi sosyal şiddet ile bireylerin anksiyetesi arasında pozitif zayıf ilişki bulundu. İlerideki araştırmalar sadece bir ildeki kişilerle değil, daha geniş bir evreni kapsayacak boyutta, olasılıklı örnekleme yöntemi kullanılarak yürütülebilir.

Anahtar Kelimeler: Erkeklerin Sağlığı, Cinsiyet Rolü, Ruh Sağlığı.

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INTRODUCTION

The term "gender" is used to describe the genetic, physiological, and biological characteristics of a living being that indicate whether it is male or female (Reale et al., 2023). From a global perspective, biological diversity encompasses all living beings. However, the concept of gender is informed by the ethnic views and values of the population in which individuals live. Both genders are assigned responsibilities by the population in which they live, and individuals conduct their lives in accordance with these responsibilities (Yıldırım et al., 2017). The term "gender" encompasses the roles and responsibilities that are socially ascribed to men and women. This concept is related to the way the population views and perceives the individual, rather than to biological differences (Philbin et al., 2024). A review of the literature reveals that gender is understood as the roles that society socially assigns to men and women. These roles are shaped by the gender factor (Akkaş, 2020; Philbin et al., 2024). This differentiation is shaped by the culture of the society in question and serves to distinguish between the two genders. From birth to death, culture determines the differentiation of genders (Giuliano, 2020). From the moment of their inception, individuals begin to assume the roles and responsibilities that are ascribed to them by society. Furthermore, the gender roles instilled by parents also manifest themselves in other processes of the individual's life (Thorne, 2021). The gender roles that are expected of both genders continue throughout their lives, with the roles specified by society bestowing different roles according to gender. In the context of the family unit, the male figure is often perceived as the primary economic provider, while the female is typically regarded as the primary caregiver, responsible for nurturing and protecting her child. One of the attitudes towards men is the idea that the needs of the wife and child must be met and that only men can provide these basic needs (Jones, 2023). The roles and expectations assigned by society on the basis of gender have a detrimental impact on numerous aspects of life. Many role attitudes towards men foster a negative outlook on men's lives (Caraballo, 2023; Suresh et al., 2023).

The male identity is characterised by a tendency to assume caretaking and protective roles within the family unit, as well as a proclivity to assert control within the family hierarchy. These qualities gradually assume the form of a test, the successful completion of which is believed to be a prerequisite for the individual's social integration (Zielińska-Król, 2014). Failure to pass this test often results in significant social and personal difficulties. Such individuals may also be subject to discourses about their gender in response to negative attitudes (Açer, 2022). As a consequence of these discourses, men begin to experience a sense of responsibility, which can subsequently give rise to mental health issues (Özel and Karabulut, 2018). Furthermore, the obligation to contribute to the family economy and have the final decision-making authority can potentially lead to adverse health outcomes, including cardiovascular problems, chronic stress, and a tendency towards these issues (Siddiqui et al., 2024). It is important to note that stress, which is a significant issue among these threats, is a dynamic phenomenon that fluctuates according to the individual's life circumstances. As a result of the inability of the individual who is exposed to stress to cope both mentally and physically, difficulties are encountered in adapting to those around him or her (Özel & Karabulut, 2018). The negative effects of anxiety and depression, which are often associated with stress, can significantly impair the quality of life of an individual and have a detrimental impact on their overall well-being. The objective of this research is to learn the relevance between gender role attitudes and the prevalence of depression, anxiety and stress among men who bear significant societal responsibilities. In line with the aforementioned objective, the following research question was posed and sought to be answered in the study: Are gender role attitudes related to depression, anxiety and stress in men?

MATERIALS AND METHODS

Type and purpose of the research

This study employed a descriptive and correlational research design to ascertain the relationship between gender role attitudes towards men and depression, anxiety, and stress.

Sample, place and time of the research

The research was carried out in Istanbul from October 2023 to March 2024. The universe of the research consists of men aged 18 and over in Istanbul. According to the TUIK (2022) data, the number of men living in Istanbul is 7,952,131, which constitutes 18.63% of the male population in Turkey. 7,952,131 men were accepted as the universe of the research, the confidence level was accepted as 95% and the margin of error was accepted as 5%, and the sample size was determined as at least 384.

Variables of the research

Dependent variables of the study

The mean scores obtained from the Men Oriented Gender Roles Attitudes Scale and the mean scores of the subscales of the DASS-21 were the study's dependent variables.

Independent variables of the study

Participants' descriptive characteristics (age, income level, education level, employment status, etc.) constitute the independent variables of the study.

Data collection

The data for the research were gathered using the snowball sampling method. The information was gathered through the Information Form, the Men Oriented Gender Roles Attitudes Scale and the Depression Anxiety Stress Scale-21 (DASS-21), which were prepared by the researcher. The necessary

permissions for the use of the scales were obtained from the authors for the scales planned to be used in the study.

Identifying information form

The form, which was devised by the researcher, comprises a series of questions pertaining to the demographic characteristics of the respondents, including their age, income level, educational attainment, and employment status.

Men oriented gender roles attitudes scale

The scale was developed by Yelegen et al. (2022). The scale comprises 26 items and is organised into seven sub-dimensions. Sub-dimensions; Emotional Bond (30, 31, 32, 33,34, 42), Financial Responsibility (16, 17, 22, 23), Social Pressure (9, 15, 24), Gendered Social Violence (13, 19, 35, 36), Physical Responsibility (1, 2, 3, 7), Public Area (27, 28, 43), Physical Appearance is (20, 21). The scale exhibits an alpha reliability coefficient of 0.86, indicating a high level of internal consistency. In the study, the scale demonstrated a reliability level of Cronbach α= 0.87.

Depression anxiety stress scale-21 (DASS-21)

The scale developed by Lovibond and Lovibond (1995) was adapted into Turkish by Yıldırım et al. The 21-item scale is comprised of three factors. The sub-dimensions are anxiety, stress and depression, and each is evaluated in isolation. The scale is a 4-point Likert type; 0 is coded as "not at all suitable for me", 1 is "suits me to some extent or some of the time", 2 is "suits me to a serious extent or a significant part of the time", and 3 is "suits me a lot or most of the time". A total score cannot be obtained from the scale, total scores are calculated separately for each sub-dimension. The scores that can be obtained from each sub-dimension vary between 0-21. An increase in the score means that the individual experiences the emotional state assessed by the relevant sub-dimension more. The test-retest reliability coefficients for each sub-dimension were found to be as follows: depression (Cronbach α = 0.93), anxiety (Cronbach α = 0.83) and stress (Cronbach α = 0.82). In the present study, the reliability coefficients were found to be α = 0.83 for depression, α = 0.85 for anxiety and α = 0.82 for stress.

Research inclusion criteria

The study population consisted of male individuals aged 18 years or older who volunteered to participate and who did not have any hearing or vision problems.

Exclusion criteria from the research

Individuals who failed to provide complete data in the designated collection instruments were excluded from the study.

Ethical responsibilities

Prior to the commencement of the study, ethical approval was sought and obtained from the Istanbul Gedik University Ethics Committee (date: 24/04/2023; number: E-56365223-050.02.04-2023.137548.85). Prior to the commencement of the research, the participants were duly informed about the nature and objectives of the study, and their consent was obtained. The necessary permission for the utilisation of the two scales included in the study was obtained from the respective owners. This study was conducted in accordance with the ethical principles set forth in the Declaration of Helsinki. The data was not conducted in any institution. Since the data was collected using the snowball method, it was not necessary to obtain institutional permission.

Analysis of data

The data were analysed using the Statistical Package for the Social Sciences (SPSS). In order to ascertain the reliability of the scales employed, a Cronbach's alpha analysis was conducted. Descriptive statistics were employed for the purpose of evaluating the individual characteristics and scale scores of the participants. Pearson correlation statistics were employed to examine the relationship between the scales utilized. In the study, a p-value below 0.05 was deemed to indicate statistical significance.

RESULTS

The average age of individuals included in the research was 23.36 ± 5.20 years. Of these individuals, 83.10% were single, 60.9% had equivalent income and expenses, 68.40% were high school graduates, 62.40% were employed, and 51.80% of the employed individuals had experience in the range of 0-1 year (Table 1).

Table 1. Descriptive statistics for individual participants (n:450).

Variables		Mean±Sd	Min-max
Age		23.36±5.20	18-60
Variables		**Number**	**%**
Marital status	Married	76	16.90
	Single	374	83.10
Monthly Earnings	Income is less than expenses	107	23.80
	Income is equivalent to expenses.	274	60.90
	Income is more than expenses.	69	15.30

Table 1. (Continue). Descriptive statistics for individual participants (n:450).

Variables		Mean±Sd	Min-max
Education Level	Literate/Primary School	3	0.70
	Secondary School	17	3.80
	High School Graduate	308	68.40
	University Graduate	122	27.10
Working status	Working	281	62.40
	Not Working	169	37.60
Working time	0-1 year	233	51.80
	1-5 years	130	28.90
	5-10 years	59	13.10
	10-20 years	23	5.10
	20 years and more	5	1.10

The mean score for the DASS-21 Depression subscale was 8.22±4.81, the mean score for the Anxiety subscale was 6.39±4.99, the mean score for the Stress Scale subscale was 8.25±4.73, and the mean total score for the Men-Oriented Gender Roles Attitudes Scale was 82.82±15.49 (Table 2).

Upon examination of the sub-dimensional correlation between the two scales utilized in the study, a positive and weakly significant relationship was identified between the DASS-21 Anxiety Dimension score and the Men Oriented Gender Roles Attitudes Scale Sexist Social Violence Dimension score ($p<0.05$). No correlation was identified between the DASS-21 and the other sub-dimensions of the Men-Oriented Gender Roles Attitudes Scale ($p> 0.05$) (Table 3).

Table 2. Total scale scores of participants.

Variables	Mean±Sd	Min- max
DASS-21 Depression Total Score	8.22±4.81	0-21
DASS-21 Anxiety Total Score	6.39±4.99	0-21
DASS-21 Stress Total Score	8.25±4.73	0-21
Men-Oriented Gender Roles Attitudes Scale Total Score	82.82±15.49	36-130
Men-Oriented Gender Roles Attitudes Scale Emotional Bond Dimension	25.15±3.36	6-30
Men-Oriented Gender Roles Attitudes Scale Financial Responsibility Dimension	11.56±4.04	4-20
Men-Oriented Gender Roles Attitudes Scale Social Pressure Dimension	8.19±3.37	3-15
Men-Oriented Gender Roles Attitudes Scale Gendered Social Violence Dimension	9.32±3.86	4-20
Men-Oriented Gender Roles Attitudes Scale Physical Responsibility Dimension	12.77±3.72	4-20
Men-Oriented Gender Roles Attitudes Scale Public Area Dimension	8.63±3.01	3-15
Men-Oriented Gender Roles Attitudes Scale Physical Appearance Dimension	7.16±2.27	2-10

Table 3. DASS-21 and Men-Oriented Gender Roles Attitudes Scale dimensions correlation.

		DASS-21 Depression Dimension	DASS-21 Anxiety Dimension	DASS-21 Stress Dimension
Men-Oriented Gender Roles Attitudes Scale Emotional Bond Dimension	Pearson Correlation	0.02	0.02	0.00
	Sig. (2-tailed)	p=0.64	p=0.59	p=0.91
Men-Oriented Gender Roles Attitudes Scale Financial Responsibility Dimension	Pearson Correlation	0.030	0.089	0.02
	Sig. (2-tailed)	p=0.52	p=0.06	p=0.55
Men-Oriented Gender Roles Attitudes Scale Social Pressure Dimension	Pearson Correlation	-0.06	-0.03	-0.02
	Sig. (2-tailed)	p=0.17	p=0.43	p=0.55

Table 3. (Continue) DASS-21 and Men-Oriented Gender Roles Attitudes Scale dimensions correlation.

		DASS-21 Depression Dimension	DASS-21 Anxiety Dimension	DASS-21 Stress Dimension
Men-Oriented Gender Roles Attitudes Scale Physical Responsibility Dimension	Pearson Correlation	0.01	0.05	0.02
	Sig. (2-tailed)	p=0.75	p=0.21	p=0.53
Men-Oriented Gender Roles Attitudes Scale Public Area Dimension	Pearson Correlation	-0.08	-0.02	-0.08
	Sig. (2-tailed)	p=0.08	p=0.62	p=0.08
Men-Oriented Gender Roles Attitudes Scale Physical Appearance Dimension	Pearson Correlation	-0.01	0.05	0.00
	Sig. (2-tailed)	p=0.75	p=0.27	p=0.95
Men-Oriented Gender Roles Attitudes Scale Total Score	Pearson Correlation	-0.01	0.07	-0.00
	Sig. (2-tailed)	p=0.77	p=0.13	p=0.89
Men-Oriented Gender Roles Attitudes Scale Gendered Social Violence Dimension	Pearson Correlation	0.00	0.13*	-0.00
	Sig. (2-tailed)	p=0.84	p=0.00	p=0.97

Pearson Correlation t test. *P<0.01

DISCUSSION

The available evidence indicates that inflexible gender norms may be a contributing factor in the development of psychological problems. An individual's gender attitudes serve to determine the extent to which they conform to the behaviours and roles that are expected of them by society. These norms, which define men as tough, emotionally repressive, and strong, may impede men's ability to express their emotional and psychological problems (Bhugra et al., 2022).

In their everyday lives, men are not content with the numerous events that examine their position in society and confront them with health, psychological and career-related issues stemming from anxiety and stress. Indeed, prescriptive stereotypes and prohibitive gender norms have the potential to yield unfavourable outcomes for men (Baranov et al., 2018). This study sought to elucidate the relationship between the gender role of men within certain gender stereotypes and negative mental health problems. The objective of this research is to elucidate the relationship between gender role attitudes in men and stress, anxiety and depression.

It is stated in the literature that anxiety, stress and depression in men are ignored, but male norms negatively affect mental health and cause psychological problems (Fisher et al., 2022). Additionally, men who conform to traditional masculine norms are less likely to express their psychological problems, which can trigger mental health issues (Wagner & Reifegerste, 2024). In this study, where men were included as a sample, it was found that men's anxiety, stress and depression scores were low, and their male gender role attitude levels were slightly above average.

It can be posited that the shift in the economic position of women is accompanied by the perpetuation of their domestic responsibilities. Consequently, the increased involvement of women in the service sector does not signify a radical transformation but rather a reorganisation of the existing male dominance. This reshaping is perceived by men as a loss of status in the realms of labour and business (Farsia, 2024).

The woman, who is a partner in economic support, causes the man who assumes financial responsibility in society to experience sexist problems. A review of the literature reveals that men who experience conflict in their gender role attitudes may experience adverse consequences, including diminished self-esteem, excessive anxiety, and depression (Kaya et. Al., 2019; Korkmaz, 2022). The findings of this study indicate that there is no statistically significant correlation between gender role attitudes and depression in men.

The existing literature indicates that unreasonable social fears, anger, and anxiety are prevalent in men despite gender pressure (Stanaland & Gaither, 2021). Indeed, the findings of this research indicate a positive, albeit weakly remarkable, relationship between gender role attitude, sexist social violence sub-dimension, and anxiety in men. It can be posited that the evidences of this research corroborate the information presented in the literature, indicating that the level of anxiety increased in tandem with the attitude towards sexist social violence, albeit to a limited extent.

A review of existing literature shows that the pressure to conform to traditional masculinity norms may contribute to an increase in stress levels. It has been observed that men tend to refrain from expressing their emotional distress due to social expectations, which has been shown to negatively impact their capacity to cope with stress. Furthermore, research has demonstrated that men are more susceptible to

stress due to circumstances such as job loss and economic instability. A significant source of this stress is the traditional perception of men as the primary providers for their families (Herreen et al, 2022; Whitley,2021). Furthermore, it has been documented that men who adhere to high levels of traditional masculinity norms experience greater challenges in coping with these stressors (Adiningsih et al., 2020). The current research did not identify a correlation between gender role attitudes and stress levels. A growing body of evidence indicates that the relationship between gender attitudes and stress in men becomes more pronounced and intricate with advancing age. It has been demonstrated that as men age, they experience heightened pressure to align with traditional gender roles, which in turn elevates their stress levels (Wagner & Reifegerste, 2024). The study underscores the notion that adherence to traditional norms of masculinity with advancing age can precipitate an increase in stress and its deleterious effects on health (Jakubowski & Sitko-Dominik, 2021). The discrepancy between the findings of this study and those of the existing literature may be attributed to the fact that the majority of the men in the study were relatively young.

Research limitations

It is significant to note that the study was conducted exclusively with male participants residing in Istanbul, which represents a significant limitation in the applicability of the findings.

CONCLUSION

The research fielded a weak positive correlation between gender role attitudes, attitudes towards sexist social violence and anxiety in men. No correlation was identified between gender role attitudes and stress and anxiety in men. Future research should include a larger sample size and not be limited to individuals from only one province. Furthermore, it would be beneficial to employ a probability sampling method in future studies to obtain more accurate data.

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None.

Conflict of Interest

The authors confirm that there are no potential conflicts of interest in relation to the research, authorship and/or publication of this article.

Author Contributions

Plan, design: SD**; Material, methods and data collection:** SD, EZP, DA**; Data analysis and comments:** SD**; Writing and corrections:** SD, EZP, DA**.**

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Ethical considerations

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Healthcare Worker and Nonhealthcare Worker Mothers' Experiences of Vaginal Examination in Labor and Their Views on Birth Satisfaction

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ABSTRACT
Objective: Birth satisfaction is an extremely important issue for both the woman's own health, the health of the baby, and positive family relationships. This study was conducted to reveal the opinions of healthcare and nonhealthcare worker mothers about vaginal examination during labor and their birth satisfaction. **Materials and Methods:** The sample of this cross-sectional and comparative study consisted of 408 mothers who gave vaginal birth between the ages of 18-45. Demographic Information Form, Birth Satisfaction Scale-Short Form, and Women's Vaginal Examination Experiences at Birth Scale were used to collect data. Independent sample t-test, one-way ANOVA and one-way MANOVA were used to analyze the data. **Results:** Birth satisfaction and vaginal examination experience were found to be associated with education level, occupation, number of pregnancies, number of live births, antenatal education, number of vaginal examinations in the last delivery, the person who performed the vaginal examination, the person who delivered the baby and the interventions performed during delivery (amniotomy, artificial labour, fundal pressure, intervention delivery) ($p<0.05$). **Conclusion:** It was observed that mothers who were health care workers had more positive vaginal examination experiences during trauma and higher birth satisfaction than mothers who were not health care workers ($p<0.05$).
Keywords: Birth, Birth Experience, Satisfaction, Vaginal examination.

Sağlık Çalışanı Olan ve Olmayan Annelerin Travayda Yapılan Vajinal Muayene Hakkındaki Görüşleri ve Doğum Memnuniyetleri

ÖZ
Amaç: Doğum memnuniyeti hem kadının kendi sağlığı hem bebeğin sağlığı hem de olumlu aile ilişkileri açısından son derece önemli bir konudur. Bu çalışma, sağlık çalışanı olan ve olmayan annelerin travayda vajinal muayeneye ilişkin görüşlerini ve doğum memnuniyetlerini ortaya koymak amacıyla yapılmıştır. **Gereç ve Yöntemler:** Kesitsel ve karşılaştırmalı olan bu çalışmanın örneklemini 18-45 yaş aralığında vajinal doğum yapan 408 anne oluşturmuştur. Veri toplamak için Demografik Bilgi Formu, Doğum Memnuniyet Ölçeği-Kısa Formu ve Kadınların Travayda Vajinal Muayene Deneyimleri Ölçeği kullanılmıştır. Verilerin analizinde bağımsız örneklem t-testi, tek yönlü ANOVA ve tek yönlü MANOVA analizi uygulanmıştır. **Bulgular:** Doğum memnuniyeti ve vajinal muayene deneyiminin; eğitim seviyesi, meslek, gebelik sayısı, canlı doğum sayısı, antenatal eğitim, son doğumda vajinal muayene sayısı, deneyimi ve vajinal muayeneyi yapan kişi, doğumu yaptıran kişi ve doğumda uygulanan girişimler (amniyotomi, suni sancı, fundal basınç, müdahaleli doğum) ile ilişkili olduğu bulunmuştur ($p<0.05$). **Sonuç:** Sağlık çalışanı olan annelerin, sağlık çalışanı olmayan annelere göre travayda vajinal muayene deneyimlerinin daha olumlu ve doğum memnuniyetlerinin daha yüksek olduğu görülmüştür ($p<0.05$).
Anahtar Kelimeler: Doğum, Doğum Deneyimi, Memnuniyet, Vajinal muayene.

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INTRODUCTION

Satisfaction with birth is an important indicator in evaluating the birth experience. Birth satisfaction is an extremely important issue in terms of the woman's own health, the health of the baby, and positive family relationships. Determining women's satisfaction with the birth experience is important because it is an indicator of maternal care quality and the well-being of the newborn and mother. Birth satisfaction is affected by support for pregnant women in labor, minimal interventions during labor, stress levels, and readiness for delivery (Hinic, 2017; Serhatlıoğlu & Karahan, 2018). Birth dissatisfaction poses risks such as obstetric interventions and emergency cesarean delivery, postpartum hemorrhage, delayed mother-baby bonding, difficulty in adapting to the role of motherhood, infant neglect/abuse, and short- or long-term lactation problems (Weeks et al., 2017; Serhatlıoğlu & Karahan, 2018). In the literature; sociodemographic and obstetric characteristics, prenatal education status, attitudes and communication of health workers, practices such as episiotomy, oxytocin application, enema, amniotomy and fundal pressure have been reported to affect birth satisfaction. In addition, vaginal examination, which is widely used to evaluate the birth process, affects birth satisfaction. When the studies investigating the experiences and feelings of women about vaginal examination in labor are examined, it can be stated that women describe vaginal examination as a necessary but unpleasant, uncomfortable, embarrassing and painful condition (de Klerk et al., 2018; Dabagh-Fekri et al., 2020). Performing vaginal examinations at frequent intervals during delivery, not showing the necessary care during this practice, being harsh, hasty, and insensitive, not establishing verbal communication with the patient, the examination being performed by a health personnel of opposite sex, examination position, instruments used, previous negative examination experiences, lack of attention to privacy, and lack of examination experience cause women to feel pain, discomfort, anxiety, fear, shame, guilt, and powerlessness and decrease their birth satisfaction (Borders et al., 2012; Hassan et al., 2012; Downe et al., 2013; Bonilla-Escobar et al., 2016; El-Moniem & Mohamady, 2016). Considering that birth is a multifaceted experience for women, the negative attitudes encountered during the birth process, the high number of vaginal examinations, traumatic vaginal experiences, the negative attitudes of health personnel and the dissatisfaction with birth, the experiences and opinions of women who are health professionals such as nurses, midwives and doctors on this issue are considered as remarkable research. For this reason, in this study, the views of health professionals and non-health professionals on vaginal examination experiences during labour and satisfaction with childbirth were compared.

MATERIALS AND METHODS

Study type

This was a cross-sectional and comparative study based on the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines (Von Elm et al., 2008).

Study group

The sample of this study, which was conducted to compare the views of mothers who were health personnel (n=204) and mothers who were not health personnel (n=204) about vaginal examination in labor and their satisfaction with delivery, consisted of 408 mothers who gave birth vaginally between the ages of 18-45. To determine the sample size, a power analysis was performed considering the studies evaluating the birth satisfaction, and the power of the study was calculated in the G*Power (v3.1.7) program. The sample size was calculated as 378 using G*Power analysis with an effect size of 0.79, α=0.05, and 98% power calculation. To increase the power of the research, it aimed to reach more women, and the sample of the study consisted of a total of 408 women who agreed to work with the snowball sampling method. The study included mothers who were 18-45 years old and who gave birth vaginally. Volunteers are required to answer every question to complete the survey in the google form, and therefore no data loss has occurred. Data were collected online using Google Forms between September and December 2022.

Research questions

1-What are the factors affecting the Vaginal Examination in Trauma Experience of mothers who are health workers and mothers who are not health workers?

2-What are the factors affecting the birth satisfaction of mothers who are health workers and mothers who are not health workers?

3-How are the traumatic vaginal examination experiences and birth satisfaction of mothers who are health workers?

4-How are the traumatic vaginal examination experiences and birth satisfaction of mothers who are not health care workers?

Variables

The Demographic Information Form was used to question information such as age, education level, occupation, total number of pregnancies and births, the status of receiving childbirth preparation education, thoughts about the last vaginal examination and the person who delivered the last birth. Birth Satisfaction Scale-Short Form (BSS-SF) was used to question labour satisfaction, Women's Experiences of Vaginal Examination in Labour Scale (WEVELS) was used to question the experience of vaginal examination in labour.

Procedures

The Demographic Information Form, the Birth Satisfaction Scale-Short Form (BSS-SF), and the

Women's Experiences of Vaginal Examination in Labor Scale (WEVELS) were used to collect data.

Descriptive information form

The descriptive information form prepared by the researcher within the scope of the relevant literature included about the socio-demographic and obstetric characteristics of the women who had vaginal delivery, their recent delivery history and their vaginal examination experiences in trauma (Afacan, 2018; Göncü, 2015; Serhatlıoğlu & Karahan, 2018).

Birth Satisfaction Scale-Short Form (BSS-SF)

The scale was revised by Martin and Martin in 2013. The revised version, the Birth Satisfaction Scale-Short Form, included 10 items on a Likert scale. The minimum and maximum scores that can be obtained from the scale are 0 and 40, respectively. Higher scores indicate higher levels of birth satisfaction. Turkish adaptation of the scale was conducted by Göncü (2015). The cronbach alpha value of the scale was reported as 0.74. In this study, Cronbach alpha value was found to be 0.76.

Women's Experiences of Vaginal Examinations in Labor Scale (WEVELS)

The scale was developed by Lewin et al. (2005) to investigate women's experiences of vaginal examination in labor. The scale consists of 20 items on a five-point Likert type scale. The scores for each item are summed, and a total score between 20-100 is obtained. Higher scores indicate higher levels of satisfaction with vaginal examination in labor. The Turkish adaptation of the scale was conducted by Afacan (2018). The cronbach alpha value of the scale was reported as 0.85. In this study, Cronbach alpha value was found to be 0.83.

Statistical analysis

This data was analyzed using SPSS software (version 26.0). Numbers, percentages, means, medians, and standard deviations were calculated in the analysis of sociodemographic data. Normal distribution was tested using the Kolmogorov–Smirnov test. For data with a normal distribution, an independent samples t test was used for two groups, and one-way ANOVA was performed for three or more groups. The effect of some independent variables on women's experiences of vaginal examinations in labor and birth satisfaction was analyzed using one-way MANOVA. The results were evaluated at a 95% confidence interval, and the level of significance was set at $p<0.05$.

Ethical considerations Written ethical approval was obtained from the Istanbul Atlas University for the conduct of the study (Date: 13.01.2022, Approval no: E-22686390-050.01.04-1188). In addition, women who agreed to participate in the study were asked to fill out an informed consent form, which was prepared in accordance with the principles of the Declaration of Helsinki and included information about the purpose of the study.

RESULTS

As a result of the analysis, it was determined that 24.0% of the women were primary school graduates, 20.6% were high school graduates and 55.4% were university graduates. It was also determined that 37.5% of the women were housewives, 12.5% were workers, 25.2% were nurses, 16.9% were midwives and 7.8% were doctors. The analysis revealed that 31% of the participants had one pregnancy and 37.0% had a live birth. There was a important difference in vaginal examination experiences and birth satisfaction by number of pregnancies and the total number of live births ($p<0.05$). A total of 22.5% of the women stated that all vaginal examinations during their last labor were disturbing. The women who do not feel uncomfortable during a vaginal examination were found to have higher vaginal examination experience and birth satisfaction mean scores ($p<0.05$) (Table 1).

One-way MANOVA analysis was performed determine how experience of vaginal examination during birth and birth satisfaction with labour differed according to occupation. Vaginal examination experiences and birth satisfaction were used as the dependent variables, and occupation was used as the independent variable. Normality, linearity, and variance matrices, which are the assumptions required to carry out this test, ensured homogeneity. The analysis revealed that the type of occupation created significant differences in both dependent variables ($F=4.617$; $p=0.010$) (Table2).

According to the analysis, it was determined that the arrival of amniotic fluid at the beginning of labor, the number of vaginal examinations, pressure applied to the fundus region, artificial pain during labor, amniotomy and the last delivery method affected the mothers' vaginal examination experiences and birth satisfaction levels (Table 3).

DISCUSSION

This study investigated mothers' birth and vaginal examination experiences and birth satisfaction by posing questions about the interventions made during the birth process. Vaginal examination experiences and birth satisfaction levels were compared according to the sociodemographic and obstetric characteristics of the mothers. According to the results of this study, it was found that birth satisfaction and vaginal examination experience were associated with the number of pregnancies, number of live births, antenatal education, the person who performed vaginal examination at the last birth, the person who delivered the baby and the definition of vaginal examination at birth.

Table 1. Distribution of total Women's Experiences of Vaginal Examinations in Labor Scale (WEVELS) and Birth Satisfaction Scale–Short Form (BSS-SF) mean scores across characteristics related to labor/pregnancy (n=408).

Demographic and obstetric characteristics **Age Mean±SD**: 31.28±5.32	**N**	**%**	**WEVELS Total Score Mean±SD**	**BSS-SF Total Score Mean±SD**
Education level				
Primary school[1]	98	24.0	61.62±10.42	20.13±4.98
High school[2]	84	20.6	63.27±12.14	21.42±5.67
University[3]	226	55.4	66.35±11.77	22.31±6.08
Test/p (value)			F=6.409 p=0.002	F=3.534 p=0.030
Post Hoc Test/Bonferroni			3>1 p=0.002	3>1, 3>2 p=0.028
Occupation				
Housewife[1]	153	37.5	59.76±9.87	19.65±6.98
Workers[2]	51	12.5	61.24±12.47	19.25±5.89
Nurse[3]	103	25.2	66.36±13.08	23.08±4.26
Midwives[4]	69	16.9	68.40±14.01	22.01±5.27
Doctor[5]	32	7.8	70.41±16.98	24.98±6.26
Test/p (value)			F=9.229 p=0.000	F=8.369 p=0.000
Post Hoc Test/Bonferroni			5>1, 5>2, 4>1, 4>2, 3>1, p<0.05	5>1, 5>2, 3>1, 3>2, p<0.05
Total number of pregnancies				
One pregnancy[1]	127	31.1	67.28±13.32	22.48±6.29
Two pregnancies[2]	120	29.4	61.59±11.32	20.93±5.73
Three pregnancies[3]	105	25.7	65.27±10.42	21.12±4.92
Four and more pregnancies[4]	56	13.7	63.57±9.16	20.95±5.17
Test/p (value)			F=5.295, p=0.001	F=0.489, p=0.030
Post Hoc Test/Bonferroni			1>2, p=0.001	-
Total number of live births				
One[1]	151	37.0	67.27±12.89	21.36±6.35
Two[2]	133	32.6	61.58±11.21	21.44±5.86
Three[3]	89	21.8	64.81±10.27	21.09±4.25
Four and above[4]	35	8.6	63.80±8.67	20.91±4.68
Test/p (value)			F=5.849, p=0.001	F=0.130, p=0.942
Post Hoc Test/Bonferroni			1>2, p=0.001	-
How would you describe the vaginal examination experience at your last labor?				
I wasn't disturbed[1]	81	19.9	66.73±12.30	23.05±5.37
I didn't feel much discomfort[2]	71	17.4	68.54±11.40	23.25±4.97
It was uncomfortable[3]	80	19.6	63.21±8.910	19.55±6.52
I was only disturbed in the period close to labor[4]	84	20.6	62.97±11.82	20.26±4.39
Vaginal examinations during labour were uncomfortable[5]	92	22.5	62.30±12.70	20.61±5.85
Test/p (value)			F=4.287, p=0.002	F=7.399, p=0.000
Post Hoc Test/Bonferroni			2>4, 1>3, 2>5, p<0.05	1>3, 2>3, 1>4, 2>4, 1>5, 2>5, p<0.05
Health personnel who performed the vaginal examinations at your last labor				
Only midwife[1]	125	30.6	65.76±14.26	21.77±6.19
Mostly midwives, less often doctor[2]	173	42.4	62.80±10.52	21.03±5.20
Mostly doctor, less often midwife[3]	46	11.3	63.70±9.09	18.48±4.80
Only doctor[4]	64	15.7	67.72±9.99	23.08±5.47
Test/p (value)			F=3.439, p=0.017	F=6.634. p=0.000
Post Hoc Test/Bonferroni			4>1, p=0.024	1>3, 2>3, 4>3, 4>1, p<0.05

Table 1. (continue) Distribution of total Women's Experiences of Vaginal Examinations in Labor Scale (WEVELS) and Birth Satisfaction Scale–Short Form (BSS-SF) mean scores across characteristics related to labor/pregnancy (n=408).

Demographic and obstetric characteristics	N	%	WEVELS Total Score Mean±SD	BSS-SF Total Score Mean±SD
Having received birth preparation training before?				
Yes	118	28.8	64.20±9.21	23.46±5.69
No	290	72.2	59.35±11.78	19.36±5.30
Test/p (value)			t=2.321, p=0.001	t=1.299, p=0.035
Person who performed the last labor?				
Doctor	220	53.9	66.59±11.54	21.72±5.68
Midwife	188	46.1	62.28±11.46	18.81±5.56
Test/p (value)			t=3.763, p=0.000	t=1.625, p=0.045
Did your water break when your last labor started?				
Yes	202	50.5	65.68±11.81	22.03±5.74
No	206	49.5	63.46±11.53	20.54±5.44
Test/p (value)			t=-1.538, p=0.125	t=-2.687, p=0.008

F= One-Way ANOVA, t= independent samples t

In study, the participants reported that they had negative views about vaginal examination because the healthcare personnel who performed the vaginal examination did not get permission from them before the examination, not communicating positively, failure to respect privacy, were examined by different health personnel each time, and the health personnel did not give information about the examination (Table 1). In similar research results, the most frequently stated expectation of women is; positive communication with health personnel, courteous behavior, informing about the procedure, getting permission before the procedure and respecting privacy (Martin & Fleming, 2011; Borders et al., 2012; Hassan et al., 2012; Bonilla-Escobar et al., 2016; El-Moniem & Mohamady, 2016; Hatamleh et al., 2012). The one-way MANOVA performed in study revealed that healthcare worker mothers had more positive vaginal examination experiences and higher birth satisfaction than nonhealthcare worker mothers (Table 2). These findings suggest that healthcare worker mothers have more knowledge about labor, vaginal examination, and delivery process than other mothers and that their colleagues have a more positive approach toward them in this process. Before vaginal examination and during labor, the expectations and needs of all women can be revealed, appropriate interventions can be planned, the steps of the procedure can be explained and then implemented, the focus should be on the woman during the procedure, and the privacy of women should be ensured, all of which can turn the vaginal examination into a more positive experience (De Klerk et al., 2016; Dabagh-Fekri et al., 2020; Borders et al., 2012; Hassan et al., 2012; Bonilla-Escobar et al., 2016; El-Moniem & Mohamady, 2016; Downe et al., 2013; Hatamleh et al., 2012).

Table 2. Comparison of the Women's Experiences of Vaginal Examinations in Labor Scale (WEVELS) and Birth Satisfaction Scale–Short Form (BSS-SF) mean scores of healthcare and nonhealthcare worker mothers (n=408).

	Independent variables	$\bar{X}$	SD	F (group)	p (group)	F (model)	p (model)	Partial Eta Squared
	Occupation							
WEVELS	Healthcare worker mother	66.81	10.81	8.769	0.003	4.617	0.010*	0.474
	Nonhealthcare worker mother	62.88	12.25					
BSS-SF	Healthcare worker mother	22.90	5.21	4.899	0.027			
	Nonhealthcare worker mother	20.67	5.28					

F= One-way MANOVA

Table 3. Distribution of mean total scores of Women's Experiences of Vaginal Examination During Labor Scale (WEVELS) and Birth Satisfaction Scale - Short Form (BSS-SF) according to the practices performed at the last birth.

Practices performed at the last birth	WEVELS Total Score		BSS-SF Total Score	
	Non-healthcare worker (n=204) Mean±SD	Healthcare worker (n=204) Mean±SD	Non-healthcare worker (n=204) Mean±SD	Healthcare worker (n=204) Mean±SD
Did you have amniotic fluid at the time of your last labour?				
Yes	63.65±11.90	66.60±11.46	20.90±5.72	23.63±5.19
No	60.02±12.51	64.99±10.24	20.40±6.24	20.23±4.92
Test/p (value)	t=-1.381 p=0.169	t=-0.916 p=0.361	t=-0.544 p=0.587	t=3.367 p=0.000
What is the average number of vaginal examinations at your last labor?				
≤4	63.47±13.06	66.75±13.87	21.70±6.12	23.36±6.26
≥5	60.18±10.47	60.74±11.68	19.25±5.98	20.17±5.51
Test/p (value)	t=-2.241 p=0.037	t=-1.676 p=0.001	t=-2.684 p=0.042	t=2.367 p=0.000
Pressure on the fundus region				
Yes	62.56±11.47	65.00±11.03	19.74±5.51	21.32±5.18
No	63.69±14.09	71.69±8.33	23.03±6.52	24.38±4.63
Test/p (value)	t=-0.592 p=0.554	t=-3.552 p=0.000	t=-3.651 p=0.001	t=-3.384 p=0.001
Artificial pain at birth				
Yes	60.92±12.40	60.35±10.12	19.11±5.97	20.38±5.17
No	65.23±11.70	70.02±9.63	22.55±5.46	23.87±5.02
Test/p (value)	t=-2.534 p=0.012	t=-6.846 p=0.000	t=-4.256 p=0.001	t=-3.412 p=0.000
Amniotomy at birth				
Yes	62.68±12.87	65.16±10.81	19.56±7.17	20.13±4.60
No	63.33±11.81	67.61±10.86	21.16±5.02	23.45±5.54
Test/p (value)	t=0.776 p=0.439	t=1.618 p=0.110	t=-0.233 p=0.029	t=3.765 p=0.000
Last type of birth (interventional/ spontaneous)				
Spontaneous	64.38±11.47	67.85±11.71	21.83±5.77	22.37±4.89
Interventional	60.46±15.45	65.74±7.24	19.01±6.95	20.33±5.97
Test/p (value)	t=1.289 p=0.199	t=-1.034 p=0.302	t=.827 p=0.039	t=2.363 p=0.019

t= independent samples t

According to the findings, it was observed that the arrival of amniotic fluid at the beginning of the last birth significantly affected the birth satisfaction of only the mothers who were healthcare workers. It was determined that both the vaginal examination experience was better and the birth satisfaction level was significantly higher in mothers who had 4 or less vaginal examinations during labor (Table 3). Performing vaginal examinations at frequent intervals during delivery, not showing the necessary care during this practice, being harsh, hasty, and insensitive, not establishing verbal communication with the patient, the examination being performed by a health personnel of opposite sex, examination position, instruments used, previous negative examination experiences, lack of attention to privacy, and lack of examination experience cause women to feel pain, discomfort, anxiety, fear, shame, guilt, and powerlessness and decrease their birth satisfaction (Borders et al., 2012; Hassan et al., 2012; Bonilla-Escobar et al., 2016; El-Moniem & Mohamady, 2016; Downe et al., 2013; Hinic, 2017). Clinically vaginal examinations among the most accepted ways to assess progress during childbirth, but its repetition at shorter intervals has no value. The intrapartum care guide for positive birth experience published by the World Health Organization (WHO) in 2018 indicated that vaginal examinations should be done every 4 hours in the active phase, but that the number of vaginal examinations should be limited in prolonged

amniotic membrane ruptures and prolonged labor, and that vaginal examinations by more than one health personnel at the same/different times for the same woman should be avoided (WHO, 2018). As a result of the analysis conducted in the study, it was determined that applying pressure to the fundus region, giving artificial pain during birth, performing amniotomy and interventional birth decreased birth satisfaction in mothers (Table 3). When the studies were examined; it was reported that women who gave birth with intervention (episiotomy, amniotomy, fundal compression, oxytocin application, vacuum, use of forceps) had lower birth satisfaction compared to women who gave birth spontaneously vaginally and it is seen that it is compatible with our findings (Hinic, 2017; Martin & Martin, 2014; Dencker et al., 2010; Hildingsson et al., 2013; Maskálová et al., 2021; Smarandache et al., 2016; Mortazavi & Mehrabadi, 2022). The current approach in the management of childbirth is not to intervene unless necessary and not to interfere with the process, especially in low-risk pregnant women. In addition, mothers do not want interventions such as induction, amniotomy, vacuum, forceps, episiotomy, and fundal pressure to accelerate or facilitate delivery unless serious problems occur in baby health. These interventions are unexpected for women. In addition, all unnecessary interventions negatively affect the birth experience and birth satisfaction of women (Hinic, 2017; Maskálová et al., 2021; Smarandache et al., 2016; Mortazavi & Mehrabadi, 2022).

Study Limitations and Strengths

This is the first national study to compare the labour satisfaction and vaginal examination experiences of women with and without healthcare professionals. This study has several limitations that should be mentioned. Firstly, the data of the present study were collected online. Secondly, the fact that women gave birth in different conditions at different times may affect the generalisability of the data of our study. We recommend that qualitative studies be conducted to examine women's labour satisfaction and vaginal examination experiences in depth.

CONCLUSION

In this study revealed that healthcare worker mothers had more positive vaginal examination experiences and higher birth satisfaction than nonhealthcare mothers. As health professionals, midwives and nurses have important responsibilities in protecting and improving women's health. Providing quality care and creating a positive experience that can contribute to overall birth satisfaction should be a common target of healthcare professionals in caring for parturient women. According to the findings, the most important duties of doctors, midwives and nurses working in delivery rooms during the birth process are to meet the physical and psychological needs of pregnant women during labor, to provide them with emotional support, to make them feel that the care given is unique to them, to help them cope with labor pain and to ensure their cooperation and contribution to ascertain that the labor is as smooth and positive as possible, which all eventually increase birth satisfaction.

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Conflict of Interest

It has been declared by the authors that there is no conflict of interest.

Author Contributions

Plan, design: EŞ, SY; **Material, methods and data collection:** EŞ, SY; **Data analysis and comments:** EŞ, SY; **Writing and corrections:** EŞ, SY.

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Ethical Approval

Committee: Istanbul Atlas University, Non-invasive Scientific Research Ethics Committee.
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Scanning Electron Microscopic Investigation of Rumen Papillae in Sheep that Died from Acidosis

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ABSTRACT
Objective: In this reseach aimed to observe changes in the rumen papillae using SEM in cases of rumen acidosis, which is prevalent among sheeps. Rumen acidosis is a common issue in sheeps, resulting from uncontrolled excessive intake of easily fermentable carbohydrates. In severe patient, it can lead to passsing away within a day. **Materials and Methods:** For this work, rumens were collected from sheep diagnosed with acidosis and slaughtered Samples were coated with gold and examined using a Jeol JVM 5000 microscope at 5-15 kV. **Results:** SEM findings revealed balloon-like cells on the surface of the rumen papillae in animals with acidosis. It was noted that there were more dead keratinized cells compared to healthy animals. No deep cellular damage or parakeratosis was observed in the papillae. Although no serious deterioration in the ruminal epithelium was found, cells exhibited alterations from their normal form. The study observed cellular damage and anatomical changes at the cellular level due to rumen acidosis, and the findings were presented. **Conclusion:** Overall, this study highlights the significant impact of rumen acidosis on the morphology of sheep papillae. Monitoring these changes through SEM can provide valuable insights into the pathophysiology of rumen acidosis and help in developing more effective management strategies for this common disease in sheep farming.
Keywords: Acidos, Rumen, Scanning Electron Microscopy, Sheep.

Asidozdan Ölen Koyunlarda Rumen Papillalarının Taramalı Elektron Mikroskobik İncelenmesi

ÖZ
Amaç: Bu çalışmada koyunlarda yaygın olarak görülen rumen asidozu olgularında SEM ile rumen papillalarındaki değişimlerin gözlenmesi amaçlanmıştır. Rumen asidozu koyunlarda yaygın görülen, kolay fermente olabilen karbonhidratların kontrolsüz aşırı alımı sonucu oluşan bir sorundur. Şiddetli hastalarda bir gün içinde ölüme yol açabilir. **Gereç ve Yöntem:** Bu çalışma için asidoz tanısı konulan ve kesilen koyunlardan rumen örnekleri toplandı. Örnekler altınla kaplandı ve 5-15 kV'da Jeol JVM 5000 mikroskobu kullanılarak incelendi. **Bulgular:** SEM bulguları asidozlu rumen bulgularında papillalarının yüzeyinde balon benzeri hücreler olduğunu gösterdi. Sağlıklı hayvanlarla karşılaştırıldığında daha fazla ölü keratinize hücre olduğu kaydedildi. Papillalarda derin hücresel hasar veya parakeratoz gözlenmedi. Ruminal epitelde ciddi bir bozulma bulunmamasına rağmen hücreler normal formlarından değişiklikler gösterdi. Çalışmada rumen asidozu nedeniyle hücresel düzeyde hücresel hasar ve anatomik değişiklikler gözlemlendi ve bulgular sunuldu. **Sonuç:** Genel olarak, bu çalışma rumen asidozunun koyun rumen papillalarının morfolojisi üzerindeki önemli etkisini vurgulamaktadır. Bu değişikliklerin SEM aracılığıyla izlenmesi, rumen asidozunun patofizyolojisi hakkında değerli bilgiler sağlayabilir ve koyun yetiştiriciliğinde bu yaygın hastalık için daha etkili yönetim stratejilerinin geliştirilmesine yardımcı olabilir.
Anahtar Kelimeler: Asidoz, Koyun, Rumen, Taramalı Elektron Mikroskobu (SEM).

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INTRODUCTION

The rumen epithelial is a important part of the immune arrangement in sheeps (Penner et al., 2011). Uncontrolled concentrated feeding, which forms the basis of acidosis, origines harm of the rumen mucosa in animals. (Liu et al., 2013). Rapidly fermentable carbohydrates accelerate the fermentation process of acid production. Acid accumulation in the rumen increases the likelihood of impaired rumen epithelial barrier function and thus exposure to toxins (Beauchemin et al., 2008). Damage in this area can be visualized histologically and by SEM (Steele et al., 2009). In Türkiye, sheep are mostly raised in non-agricultural areas, pastures and meadows, and contribute to the economy by converting natural vegetation into meat, milk and wool.

Sheep, which are ruminants, digest hay-like feeds in their forestomachs through microbial fermentation. This is enhanced by different mucosal structures that vary greatly in shape according to their feeding habits. Many studies have revealed the anatomical and histological structure of the forestomach mucosa in ruminants (Loe et al., 1959; Yamamoto et al., 1998). Such animals have been classified into three categories according to their feeding preferences: pasture-feeders, concentrate-feeders and inter mediate-type feeders (Hofmann, 1982). Domesticated ruminants are either grazers or inter mediate-type eaters. Pasture-feeders generally digest low-quality roughage, while inter mediate-type feeders select leaves and young plants with high energy content if available (Hofmann, 1982). High-energy feeding causes a deteriorated epithelial erosion in the rumen. Multiple systemic symptoms such as rumenitis and liver abscess are observed in high-energy diets (Liu et al., 2013). It has been defined that papillae are under the impact of dietary replace and feeding period. It has been noticed that the number of papillae increases significantly in groups fed with concentrate compared to those fed with dry feed (Gäbel, 1987). It has also been observed that the shape of the papillae changes basing on the food. While small, finger-shaped papillae were noticed in the group fed with hay, large, leaf-shaped and tongue-shaped papillae with a wide surface were observed in animals fed with concentrate (Ahmed et al., 2013). In general, it has been reported that the development and growth of rumen papillae is highly related to diet. Physically and chemical stimuli, short-chain fatty acids, the animal's age, and the timing of weaning have been identified as factors directly influencing the size and shape of papillae. (Ahmed et al., 2013; Swan & Groenewald, 2000; Zitnan et al., 1999). It has been presented that papillae are largest and densest in the ventral part of the rumen, in the parts most exposed to feed. It has been observed that the total of papillae per cm^2 mucosa grows importantly in concentrated feeding compared to straw feeding. As the duration of concentrated feeding increases, the papillae ruminis take the form of leaves and elongate (Ahmed et al, 2013; Gäbel et al., 1987). It has also been noticed that papilla growth depends on short-chain fatty acids originating from feed ingredients (Brownlee, 1956). It is recognized that ruminal surface experience proliferative or reductive actions basing on the type of feed. Ruminal mucosa gradually decreases in the number and volume of ruminous papillae when fed energy-poor diets, but increases intensively with high-energy diets (Dirksen, 1985).

When the average length and width of ruminous papillae were compared between the concentrate and straw-fed groups, it was reported that the papillae were strikingly higher in the concentrate-fed group (Ahmed et al., 2013). SEM findings indicated that in the views of rumen papillae, recess and dead keratinized cells along the surface were more pronounced in the concentrate-fed animals than in the straw-fed animals. Deep cellular harm were noticed in the surface cells of rumen papillae in goats fed concentrate. During the straw diet, rumen papillae sections, nuclei, mitochondria and intercellular connections were normal. Cellular necrosis and cellular corrosion were observed in all cell layers in goats fed with concentrate feed. It has been reported that high energy diet causes serious deterioration in ruminal epithelium, especially in subacute ruminal acidosis during feeding, and significant epithelial cell damage and cell erosion (parakeratosis) have been detected (Liu et al., 2013; Steele et al., 2009). In addition, in such cases where the rumen epithelium is disrupted, this layer becomes permeable to endotoxin and can cause poisoning (Liu et al., 2013). It has been reported that morphologically rich deep ridges and grooves are observed in SEM images of rumen papillae taken from all cattle. Heterogeneous microflora including abundant bacteria and protozoa has been reported to be detected in deep ridges and grooves, especially in the roughage-based diet. In additional magnification, keratinized squamous cells of the stratum corneum layer were found to be prominent in the high energy diet. While the microbial flora decreases, peeling of dead keratinized cells was reported to be prominent (Steele et al., 2009). It has been reported that sheep fed a high energy density diet have darker brown ruminus papillae in the ventral part of the rumen compared to sheep fed a low energy density diet (Joshua et al., 2018).

In this regard, this study aimed to reveal the morphological status of the mucosal morphology structures of the rumen from the forestomachs of sheep that died of acidosis.

MATERIALS AND METHODS

Four female and adult Akkaraman sheep, a breed native to Turkiye that died of acidosis, were used in the study. Sections taken from the ventral part of the rumen of animals that died of acidosis were fixed in

the laboratory for SEM examinations and morphological findings were obtained. For SEM specimens were fixed in 5% glutaraldehyde in phosphate buffer (pH 7.3), followed by fixation in 1% osmium tetroxide (OsO4) at 40 °C for 2 hours. Material specimens were processed through alcohol series and critical point dried. Samples were coated with gold and examined using a Jeol JVM 5000 microscope at 5-15 kV (JSM 6390LV, JEOL, Germany).

Ethical considerations

Since the study was conducted on dead material, ethics committee approval is not required.

RESULTS

Finger-shaped structures called papillae ruminis and areas called pila ruminis were observed macroscopically on the rumen surface of our materials. Ruminal papillae (Figure 1) were seen all over the ruminal mucosa except for the rumen columns called pila ruminis. The ruminal columns called pila ruminis and their vicinities were reduced in both number and length. It was observed that the papillae were densely distributed throughout the ruminal surface outside of this. Their color was determined as dark brown. Ruminal papillae were plump. They varied greatly in shape from short tongue-shaped to long and wide leaf-like shapes, depending on their location. Short tongue-shaped papillae ruminis were mostly noticed on the dorsal and lateral walls of the rumen, while long and wide leaf-like papillae were found in the ventral part. No grooves called primary or secondary were observed on the papilla rumenis.

Cells on the rumen surface were observed at different magnifications (Figure 2). In scanning electron microscopic magnification (x34), a granular shape was seen on the surface of the papilla ruminis (Figure 1). Polygonal cells were noticed on the entire inner mucosa of the rumen at 10 kV and 130 magnification. The cells were mostly determined to be quadrangular, pentagonal and hexagonal (Figure 2). It was determined that each side of the cells had different lengths. It was determined that these lengths varied between 8.5 µm and 11.4 µm. In the 130 magnifications in the SEM images, swollen intermediate balloon-type cells were seen on the rumen surface. In the spacimen taken from the rumen ventral wall, cell harm was detected in the root parts of the papilla at 34 magnification. It was determined that these erosions were observed in each papilla ruminis and occupied approximately one-third of the area. This was determined to cover a considerable area in terms of volume (Figure 1).

DISCUSSION

In the study, the color of the rumen papillae was determined to be brown. Studies have shown that changes in papilla color are dependent on diet (Ahmed et al., 2013; Atalgin et al., 2023; Dyce et al., 2010). Ahmet et al. (2013) reported that papillae obtained from sheep fed with straw were light brown. However, in the 6 and 12 weeks of concentrated feed group, dark brown colored papillae were observed

It was shown that the forestomach of sheep dying of acidosis had papillae of various shapes and sizes. In the imaging performed with SEM, many papillae were detected, topographically different in number and shape (Anderson et al., 1987; Tamate et al., 1979).It was shown that these differences in papilla development were partially related to feeding habits, as in our results. These studies noticed in animals with known nutritional position revealed wide differences, especially in the rumen, according to the written Works (Ahmed et al., 2013; Atalgin et al., 2023; Dyce et al., 2010; Loe et al., 1959; Sander et al., 1959; Weyrauch & Schnorr, 1979).

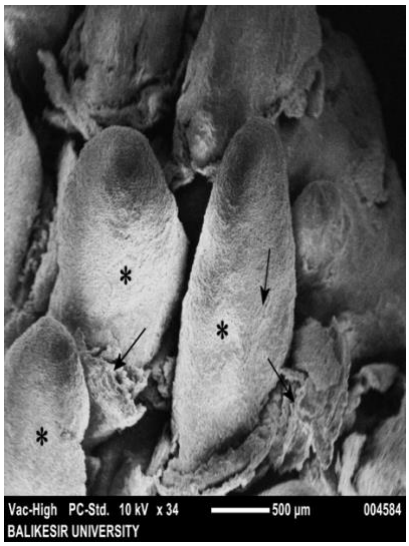

Figure 1. Ruminal papillae (asterisks), cell debris (arrows).

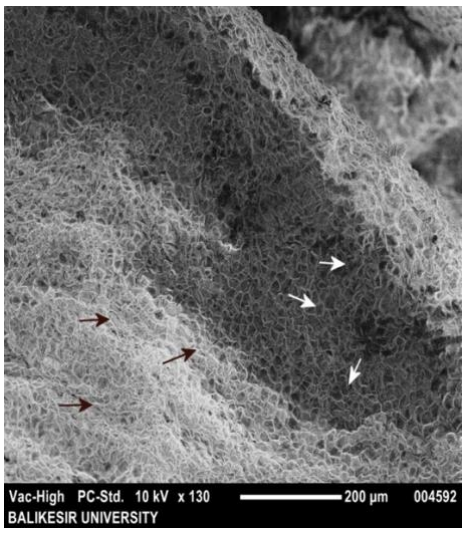

Figure 2. Balloon type cells (arrows).

(Ahmed et al., 2013; Dyce et al., 2010). These evidences are generally consistent with the ends of our work.

A study reported that the entire rumen surface was covered with polygonal cells (Scott & Gardner, 1973). This finding is consistent with our findings. Scott and Gardner (1973) reported that cell boundaries were clearly seen. The existing boundaries were also observed in our study. Angela García (2012) reported in her study that the ruminal wall was seen as a smooth surface and there were no signs of keratinization or desquamation, this view is not fully consistent with our study. Necrotic areas were observed in our study and cell debris was detected.

Along with our results, most researchers (Ahmed et al., 2013; Penner et al., 2011) reported that there was cellular necrosis, parakeratosis and cell debris in the papillae ruminis of animals fed with concentrate feed. However, in one study (Scott & Gardner, 1973; Penner et al., 2011; Ahmed et al., 2013), it was stated that this shedding is a feature of the rumen epithelium and that this shedding is normal. In our study, necrotic cell residues were observed in the epithelial cells of the ruminus papilla in acidotic animals. These results contradict the results of this literature, except for normal cell death. Tamata et al. (1979) defined primary and secondary grooves in the ruminal papilla in sheep, resulting from the longer stay of concentrated feeds in this area. Yamamoto et al. (1994) and Scott and Gardner (1973) also mentioned these structures. Atalgın et al., (2023) stated in his study that the ruminus papilla contains two different types of grooves in terms of length and size, and that these grooves are shaped by the longer stay of concentrated feeds in this area. Although it was stated that the primary groove is located in the middle along the length of the papilla and the small secondary ones are shallow shaped, and the secondary grooves cut the primary groove, no groove was observed in our study. Mahes et al. (2014) detected smaller pointed and blunt protrusions such as secondary papillae between the large and small dense papillae on the ventral wall of the rumen in their study. However, such secondary papillae were not observed in our study.

Cytologically, Schnorr and Vollmerhaus (19682), Hofmann and Schnorr (1982) defined ceratinized cells as flat, balloon and intermediate type cells. It was determined that the cells seen in our study mostly resembled balloon type cells.

Steele et al. (2011) stated that heterogeneous microflora such as bacteria and protozoa were observed in SEM images, especially in hay-based diets. However, such microflora was not observed in our study, but the presence of this flora is thought to be directly related to the sample preparation technique. In the study of Atalgin (2023), it was observed that the ruminus papillae were not full. Atalgin (2023) reported that the ruminus papillae in his study were relatively weaker than our study and had grooves on them, which is consistent with this data, whereas in our study, the ruminus papillae were observed to be quite full.

CONCLUSION

As a result, in this article, the rumen of sheep with acidosis was investigated electron microscopically using SEM. Rumen papillae and cells were visualized. It was observed that the papillae were dark brown. According to the literature, it was determined that the papillae were more swollen and full in shape. It was observed that the cells in the rumen mucosa were mostly balloon-type cells. Epithelial debris and cell necrosis were detected. It was determined that these erosions were observed in the ventral part of each ruminus papillae and were approximately one-third of the area. Although it was reported theoretically (Ahmed et al., 2013; Penner et al., 2011), this finding was shown by scanning electron microscopy. It is thought that an acidotic animal will be exposed to necrotic areas and a deteriorated epithelial erosion, depending on the degree of the disease. As a result, the presence of cellular erosion formed by necrotic cells in the ruminous papilla of acidotic animals has been demonstrated.

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Conflict of Interest

The author declare no potential conflicts of interest with respect to the research, authorship and/or publication of this article.

Author Contributions

Plan, design: ŞHA; **Material, methods and data collection:** ŞHA; **Data analysis and comments:** ŞHA; **Writing and corrections:** ŞHA.

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Since the study was conducted on dead material, ethics committee approval is not required.

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Utilizing Physiological Metrics and Change Point Analysis for Real-Time Livestock Health Monitoring

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ABSTRACT
Objective: This study introduces a smart ear tag system for real-time monitoring of cattle health, integrating physiological metrics such as body temperature, heart rate, and oxygen saturation (SpO2) with Change Point Analysis (CPA) to detect state changes. **Materials and Methods:** The system was tested over a 7-day period on 10 cattle, monitoring health metrics continuously. CPA was applied to identify synchronized changes in the monitored parameters. The system's performance was evaluated based on its ability to detect potential health status changes while maintaining reliability and specificity. **Results:** The system successfully identified synchronized state changes in one animal, flagging a potential health issue, while showing no significant changes in the other nine animals. This indicates the system's capability to differentiate between normal variability and significant health-related changes. **Conclusion:** The proposed smart ear tag system demonstrates significant potential for Precision Livestock Farming. By integrating multiple physiological metrics and advanced analysis, it offers a reliable framework for improving animal welfare and enabling early disease detection.
Keywords: Livestock Health Monitoring, Digital Technologies in Livestock Farming, Change Point Analysis, Body Temperature, Heart Rate, Oxygen Saturation.

Fizyolojik Metrikler ve Değişim Noktası Analizi Kullanılarak Gerçek Zamanlı Hayvan Sağlığı İzleme

ÖZ
Amaç: Bu çalışma, vücut sıcaklığı, kalp atış hızı ve oksijen doygunluğu (SpO2) gibi fizyolojik metrikleri Değişim Noktası Analizi (CPA) ile entegre ederek, sığır sağlığının gerçek zamanlı izlenmesi için bir akıllı kulak etiketi sistemi sunmaktadır. **Gereç ve Yöntem:** Sistem, 7 gün boyunca 10 sığır üzerinde test edilerek sağlık metrikleri sürekli olarak izlenmiştir. İzlenen parametrelerdeki eş zamanlı değişiklikleri tespit etmek için CPA uygulanmıştır. Sistemin performansı, potansiyel sağlık durumu değişikliklerini tespit etme yeteneği ve güvenilirlik ile özgüllük açısından değerlendirilmiştir. **Bulgular:** Sistem, bir hayvanda eş zamanlı durum değişikliklerini başarıyla tespit ederek potansiyel bir sağlık sorunu işaret ederken, diğer dokuz hayvanda önemli bir değişiklik göstermemiştir. Bu durum, sistemin normal değişkenlik ile sağlıkla ilgili önemli değişiklikleri ayırt etme yeteneğini göstermektedir. **Sonuç:** Önerilen akıllı kulak etiketi sistemi, Hassas Hayvancılık Yönetimi için önemli bir potansiyele sahiptir. Çoklu fizyolojik metriklerin entegrasyonu ve ileri analiz yöntemleri sayesinde hayvan refahını artırmak ve hastalıkların erken teşhisini sağlamak için güvenilir bir çerçeve sunmaktadır.
Anahtar Kelimeler: Hayvan Sağlığı Izleme, Dijital Teknolojilerle Hayvancılık, Değişim Noktası Analizi, Vücut Sıcaklığı, Kalp Atış Hızı, Oksijen Doygunluğu.

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INTRODUCTION

Precision livestock farming (PLF) has revolutionized animal health monitoring by integrating sensor technologies and advanced data analytics. These systems enable continuous and real-time monitoring of livestock, addressing critical challenges in animal welfare, early disease detection, and sustainable farming practices (Besler et al., 2024 and Handa et al., 2022). Livestock health plays a pivotal role in ensuring productivity and economic efficiency, as physiological changes often precede visible signs of illness. Parameters such as body temperature, heart rate, and oxygen saturation (SpO2) provide essential insights into the health and well-being of animals (Halachmi et al., 2019 and Hammer et al., 2016).

The use of sensors in livestock monitoring has evolved significantly, offering non-invasive methods for tracking vital signs. Body temperature is a critical metric for detecting conditions such as fever or estrus, while heart rate serves as an indicator of stress, metabolic activity, and cardiovascular health(Neethirajan et al., 2018 and Nie et al., 2020). SpO2, often overlooked in livestock, provides valuable information on respiratory efficiency and oxygenation, which are crucial in detecting pulmonary or circulatory issues (Rahman et al., 2018 and Shahriar et al., 2016).

Despite advancements in PLF technologies, studies have predominantly focused on these parameters individually, leaving a gap in comprehensive, multi-metric monitoring approaches (Besler et al., 2024 and Tzanidakis et al., 2023). The integration of multiple physiological parameters offers a holistic understanding of animal health, enabling early detection of stressors and illnesses (Zhang et al., 2020 and Peschel et al., 2022). Temperature and heart rate are widely studied early indicators of disease in pigs (Jorquera-Chavez et al., 2020), poultry (He et al., 2022), sheep (Chevalier et al., 2023), calves (Lowe et al., 2019) and dairy cattle (Kim et al., 2019). Recent developments in Change Point Analysis (CPA) further enhance the capability to identify significant shifts in time-series data, making it an ideal tool for livestock health monitoring (Saint-Dizier et al., 2012 and Peel, 2020).

In this study, we hypothesize that integrating body temperature, heart rate, and SpO2 measurements into a single monitoring system can provide a comprehensive and real-time assessment of livestock health. The purpose of this research is to develop and validate a smart ear tag system that employs advanced sensor technology and CPA to detect physiological changes. By simultaneously monitoring these three critical parameters, we aim to ***detect state changes*** caused by key factors such as ***estrus, early signs of illness***, and ***environmental stress***. By capturing such diverse state changes, the smart ear tag system not only enhances health monitoring but also supports decision-making in areas like breeding, disease management, and welfare optimization, aligning with the goals of sustainable PLF.

MATERIALS AND METHODS

Study design and ethical statement

This study was conducted to develop and validate a smart ear tag system for continuous monitoring of physiological parameters in cattle, including body temperature, heart rate, and SpO2. Ethical approval for the study was obtained from the Mehmet Akif Ersoy University Animal Experiments Local Ethics Committee (Approval no: 1203). All experimental procedures adhered to ethical guidelines for the care and use of animals in research.

Development of the smart ear tag system

The smart ear tag system is designed to enable continuous monitoring of critical physiological parameters in cattle, specifically body temperature, heart rate, and SpO2 (oxygen saturation). The hardware components included the LM35 temperature sensor (Texas Intruments, United States of America), selected for its precision in detecting subtle temperature variations, and the MAX30100 (Analog Devices, United States of America) sensor module, which integrates optical technology to measure heart rate and SpO2. These sensors were paired with an Arduino microcontroller (Figure 1), chosen for being open-source hardware, its compatibility with multiple modules and its ease of programming, making it an ideal choice for real-time data acquisition and processing.

To ensure portability and minimal weight, the system was powered by a compact, rechargeable lithium-ion battery, while a MicroSD card module was used to store the collected data in CSV (Comma-seperated values) format for seamless transfer and analysis. The entire assembly was encased in a durable, waterproof shell to protect it from environmental factors such as moisture, dust, and physical impacts.

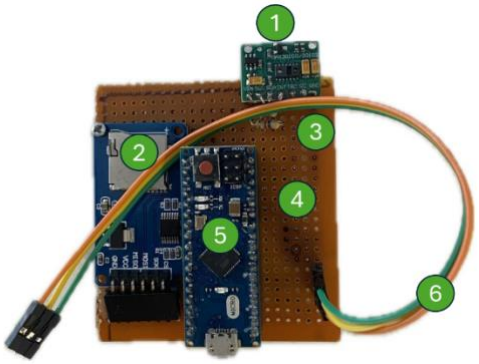

Figure 1. The smart ear tag system. Components: (1) MAX30100 sensor module, (2) Micro SD, (3) 4.7 Ohm Resistor, (4) Perforated PCB (Protoboard), (5) Arduino Microcontroller, (6) LM-35 Temperature Sensor

The software development process focused on programming the Arduino microcontroller using the Arduino IDE, with code written in C++ to handle sensor data acquisition, storage, and error management. The data were formatted into CSV files, including timestamps with second-level accuracy, to facilitate post-processing and analysis. The assembly process began with prototype testing on a breadboard, allowing iterative debugging of hardware connections and software logic. Once the prototype passed initial tests, the components were transferred to a perforated printed circuit board (PCB) and soldered to create a compact and durable system. The PCB was then mounted within the protective casing, designed with ports for changing batteries and data extraction.

Data collection

The ear tag system was tested on 10 Holstein cows in their early lactation period, between 2 and 4 ages. The smart eartag soldered onto a standard ear tag and they were securely attached using a standard ear tag applicator. Data were collected twice daily for one-hour sessions over a 7-day period. During each session, the tag continuously recorded body temperature, heart rate, and SpO2, and stored the data in CSV format. Data files were extracted and transferred to a computer at the end of each session for further analysis.

Implementation

The analysis was carried out using Python's *ruptures* library (Truong et al., 2018), which provides robust support for multiple cost functions and optimization algorithms. The process began with a thorough preprocessing of the physiological time series data. Using the *pandas library*, the data were loaded and cleaned to remove any missing or outlier values that could compromise the analysis. This step was crucial to ensure data integrity and reliability.

For segmenting the data, the "least squares" cost function was applied. This function calculates the variance within each segment, effectively detecting shifts in both mean and variance across the time series. The dynamic programming algorithm available in the *ruptures library* was then employed, enabling precise identification of change points within the data.

Finally, the results of the segmentation were visualized using the *matplotlib library*. The detected change points were plotted against the original time series data, with each change point clearly marked. This visual representation allowed for the validation of segmentation accuracy, ensuring that the detected changes aligned with expected physiological shifts. This integrated approach provided a comprehensive framework for analyzing and interpreting the physiological data effectively.

Statistical analysis

Collected data were analyzed using CPA (Chen et al., 2000) a statistical method designed to detect abrupt changes in the statistical properties of a time series, such as mean, variance, or distribution. CPA is particularly useful in identifying *transitions in physiological data* over time, making it ideal for real-time health monitoring in livestock. *Mathematical Framework of CPA* is as follows:

Let $X = \{x_1, x_2, \dots, x_n\}$ represent the time series data for a physiological parameter (e.g., body temperature, heart rate, or SpO_2). The objective of CPA is to identify points τ where the statistical characteristics of X change. Specifically, these change points split the time series into segments $X_1, X_2, \dots, X_k$, where each segment is statistically homogeneous.

Model Assumption: CPA assumes that for ith segment $X_i = \{x_{\tau_{i-1}+1}, \dots, x_{\tau_i}\}$

$$x_t \sim F_i \quad \forall t \in [\tau_{i-1} + 1, \tau_i]$$

where F_i represents the distribution of X_i. The change points $\tau_1, \tau_2, \dots, \tau_k$ are determined such that $F_i \neq F_{i+1}$

Cost function: A cost function $C(X_i)$ quantifies the dissimilarity within a segment. The goal is to minimize the total cost:

$$Total\ Cost = \sum_{i=1}^{k} C(X_i)$$

subject to constraints on the number or location of change points. For example, $C(X_i)$ could be based on changes in mean, variance, or both.

To detect changes in the time series data accurately, various optimization algorithms were employed. Dynamic Programming was utilized to minimize the cost function over all possible segmentations, ensuring a globally optimal solution. This algorithm is computationally intensive but highly precise in identifying change points. For scenarios requiring faster computation, Binary Segmentation was considered. This iterative approach splits the data into segments based on the largest detected change, offering a quicker but approximate solution. These algorithms formed the foundation for implementing CPA in this study.

Ethical considerations

Ethics committee approval for this study was obtained from Mehmet Akif Ersoy University Animal Experiments Local Ethics Committee (Decision No: 1203, Decision Date: 27.10.2023). This study was conducted by the Declaration of Helsinki.

RESULTS

The smart ear tag system successfully monitored body temperature, heart rate, and SpO2 in cattle over a 7-day period. Among these animals, significant changes were detected only in one individual, while no state changes were observed in the remaining nine. The results demonstrate the system's capability to detect physiological deviations while maintaining specificity and avoiding false positives.

Individual parameter analysis

The graph (Fig. 2) illustrates significant state changes in SpO2 levels over time. In the initial phase (0-75), two sharp drops followed by a rapid spike above 100% suggests a problem with recording or

environmental effects on sensors. Between 75 and 200, SpO2 levels stabilize, indicating homeostasis and a balanced physiological state. However, after 200, the data reveal a new state, where SpO2 levels remain consistent but slightly shifted, suggesting either long-term adaptation or a lasting change in the animal's physiological condition.

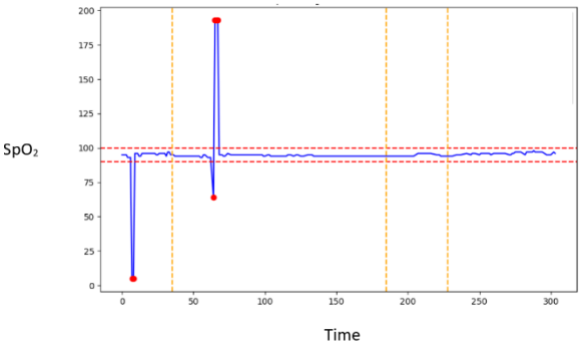

Figure 2. SpO_2 levels and detected state shifts over time.

The graph (Fig. 3) illustrates the temperature variations over time, highlighting significant state changes rather than focusing solely on the temperature values themselves. Since temperature is measured from the ear, environmental factors such as ambient temperature, humidity, or direct exposure can influence the readings, leading to fluctuations. However, CPA is designed to detect shifts in the state of the temperature pattern, providing deeper insights into potential physiological or systemic changes. In phase *0-200*, The temperature shows fluctuations but generally remains within a lower range, likely reflecting a stable physiological state with minor environmental influences. After the marked state change between 200-250, the temperature readings stabilize within a new range, despite occasional anomalies. This shift suggests the animal has transitioned to a new physiological state, potentially as an adaptive response to internal or external factors. The graph (Fig. 4) depicts heart rate variations over time, focusing on state changes rather than isolated anomalies. Heart rate is a highly dynamic parameter, influenced by both physiological factors (e.g., stress, activity levels) and environmental stimuli. CPA identifies shifts in the overall state of heart rate patterns, providing insights into underlying physiological transitions. In phase *0-200,* heart rate readings are moderately stable with occasional spikes, likely reflecting minor stressors or activity-related changes. The overall state suggests a balance between baseline heart activity and short-term variations. Following the marked state change between 200-250, heart rate patterns stabilize within a new range. While occasional anomalies persist, the general trend indicates a shift to a new physiological equilibrium, possibly as an adaptive response to the earlier stress or environmental factors.

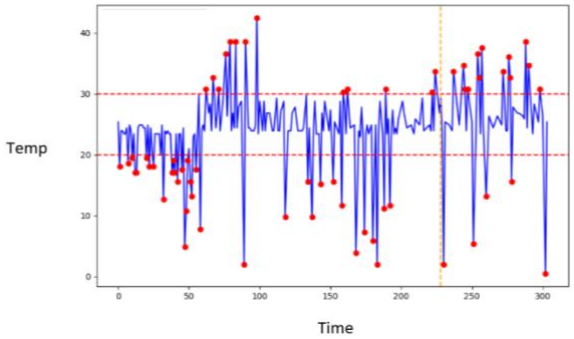

Figure 3. Body temperature variations and detected state shift.

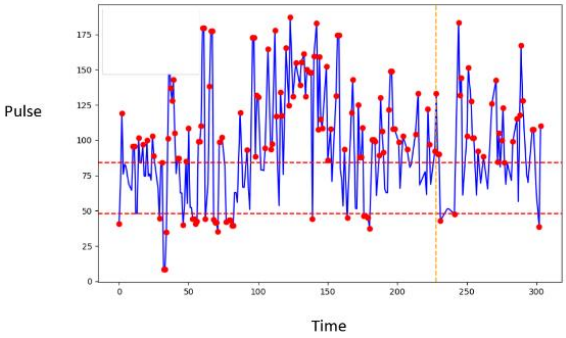

Figure 4. Heart rate variations and detected state shifts.

Multi-Parameter Change Detection

The combined analysis of SpO2, body temperature, and heart rate reveals a synchronized state change occurring around the same time period, particularly between 200th and 250th time unit. (It corresponds to approximately 4.5 to 5.5 days in the 7-day measurement period). While each parameter independently shows fluctuations influenced by physiological or environmental factors, the concurrent shift across all three suggests a significant systemic transition. The SpO2 data stabilizes into a new range, indicating a potential adaptation in respiratory efficiency, while body temperature also transitions to a different stable state, possibly reflecting a response to internal or external stressors. Similarly, heart rate variability reduces post-transition, settling into a more consistent pattern.

DISCUSSION

This study introduces a novel smart ear tag system capable of simultaneously monitoring three critical physiological parameters—body temperature, heart rate, and SpO_2—in cattle. By integrating these metrics with CPA, the system offers an innovative approach to detecting state changes in livestock, which are indicative of significant physiological or behavioral transitions, such as estrus or illness.

While extreme changes of SpO2 levels above 100% or below 75% suggests a problem occurred during data recording or transfer, SpO2 levels after time 75 stabilizes and records values coherent with the

optimum values of around 95% (Calcante & Tangorra, 2021).

Cattle's optimum body temperature is between 39.08 and 41.1 degrees Celsius. This reflects core body temperature (Gaughan & Mader, 2014), this study relied on body surface temperatures. Body surface temperature varies greatly between different parts of the body and can be up to 13 degrees Celsius lower then the rectal temperature (Salles et al., 2016). This study's results are coherent with this data with the lower measurements are slightly lower then expected. This suggests ear's surface temperature is effected by ambient temperature more than flanks or legs.

Although the optimum heart rate of cattle is between 55 and 80 (Darwis et al., 2022), it can reach 135 beats per minute during physical activity (Zerbini et al., 1992). Results of this study is coherent with the previous findings with the exception of several spikes in recordings.

Overall coherence of the recordings suggests that this type of a device complementing other PLF instruments would be feasible in farm setting, but further research should focus on spikes and errors in its current readings to improve consistency and reliability. Also, the absence of physical activity information or visual monitoring prevents any solid insights into the reasons behind these state changes. Milking may cause various physiological responses in a cow's body (Hopster et al., 2002). However, in this study, it can be conjectured that the state change is not related to milking, as milking is expected to occur 4 to 10 times within the study timeframe.

The results suggest that the state change observed in the single animal coincided with its known estrus state at the time of application, with the transition detected between 200–250 time units (approximately 4.5 to 5.5 days) likely reflecting its metabolic changes. In contrast, no significant state changes were detected in the other nine cattle. This indicates that the system's ability to detect state changes is closely tied to the timing of physiological transitions, emphasizing the importance of synchronized monitoring with known reproductive cycles.

The ability to monitor body temperature, heart rate, and SpO_2 simultaneously provides a multi-dimensional perspective on cattle health. These parameters are highly interdependent and sensitive to systemic changes; for example, estrus often induces fluctuations in body temperature, heart rate, and oxygen saturation as part of the metabolic and hormonal shifts associated with reproduction. By detecting synchronized state changes across these parameters, the system reduces the likelihood of overlooking critical transitions, which single-metric systems might miss.

These findings contribute to scientific efforts in the PLF concept. PLF aims to increase yields, production, and welfare (Cox, 2003) and strives to achieve environmental, social, and economic sustainability (Vranken & Berckmans, 2017).While there are challenges about real-time measurements (Neethirajan, 2023) or data management (Halachmi et al., 2019) PLF concept will meet these targets by improvements on the devices used such as smaller or easier to install devices which are also more accurate and efficient (Michelena et al., 2024).

Prior research, such as (Lovarelli et al., 2020 and Zhang et al., 2020), emphasized environmental or behavioral monitoring but lacked the integration of real-time physiological metrics. Similarly, (Nie et al., 2020) discussed the challenges of heart rate monitoring without addressing multi-metric synchronization. (Lee & Seo, 2021) emphasized inconsistency as an area of improvement. This study addresses these gaps by combining physiological data into a unified framework, validated through CPA, to deliver more comprehensive insights into livestock health dynamics.

Study Limitations

While the findings demonstrate the system's potential, the small sample size limits the generalizability of the results. Future studies will focus on larger populations to validate these findings across diverse physiological conditions and reproductive cycles. Integrating external environmental data and applying machine learning techniques could also enhance the system's predictive accuracy, allowing for broader applications in PLF.

CONCLUSION

This study introduces a pioneering approach to livestock health monitoring through the integration of multi-metric physiological data and advanced analytical techniques. By employing body temperature, heart rate, and oxygen saturation (SpO2) as key parameters and detecting synchronized state changes using CPA, the proposed smart ear tag system addresses critical challenges in PLF. The ability to monitor multiple metrics simultaneously ensures a more comprehensive understanding of livestock health, which is vital for early detection of diseases and effective animal welfare management.

The results highlight the system's robustness in distinguishing between normal physiological variability and significant state changes, underscoring its reliability and precision. These attributes are essential for ensuring that livestock management practices are proactive and aligned with the goals of sustainable farming. Additionally, the system's capacity to identify systemic changes, such as those associated with estrus or stress, further validates its potential to support decision-making processes in breeding, health management, and overall productivity optimization.

In conclusion, this research represents a significant step forward in leveraging digital technologies for the agricultural sector. By providing a scalable and practical tool for real-time health monitoring, the smart ear tag system supports the transition towards data-driven and sustainable livestock management.

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Conflict of Interest
The author declares no potential conflicts of interest with respect to the research, authorship and/or publication of this article.

Author Contributions
Plan, design: B.C., M.M.D**; Material, methods and data collection:** B.C., M.M.D, H.B.A., H.I.E**; Data analysis and comments:** B.C., H.B.A**; Writing and corrections:** B.C., M.M.D, H.B.A**.**

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Ethical Approval
Institution: Mehmet Akif Ersoy University Animal Experiments Local Ethics Committee
Date: 27.10.2023
Approval no: 1203

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Investigating Oxidative Stress and Histopathological Changes in The Liver of Hyperglycemic Rats

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ABSTRACT
Objective: This study aimed to investigate the impact of hyperglycemia on the liver in rats. **Materials and Methods:** An experimental diabetes was created by intraperitoneal streptozotocin administration to Sprague-Dawley rats, and blood glucose levels over 250 dl/kg were counted as diabetic. The experiment was continued for 6 weeks, and weight and blood glucose were observed weekly. After sacrification, liver tissues were fixed with formaldehyde and enclosed in paraffin for histological analysis. Hematoxylin and eosin staining was carried out on 4 µm sections taken from paraffin blocks, and the sections were evaluated histopathologically. At the same time, apoptosis was examined immunohistochemically in those sections by active caspase-3 labeling. Finally, oxidative stress status in liver tissue was analyzed by hydrogen peroxide (H_2O_2) and superoxide dismutase (SOD) levels. **Results:** The results revealed a significant elevation in H2O2 levels and a slight decline in SOD levels in the liver tissues in the hyperglycemia group. Additionally, apoptotic hepatocyte numbers were elevated. Histopathological analysis revealed disrupted lobular structure, dilatation of the central vein and sinusoids, hepatocyte shrinkage, and lymphocytic infiltration in the hyperglycemia group. **Conclusion:** This study underscores the critical role of apoptosis and oxidative stress in liver dysfunction caused by diabetes, highlighting the need for novel therapeutic strategies to protect against hyperglycemia-induced liver damage and improve outcomes for diabetic patients.
Keywords: Experimental Diabetes, Liver, Oxidative Stress, Histopathology, Apoptosis.

Hiperglisemik Sıçanların Karaciğerindeki Oksidatif Stres ve Histopatolojik Değişikliklerin Araştırılması

ÖZ
Amaç: Bu çalışmada sıçanlarda hipergliseminin karaciğer üzerine etkisinin değerlendirilmesi amaçlandı. **Gereç ve Yöntem:** Sprague-Dawley tipi sıçanlarda, streptozotosin ile deneysel diyabet modeli oluşturuldu ve kan glikozunun 250 dl/kg'nin üzerinde olduğu sıçanlar diyabetik kabul edildi. 6 hafta süren deney boyunca, haftalık olarak kan glikozu ve ağırlık takibi yapıldı. Sakrifikasyondan sonra alınan karaciğer dokuları, histolojik incelemeler için formaldehit ile fikse edildi ve doku takibinin ardından parafine gömülmüştür. Parafin bloklardan alınan 4 um'lik kesitlerde hematoksilen ve eozin boyaması yapıldı ve kesitler histopatolojik olarak değerlendirildi. Aynı zamanda bu kesitlerde aktif kazpaz-3 işaretlemesi ile apoptoz, immünohistokimyasal olarak incelendi. Son olarak karaciğer dokusundaki oksidatif stres durumu, hidrojen peroksit (H_2O_2) ve süperoksit dismutaz (SOD) seviyeleri üzerinden analiz edildi. **Bulgular:** Sonuçlara göre, hiperglisemi grubundaki sıçanlara ait karaciğerlerde H_2O_2 düzeyinin anlamlı derecede yükseldiği ve SOD düzeyinin bir miktar düştüğü, hepatositlerde apoptoza giden hücre sayısının arttığı görüldü. Karaciğer histopatolojisi, hiperglisemi grubunda bozulmuş karaciğer lobüler yapısını, santral ven ve sinusoidal dilatasyonları, hepatositlerde küçülmeyi ve lenfositik infiltrasyonu ortaya koydu. **Sonuç:** Bu çalışma, diyabet kaynaklı karaciğer fonksiyon bozukluğunda oksidatif stres ve apoptozun kritik rolünü vurgulayarak, hiperglisemi kaynaklı karaciğer hasarına karşı koruma sağlamak ve diyabetli hastalarda sonuçları iyileştirmek için yeni tedavi stratejilerine olan ihtiyacı vurgulamaktadır.
Anahtar Kelimeler: Deneysel Diyabet, Karaciğer, Oksidatif Stres, Histopatoloji, Apoptoz.

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INTRODUCTION

Diabetes is a chronic metabolic disorder characterized by persistently high blood glucose levels, arising due to insufficient insulin production or the body's inability to use the insulin it produces effectively. The disease is tried to be kept under control with insulin treatment and lifestyle modification (Crofts, 2015). However, uncontrollable high blood glucose can lead to seconder complications involving the blood vessels, heart, retina, kidneys, and nervous system (Su et al., 2022). Over 400 million people worldwide currently have diabetes, mostly in low- and middle-income countries. By 2045, this number is anticipated to reach 700 million (Saeedi et al., 2019). The destruction of pancreatic β cells by autoimmune mechanisms, which impairs insulin production, characterizes one type of diabetes known as Type 1 diabetes (T1D) (Izadi et al., 2022). Type 2 diabetes (T2D), responsible for over 90% of all cases, involves β-cell dysfunction and insulin resistance (Arte et al., 2024). Both types of diabetes arise from a combination of genetic and environmental factors, and despite ongoing research, no widely effective treatment option has been developed to date. In both types of diabetes, the treatment approach is based on keeping blood glucose balanced, but these approaches are unable to stop the advance of the disease and are insufficient to stop long-term complications (Wu & Mahato, 2014).

Hyperglycemia due to diabetes can damage various tissues and organs in the body if not effectively managed (Burrack et al., 2017). These complications are generally classified as macrovascular diseases, including cardiovascular disease, or microvascular diseases, including retinopathy, nephropathy, and neuropathy (Adu et al., 2019). Diabetes commonly affects the liver, making it one of the organs most impacted by the condition. Studies report a higher prevalence of advanced liver fibrosis in diabetic individuals than non-diabetic individuals (Gao et al., 2024). Additionally, conditions such as hepatitis, cirrhosis, and even hepatocarcinoma are more commonly observed in those with diabetes. A complex relationship also exists between diabetes mellitus and non-alcoholic fatty liver disease (NAFLD), where lipid accumulation in the liver occurs due to hepatic inflammation and oxidative stress (Yang et al., 2019). Although the long-term effects of hyperglycemia on the liver are well documented, the exact mechanisms are still being investigated. Understanding these mechanisms will facilitate the development of supplementary treatments to protect other organs while managing diabetes, for which no definitive cure exists. This is especially important for patients with early-stage diabetes, as such advances could help reduce mortality from diabetes-related complications. Therefore, this study investigated the relationship between liver damage, oxidative stress, and apoptosis in rats exposed to hyperglycemia for six weeks.

MATERIALS AND METHODS

Design of the Study

The ethics approval was taken from the Bezmialem Vakıf University Local Ethics Committee (1293-1/ 31.10.2024-E.169810). 12 male Sprague-Dawley rats (12 weeks old) were used and they were maintained on a 12-hour light/dark cycle with unrestricted access to chow and water. The groups were designed as follows (n=6): For the hyperglycemia group (H), experimental diabetes was conducted by intraperitoneal injection of 20 mg/kg STZ (Sigma-Aldrich) in citrate buffer for five days, while controls (C) received only the buffer (Kim et al., 2006). Blood glucose was measured from the tail vein of rats, and above 250 mg/dl were counted as diabetic (Metwally et al., 2018). The experimental process lasted 7 weeks, and the animals were sacrificed. Blood glucose levels were monitored weekly, and body weights were observed throughout the experiment.

Histological analysis

Small liver tissue samples were fixed in 10% neutral buffered formalin for histological examination. After dehydration in ethanol, the tissues were embedded in paraffin. Paraffin blocks were then sectioned into 4-micrometer slices and stained with hematoxylin-eosin (H&E) (Anapali et al., 2022). Sections were stained with hematoxylin for 20 minutes, rinsed in tap water for 15 minutes, stained with eosin, and processed through a graded alcohol series and toluene. This staining resulted in purple-stained nuclei and pink cytoplasm. The slides were examined for alterations in liver morphology using an Olympus BX53 light microscope. Histomorphometric analyses were performed using the ImageJ program. Sinusoidal expansion and hepatocyte size were calculated as the average of measurements taken from three different regions of a single section per animal (n=5). Group values were expressed in pixels as mean ± SEM.

Immunohistochemical analysis

The apoptosis was evaluated in liver immunohistochemically. Immunohistochemical analysis was conducted using the following method (Isildar et al., 2022). First of all, the sections were deparaffinized and rehydrated. For the following process, caspase-3 served as the primary antibody (1:500, ThermoFisher, MS-1123), while the secondary antibody provided in the HRP kit was used for detection (Thermo Scientific TP-125-HL). The slides were microwaved in citrate buffer (pH 6.0) for antigen retrieval at two 10-minute intervals. After washing with phosphate-buffered saline (PBS), endogenous peroxidase activity was inhibited by treating the sections with 3% H_2O_2 (Merck, Darmstadt, Germany) for 10 minutes. Following another PBS wash, the slides were incubated in the blocking solution for 10 min to minimize non-specific

antibody binding. Primary antibody incubation was performed overnight at +4 °C on the slides. After incubation and washing step, the slides were treated with a biotinylated secondary antibody solution for 10 minutes and rewashed. Streptavidin-peroxidase solution was then applied for 10 minutes, and the reaction was visualized using 3-amino-9-ethyl carbazole (Thermo Scientific TA-125-HA). The samples were examined using light microscopy (Olympus BX53). Analysis was performed by counting active caspase-3 positive cells in 4 separate fields of a single section for each animal and calculating the average per group (n=4).

Determination of H_2O_2 and SOD levels in liver

For oxidative stress assessment, liver tissues weighing approximately 20 mg were washed in PBS and then homogenized in 180 µL PBS using a tissue lyser at 4°C for 2.5 minutes at 50 oscillations. The homogenates were then centrifuged at 4000 RPM for 10 minutes at 4°C to separate insoluble material. The supernatant was collected and kept on ice for analysis. Protein concentrations in the supernatant were measured using the bicinchoninic acid (BCA) assay (Thermo Scientific, 23225 and 23227). To measure total superoxide dismutase (SOD) activity, 1 mL of working buffer was combined with 0.07 mL of the sample for the test tube, and double-distilled water was used for the control tube. Afterwards, 0.1 mL of nitrosogenic agent, substrate solution, and enzyme solution were added, mixed with a vortex, and incubated at 37°C for 40 minutes. Next, 2 mL of the chromogenic agent was added, mixed, and allowed to incubate at room temperature for 10 minutes. The optical density (OD) was then measured at 550 nm using a quartz cuvette, with double-distilled water as the blank. SOD concentration was calculated based on OD values, and the groups were compared. To measure H_2O_2 concentration, 1 mL of buffer solution was added to tubes and incubated at 37°C for 10 minutes. Next, 0.1 mL of double-distilled water, 0.1 mL of 60 mmol/L H_2O_2, and 0.1 mL of the sample were added to set up the blank, standard, and sample tubes, respectively. Then, 1 mL of ammonium molybdate reagent was added to each tube and mixed well. The spectrophotometer was calibrated with double-distilled water, and each tube's optical density (OD) was recorded at 405 nm using a quartz cuvette. H_2O_2 concentration was calculated based on OD values, and the groups were compared (n=5).

Statistical analysis

The statistics were analyzed using SPSS version 20.0. Data are expressed as mean ± standard error. The normality of the data distribution was assessed, and an independent t-test was applied for group comparisons. Statistical significance was set at a p-value of less than 0.05.

Ethical considerations

The study received approval from the Bezmialem Vakıf University Local Ethics Committee (Decision No. 1293-1/ 31.10.2024-E.169810, Date: 31.10.2024).

RESULTS

Blood glucose levels and body weights of rats

Following the induction of diabetes with STZ injection, blood glucose levels in the rats began to rise gradually. By the end of the first week, all rats in the hyperglycemia group had glucose levels exceeding 250 mg/dl, meeting the criteria for diabetes. Throughout the study, weekly monitoring showed that glucose levels remained consistently high, over 400 mg/dl. Despite the ongoing hyperglycemia, there were no significant changes in body weight compared to the control group. This indicates that the induction of diabetes did not result in noticeable changes in body weight throughout the experiment.

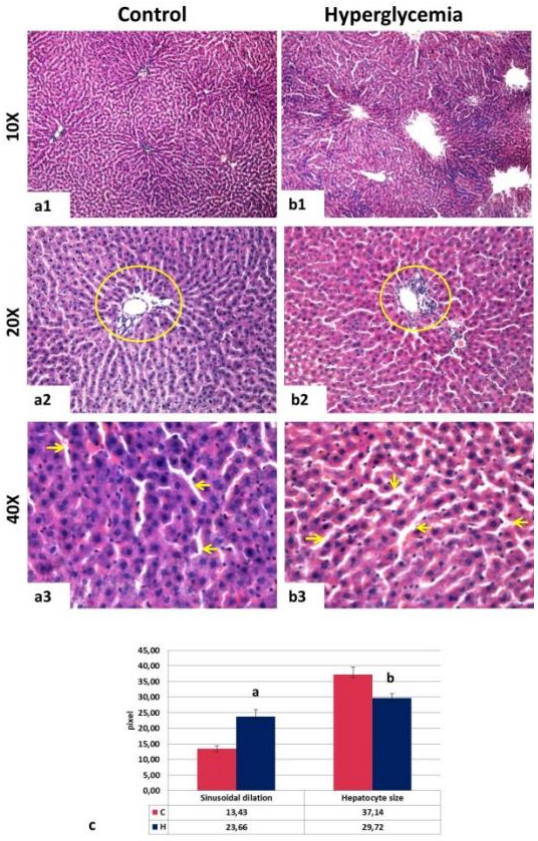

Figure 1. Representative hematoxylin and eosin stained micrographs of the groups (a-b). C group 10x (a1), 20x (a2), 40x (a3). H group 10x (b1), 20x (b2), 40x (b3). Circle: Portal triad, arrow: sinusoidal spaces. The graphs of sinusoidal dilatations and hepatocyte size (c). $^{a}p < 0.01$, $^{b}p < 0.05$ vs. C groups.

Histological analysis

Histomorphological effects of hyperglycemia on the liver were assessed using H&E stained preparations. Accordingly, the liver sections showed typical lobular structure in the control group, with central veins, portal triad areas, and polygonal hepatocytes separated by sinusoids. Conversely, hyperglycemia group exhibited disrupted lobular organization, enlargement of the central vein, structural changes in

the portal triad areas, lymphocytic infiltration, shrunken hepatocytes, and dilated sinusoidal spaces.

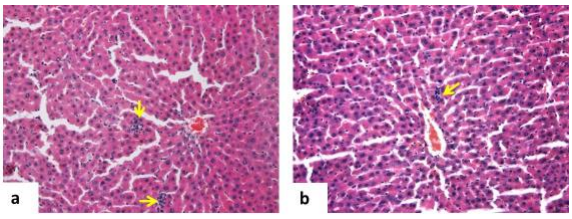

Figure 2. Representative micrographs of the hyperglycemia group. Arrow: areas of lymphocytic infiltration, 20X, H&E.

Sinusoidal dilations were seen in the entire liver tissue, and according to the measurements, the average was determined as 13.43±0.2 px in the control group and 23.66±2.27 px in the hyperglycemia group. A statistically significant difference was observed between the groups (p=0.008). The shrinkage of hepatocytes in the hyperglycemia group was also found to be statistically significant. The average hepatocyte size was measured at 37.14±2.39 pixels in the control group, while in the hyperglycemia group, the average size was significantly reduced to 29.72±1.32 pixels (p=0.026). This reduction in hepatocyte size underscores the impact of hyperglycemia on liver cell morphology, further highlighting the pathological changes induced by the diabetic condition. In addition to the reduction in hepatocyte size, cytoplasmic vacuolization and pyknotic nucleus appearance were present in the cells in the hyperglycemia group. Representative micrographs of the groups and the graphs of sinusoidal dilations and hepatocyte size data are given in Fig. 1, and micrographs of lymphocytic infiltration are in Fig.2.

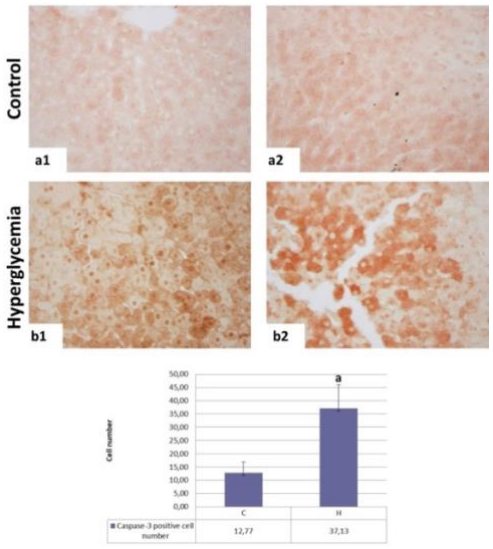

Figure 3. Representative hematoxylin and eosin stained micrographs of the groups (a-b). The graphs of active caspase-3 positive cell number (c). [a]p < 0,05 vs. C group.

Immunohistochemical analysis

Active caspase-3 expression was analyzed immunohistochemically for the evaluation of apoptosis. The mean of active caspase-3-positive cell number revealed that hyperglycemia markedly elevated hepatocyte apoptosis compared to the control group (p=0.047). Representative micrographs of the groups and the data are given in Fig. 3.

H_2O_2 and SOD levels in liver

In oxidative stress analyses, the H_2O_2 level in the liver tissue of normal rats was 0.0401 nmol/g, which significantly increased to 0.0428 nmol/g in the hyperglycemia-induced group (p=0.016). SOD levels, initially 180.7 U/mg in normal rats, decreased to 176.8 U/mg in the hyperglycemia group, but this reduction was not statistically significant. The graph of the results is given in Fig. 4.

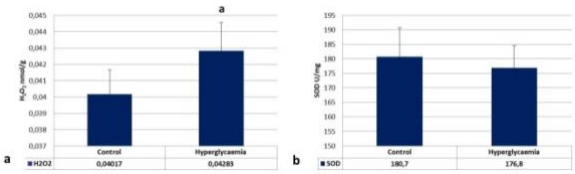

Figure 4. Graph of H_2O_2 concentration in the liver, [a]p<0.05 (a). Graph of SOD concentration in the liver (b).

DISCUSSION

Diabetes is a metabolic disorder characterized by elevated blood glucose levels. The disease is tried to be kept under control with insulin treatment and lifestyle modification. Secondary complications can arise from poorly controlled high blood glucose, affecting vital organs and systems such as the blood vessels, heart, retina, kidneys, and nervous system. Secondary complications play an important role in diabetes-related deaths (Päth et al., 2019). Identifying the secondary complications caused by diabetes in the body and their underlying mechanisms is essential for developing complementary or supportive treatments to mitigate the effects of uncontrolled hyperglycemia alongside primary diabetes management. Besides, the relationship between diabetes and the liver, which is a vital organ for maintaining homeostasis, has not been studied in the literature as much as the kidney, retina, and nervous system. Here, we demonstrated diabetes-induced liver damage in rats, characterized by histopathological alterations, increased oxidative stress, and enhanced apoptosis.

Histological analysis demonstrated marked alterations in the hepatic lobular structure in the hyperglicemia group. While the control group exhibited typical lobular organization with well-formed central veins, portal triads, and sinusoidal spaces, the hyperglycemia group showed disrupted architecture with enlarged central veins, and dilated sinusoidal spaces. The statistically significant

increase in sinusoidal dilation suggests vascular congestion and altered hepatic blood flow, consistent with previous reports on diabetes-induced microvascular damage (Al-Shaeli et al., 2022; El-Megharbel et al., 2022). Lymphocytic infiltration seen in liver sections of the hyperglycemia group suggests liver damage (Xie et al., 2022). Furthermore, shrunken hepatocytes with cytoplasmic vacuolization and pyknotic nuclei highlight cellular degeneration and stress that may be driven by hyperglycemia and associated metabolic disorders. Considering the increased active caspase-3 expression in the hyerglicemia group, along with the observed histological alterations, it is evident that hyperglycemia induces apoptosis in cells. It has been reported that in long-term exposure to hyperglycemia, hepatocytes undergo senescence and the rate of apoptosis increases (Yuniartha et al., 2022). Hyperglycemia-induced apoptosis has been associated with mitochondrial dysfunction (Hou et al., 2022). Hou et al. applied adipose tissue-derived mesenchymal stem cells (MSCs) as therapeutic agents in an STZ-induced diabetes model and examined their effects in the liver. Accordingly, they demonstrated that adipose tissue-derived MSCs protect the liver from apoptosis by alleviating mitochondrial stress and inflammation (Hou et al., 2022). Since the importance of mitochondrial dysfunction in liver diseases is also known (LeFort et al., 2024), it is obvious that it would be beneficial to analyze mitochondrial function in liver cells.

Oxidative stress analysis further supports the hypothesis of hyperglycemia-induced liver damage. The significant increase in H_2O_2 levels has shown the heightened reactive oxygen species (ROS) production, which is a hallmark of diabetic complications (Caturano et al., 2023). Although the change in SOD levels was not statistically significant, this situation indicates that the antioxidant defense system tends to be partially impaired. It is thought that the imbalance caused by increased ROS formation and decreased antioxidant capacity further exacerbates cellular damage, promotes apoptosis, and further impairs liver function. Previous studies have reported increased oxidative stress and reduced antioxidant capacity in the diabetic liver, using various markers to assess these changes and observing oxidative stress dynamics during treatment (Yang et al., 2019; Ye et al., 2023). Considering the findings of our study, it appears that oxidative stress is one of the key parameters in liver damage due to hyperglycemia.

CONCLUSION

In conclusion, the relationship between oxidative stress and apoptosis observed in this study demonstrates the differential effects of diabetes on the liver. Hyperglycemia-induced ROS production triggers apoptotic signaling pathways, leading to hepatocyte loss, and these changes disrupt hepatic microarchitecture and function, contributing to the pathogenesis of diabetes-associated liver dysfunction, including NAFLD and diabetic hepatopathy. It is crucial to understand how diabetes causes liver damage to develop supplementary treatments that protect against the harmful effects of hyperglycemia and improve the quality of life for diabetic patients. This study highlights the need for new treatment strategies by exploring the molecular pathways that connect hyperglycemia, oxidative stress, and apoptosis, offering a basis for future research.

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Conflict of Interest

The authors declare that they have no competing interests.

Author Contributions

Plan, design: BI, MK; **Material, methods and data collection:** BI; **Data analysis and comments:** BI, MK; **Writing and corrections:** BI, MK.

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Ethical Considerations

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The Relationship of Risk Perception in Pregnancy with Uncertainty Tolerance and Psychological Resilience

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ABSTRACT

Objective: This study was conducted to determine the relationship between risk perception during pregnancy and intolerance of uncertainty and psychological resilience level. **Materials and Methods:** The sample of this cross-sectional and correlational study consisted of 373 pregnant women who were attending a hospital in Eastern Turkey. Data were collected using the Personal Information Form, the Intolerance of Uncertainty Scale (IUS), the Brief Psychological Resilience Scale (BPRS), and the Pregnancy Risk Perception Scale (PRPS). **Results:** As a result of the correlation analysis, it was determined that there was a negative and moderately significant relationship between the mean scores of the Psychological Resilience Scale and the mean scores of the Uncertainty Tolerance Scale (r=-0.215; p=0.000). In addition, a weakly significant positive correlation was found between the mean score of the Risk Perception Scale and the mean score of the Uncertainty Tolerance Scale (r=0.125; p=0.015). **Conclusion:** It was found that as the risk perception levels of pregnant women increased, their intolerance of uncertainty increased and there was a significant relationship between them, and as the intolerance of uncertainty of pregnant women increased, their psychological resilience decreased and the relationship between them was significant.
Keywords: Uncertainty, Pregnant, Risk, Resilience, Psychological, Intolerance.

Gebelikte Yaşanan Risk Algısının Belirsizliğe Tahammülsüzlük ve Psikolojik Sağlamlık Düzeyi ile İlişkisi

ÖZ

Amaç: Bu araştırma gebelikte yaşanan risk algısının belirsizliğe tahammülsüzlük ve psikolojik sağlamlık düzeyi ile ilişkisinin belirlenmesi amacıyla yapıldı. **Gereç ve Yöntem:** Kesitsel ve ilişki arayıcı nitelikte yapılan bu araştırmanın örneklemini, Türkiye'nin doğusunda bir hastaneye başvuran 373 gebe oluşturdu. Veriler, "Kişisel Tanıtım Formu", "Belirsizliğe Tahammülsüzlük Ölçeği (BTÖ)" "Kısa Psikolojik Sağlamlık Ölçeği (KPSÖ)" ve "Gebelikte Risk Algısı Ölçeği (GRAÖ)" aracılığıyla elde edildi. **Bulgular:** Yapılan korelasyon analizi sonucunda, psikolojik sağlamlık ölçeği puan ortalaması ile belirsizliğe tahammülsüzlük ölçeği puan ortalamaları arasında negatif yönde orta düzeyde anlamlı ilişki olduğu belirlendi (r=-0.215; p=0.000). Ayrıca risk algısı ölçeği puan ortalaması ile belirsizliğe tahammülsüzlük ölçeği puan ortalaması arasında pozitif yönde zayıf düzeyde anlamlı bir ilişki olduğu saptandı (r=0.125; p=0.015). **Sonuç:** Gebelerin risk algısı düzeyleri arttıkça belirsizliğe tahammülsüzlük düzeylerininde arttığı ve aralarında anlamlı bir ilişki olduğu, ayrıca belirsizliğe tahammülsüzlük düzeyleri arttıkça psikolojik sağlamlık düzeylerinin azaldığı ve aralarındaki ilişkinin anlamlı olduğu bulundu.
Anahtar Kelimeler: Belirsizlik, Gebe, Psikolojik, Risk, Sağlamlık, Tahammülsüzlük.

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INTRODUCTION

While a woman and her partner experience happiness, joy, and excitement during pregnancy, they begin to experience the role of parenthood with the physiological burden of pregnancy and the anxiety caused by psychological changes. Women are increasingly exposed to the view that pregnancy and childbirth are inherently risky and require medical supervision and management. Because of social pressures, women are expected to behave "appropriately" during pregnancy. In addition to these changes that occur during pregnancy, these social pressures have led to an increase in women's perceptions of risk (Kahyaoğlu & Mehmet, 2011).

Perceptions of risk in pregnancy are a complex web of individual, psychological, and cultural factors, including objective medical predictions and more subjective and socially constructed estimates of risk (Lennon, 2016). Pregnant women's perceptions of their own risk are more subjective and closely related to personal and social experiences (Evcili & Dağlar, 2019). Risk perceptions during pregnancy can also influence decisions about whether to undergo screening tests, the use of medications, and even where to give birth (Lennon, 2016; Okyay & Sunay, 2022). In addition, biomedical risk factors and psychosocial factors can alter pregnant women's risk perceptions (Altındaş et al., 2020; Gupton et al, 2001;). Early diagnosis and treatment of any problem that affects the quality of life by putting the mother at risk during pregnancy is extremely important (Akpınar & Apay, 2020). Otherwise, uncertainty can negatively affect women and pregnancy, and lead to intolerance. Uncertainty intolerance is defined as the tendency to react negatively emotionally, cognitively, and behaviorally to uncertain events and situations (Buhr & Dugas, 2002). Uncertainty about future events can lead to anxiety or even dysfunction. Existing evidence suggests that intolerance of uncertainty is associated with both increased symptoms of depression and anxiety (Huang, 2019). Pregnancy is a period that every woman experiences differently and some women's mental health is negatively affected (Dikmen, 2020). Most women can adapt to possible psychological changes during pregnancy. However, some women may experience mild, moderate, or severe stress during the period of adjustment to a new role with the change in bio-psychosocial balance, thoughts of change in body image, social relationships, and family and work roles. Thoughts and uncertainties about the health status of the baby and labor are common sources of stress during pregnancy (Koyuncu et al., 2020).

It has also been reported that individuals with high uncertainty intolerance tend to view uncertainty situations as unpleasant and stressful, and experience problems with their functioning in uncertainty situations (Yüksel, 2014). Such stressful uncertainty situations are thought to negatively affect the psychology and psychological resilience of pregnant women.

Psychological resilience is the capacity of an individual to successfully overcome and adapt to adverse conditions, despite challenging circumstances (Öz & Yılmaz, 2009). While some women experience the pregnancy process in a healthy manner, others may encounter various mental health issues, including depression, anxiety disorders, psychosomatic complaints, and psychotic episodes. A history of depression, marital discord, low socioeconomic status, economic concerns, negative life experiences, unwanted pregnancy, abortion history, new difficulties and needs created by pregnancy, anxiety about the fetus, and high parenting stress are among the factors that increase susceptibility to mental health problems during this process (Üzar Özçetin & Erkan, 2018). Pregnant women with high psychological resilience are more likely to cope with the challenges they face during this process and protect themselves from emotional distress (Mautner, 2013). Indeed, it is well established that individuals with high psychological resilience have greater stress resistance and are better able to cope with the consequences of traumatic events. Risk factors that pose a threat to psychological resilience include biological, psychological, environmental, or socio-economic factors that increase the likelihood of a negative situation or cause the negativity in question to persist (Varıcıer, 2019). From this perspective, the relationship between risk perception during pregnancy intolerance of uncertainty and psychological resilience is an intriguing area for further investigation. The aim of this study was to determine the relationship between risk perception during pregnancy and intolerance of uncertainty and psychological resilience.

Research question:

Question 1: Is there a relationship between the perception of risk during pregnancy and the level of intolerance to uncertainty?

Question 2: Is there a relationship between the perception of risk during pregnancy and the level of psychological resilience?

MATERIALS AND METHODS

This cross-sectional study was conducted in a public hospital in Malatya between July 1 and 30, 2022. The objective was to determine the relationship between risk perception during pregnancy intolerance of uncertainty and psychological resilience. The study population consisted of pregnant women attending the antenatal class where the study was conducted.

The criteria for inclusion in the research

- All pregnant women who were admitted to the hospital on the day of the study,
- Who consented to participate,
- Who did not have communication difficulties or psychological problems were included in the study.

A power analysis was performed to determine the minimum sample size required to achieve with a 95% confidence interval and 95% representativeness via Openepi program (Openepi, 2022). The study was completed with 373 pregnant women, which met the calculated sample size.

Data collection tools

Data were collected by administering the following instruments: the Personal Information Form, the Intolerance of Uncertainty Scale (IUS), the Brief Psychological Resilience Scale (BPRS), and the Pregnancy Risk Perception Scale (PRPS).

Personal information form

The researchers used a personal information form to collect data from pregnant women. This form included nine items that covered both descriptive characteristics (e.g., age, educational status, and economic status) and obstetric characteristics (e.g., gestational week, infant sex, and type of pregnancy) Evcili & Dağlar, 2019; Altiparmak & Yilmaz, 2021; Derya et al., 2021).

Pregnancy Risk Perception Scale (PRPS)

The scale was developed by Heaman and Gupton in 2004 to assess risk perception in pregnant women. It consists of 11 items developed based on the literature and clinical experience of the researchers (Heaman et al., 2004). The Turkish validity and reliability study of the scale was conducted by Evcili and Dağlar in 2019 (Evcili & Dağlar, 2019). The number of items of the scale was reconsidered, which resulted in the identification of nine items. The factor "Pregnant women's risk perception towards the baby" consists of five items (items 2, 6, 7, 8, and 9). The factor "Pregnant women's risk perception towards themselves" consists of four items (items 1, 3, 4 and 5). The scale consists of a linear line from 0 to 100 mm, with "no risk at all" and "extremely high risk" immediately below each item. Each item receives a score from 0 to 100. The scores are summed and divided by the number of items, resulting in a self-report index. The total scale score is calculated by summing the scores for each of the nine items and dividing the resulting score by nine. In addition, the scale factors can be scored. The score for the factor "Pregnant women's perception of risk to their baby" is calculated by summing the scores for each of the five items under this factor and dividing the resulting score by five. The score for the "pregnant women's risk perception towards themselves" factor is obtained by summing the scores for each of the four items under this factor and dividing the score by four. The Cronbach alpha reliability coefficient of the scale is 0.84 (Evcili & Dağlar, 2019). In this study, the Cronbach's alpha reliability coefficient was 0.83.

Intolerance of Uncertainty Scale (IUS)

The scale developed by Buhr and Dugas in 2002 (Buhr & Dugas, 2002) was adapted into Turkish by Sarı and Dağ in 2009 (Sari & Dağ, 2009). It is emphasized that this scale can distinguish between individuals with high and low levels of anxiety in non-clinical samples, and therefore its criterion validity is sufficient. The Turkish version of the scale includes 26 items. The scale employs a 5-point Likert-type structure, with responses ranging from 1 (indicating "does not define me at all") to 5 (indicating "defines me completely"). As the scores obtained from the scale increase, intolerance of uncertainty decreases. The Cronbach alpha internal reliability coefficient of the scale was determined to be 0.78 (Sari & Dağ, 2009). In this study, the Cronbach alpha internal reliability coefficient of the scale was found to be 0.93.

Brief Psychological Resilience Scale (BPRS)

The scale was developed by Smith et al. (2008) to measure psychological resilience (Smith et al., 2008). The BPRS is a 5-point Likert-type, 6-item, self-report measure. Items 2, 4, and 6 are reverse coded. High scores, which are obtained after converting the reverse coded items, indicate a high level of psychological resilience. Accordingly, the Cronbach alpha internal consistency coefficient was found to be 0.83 (Doğan, 2015). In this study, the Cronbach's alpha internal reliability coefficient of the scale was found to be 0.95.

Data collection

The research data were collected by the researcher through face-to-face interviews with pregnant women who met the inclusion criteria and were present in a public hospital in Malatya between July 1-30, 2022. Data collection took 10-15 minutes on average.

Statistical analysis

The data were analyzed using the SPSS 25.0 package program (IBM, Armonk, NY, USA) in a computerized environment. Descriptive statistics, Pearson correlation analysis and regression analysis were used for statistical evaluation.

Ethical considerations

Ethical approval from Inonu University Health Sciences Non-Interventional Clinical Research Ethics Committee (decision number: 2022/3718) and institutional approval were obtained. In addition, an informed consent form was signed by all pregnant women before the study. The Declaration of Helsinki was adhered to throughout the study.

RESULTS

Table 1 shows the distribution of pregnant women who participated in the study according to their descriptive characteristics. The mean age of the pregnant women was 28.27±5.25 years and the mean gestational age was 36.51±3.49 weeks. It was found that 35.7% of the pregnant women who participated in the study were high school graduates, 78.0% were unemployed, 85.0% had an income equal to their expenses, and majority of the pregnant women (86.3%) had a nuclear family. It was found that 50.1% of the pregnant women underwent antenatal care by doctor, 51.5% of them had 2 or more pregnancies, and 78.6% of them had healthy pregnancies.

Table 1. Distribution of descriptive characteristics of pregnant women (n=373).

Descriptive Features	Mean ± SD (Min - Max)	
Age (Year)	28.27 ± 5.25 (14-46)	
Gestational week (week)	36.51 ± 3.49 (29-42)	
	n	**%**
Education Level		
Primary School	57	15.3
Secondary School	62	16.6
High School	133	35.7
University or Higher	121	32.4
Work Status		
Working	82	22.0
Not Working/Housewife	291	78.0
Economic Status		
Income more than expense	51	13.7
Income equals expense	317	85.0
Income less than expense	5	1.3
Family Structure		
Nucleus Family	322	86.3
Extended Family	51	13.7
Pre-pregnancy health check by doctor		
Yes	187	50.1
No	186	49.9
Pregnancy Status		
Healthy	293	78.6
At Risk	80	21.4
Total number of pregnancies		
First	181	48.5
Second or more	192	51.5
Total	**373**	**100.0**

SD: Standard Deviation

Table 2. Distribution of lowest-highest scores and mean scores of the total and subscale pregnancy risk perception scales, intolerance of uncertainty scale, and brief psychological resilience scale (n=373).

	Min.	Max.	Mean± SD. Deviation
BPRS	6.00	30.00	23.12±8.12
PRPS	9.00	40.00	13.43±5.26
Risk perception of the pregnant woman towards her baby	5.00	29.00	6.37±2.20
Risk perception of the pregnant woman towards themselves	4.00	24.00	7.06±4.05
IUS	26.00	130.00	62.34±39.50

SD: Standard Deviation**;** PRPS: Pregnancy Risk Perception Scale; IUS: Intolerance of Uncertainty Scale; BPRS: Brief Psychological Resilience Scale.

Table 2 shows the mean scores and the lowest and highest scores of pregnant women in BPRS, PRPS and IUS. It was found that the lowest score on the BPRS was 6 and the highest score was 30, the lowest score on the PRPS was 9 and the highest score was 40, and the lowest score on the IUS was 26 and the highest score was 130. In our study, the lowest and highest scores of pregnant women in the sub-dimension "pregnant women's risk perception towards their baby" were 5 and 29 points, respectively, and in the sub-dimension "pregnant women's risk perception towards themselves" were 4 and 24 points. The mean total score of BPRS was 23.12±8.12, the mean total score of PRPS was 13.43±5.26, and the mean total score of IUS was 62.34±39.50. The mean score of the PRPS sub-dimensions "pregnant woman's risk perception towards their baby" was 6.37±2.2 and "pregnant woman's risk perception towards herself" was 7.06±4.05.

Table 3. Correlation analysis between the perception of risk in pregnancy, the intolerance of uncertainty, and the brief psychological resilience of pregnant women scales (n=373).

Scales	*r	p
IUS-BPRS	-0.215	0.000**
PRPS-IUS	0.125	0.015***

PRPS: Pregnancy Risk Perception Scale; IUS: Intolerance of Uncertainty Scale; BPRS: Brief Psychological Resilience Scale.
*Pearson Correlation Coefficient (r=0.00-0.25 very low, r=0.26-0.49 low, r=0.50-0.69 moderate, r=0.70-0.89 high, r=0.90-1.00 very high)
**p=0.001 *** p<0.05

As a result of the correlation analysis, when comparing the total mean scores of pregnant women from the BPRS, PRPS and IUS scales (Table 3), it was determined that there was a weakly significant negative relationship between the mean BPRS score and the mean IUS score, and that the level of intolerance of uncertainty decreased as the level of psychological resilience increased (r=-0.215; p=0.000). It was also found that there was a weak significant positive correlation between the mean PRPS score and the mean IUS score, and that the level of intolerance of uncertainty increased with increasing risk perception (r=0.125; p=0.015).
In Table 4, as a result of the regression analysis in which BPRS of pregnant women was taken as the dependent variable and PRPS and IUS were taken as independent variables, a significant regression model F=0.629, p<0.001 was found and the variance in the dependent variable (R^2adjusted=0.003) was explained by the independent variable, and a significant relationship of intolerance of uncertainty in pregnant women was found with risk perception and psychological resilience levels.

Table 4. Regression Analysis Between Perception of Risk in Pregnancy, the Intolerance of Uncertainty, and the Brief Psychological Resilience of Pregnant Women Scales (n=373).

	BPRS	SE	β	t	Sig.	R=0.058* R^2=0.003 F=0.629 p<0.001
PRPS	0.019	0.023	0.044	0.841	0.401	
IUS	0.006	0.009	0.033	0.630	0.529	

PRPS: Pregnancy Risk Perception Scale; IUS: Intolerance of Uncertainty Scale; BPRS: Brief Psychological Resilience Scale. Unstandardized regression coefficient, **p<0.001, *p<0.05, SE: standard error, β: Standardized regression coefficient, R: degree of association, R^2: Coefficient of Determination, a: Dependent Variable: Brief Psychological Resilience Scale of Pregnant Women (BPRS) mean score. b. Predictors: (Constant): Perception of risk experienced during pregnancy and level of intolerance to uncertainty.

DISCUSSION

In this section, the data of this study, which examined the relationship of pregnant women's risk perception with uncertainty intolerance and psychological resilience, are discussed with the relevant literature. It was found that the mean scores of the pregnant women included in the study were 13.43±5.26, 6.37±2.20, and 7.06±4.05 for the total score of the PRPS and the mean scores of the subdimensions of risk perception toward the baby and toward the self, respectively, and that the pregnant women experienced a moderate level of risk perception (Table 2). Although the concept of risk perception among pregnant women is quite broad, it is generally associated with stress, anxiety, depression, and chronic disease. These problems have a negative impact on pregnant women and their babies. A review of the literature found that the mean total risk perception scores of pregnant women were higher than our findings (Lee et al., 2019; Okyay & Sunay, 2022;). In a study conducted to compare risk perception in pregnant women of different age groups, it was found that adolescent pregnant women had higher risk perception than adult pregnant women (Taghizadeh et al., 2017). This may be because of age-related uncertainty in adolescent pregnancy. In addition, it is thought that risk perception is at a moderate level in women with advanced age pregnancy, which may be due to the negative obstetric factors that advanced age brings (Dağlar & Aksöz, 2023). However, Rajbanshi et al. (2021) found that pregnant women perceived pregnancy as a normal event and did not see themselves as being at risk because they were observed in a close environment (Rajbanshi et al., 2021).

The mean BPRS total score of the pregnant women included in the study was 23.12±8.12 (Table 2). Considering that the highest total score that can be obtained from the scale is 30, it can be said that the psychological resilience of pregnant women was high. Psychological resilience increases positive adaptation to the process by providing a protective effect against psychological outcomes such as depression and anxiety during pregnancy (Üzar Özçetin & Erkan, 2018). Abera et al. (2023) found the mean BPRS score to be 16.6±4.7 in a study conducted in pregnant women and stated that psychological resilience is associated with low income in pregnant women, which is characterized by a decrease in psychological resilience (Abera et al., 2023). Ekrem et al. (2023) found that perceived stress during pregnancy had a negative relationship with psychological resilience in women and psychological resilience decreased as the perceived stress level increased (Ekrem et al., 2023).

The mean IUS total score of pregnant women was 62.34±39.50 (Table 2). Considering that the highest IUS score is 130, pregnant women showed a moderate level of intolerance to uncertainty. A review of the literature shows that pregnant women experience moderate intolerance to uncertainty and that various risk factors, such as the risk of abortion and pandemics encountered during pregnancy, causing them to experience a feeling of uncertainty and increase their intolerance to this feeling (Çevik, 2017; Dilcen et al., 2021). In fact, our study found that there was a weakly significant positive correlation between the mean IUS score and the mean PRPS score of pregnant women, and as the risk perception of pregnant women increased, their intolerance of uncertainty levels also increased (p<0.05) (Table 3). In this respect, our findings are similar to the relevant literature. Çankaya and İbrahimoğlu (2022) found that factors such as stress, anxiety, and intolerance of uncertainty are important risk factors that affect the psychological well-being of pregnant women under the threat of abortion by 52% (Çankaya & İbrahimoğlu, 2022). Çevik (2017) also found that the mean intolerance of uncertainty score of pregnant women with abortion risk was higher, while the mean intolerance of uncertainty score of pregnant women without abortion risk was lower. This result is similar to our study and supports the relationship between intolerance of uncertainty and perceived risk (Çevik & Yağmur, 2017). These studies are similar to our study because the relationship between anxiety disorders and risk perception and psychological resilience is clear in pregnant women (Yu et al., 2020).

It was found that there was a negative and moderately significant relationship between the mean scores of psychological resilience and intolerance of uncertainty; as the level of psychological resilience of pregnant women increased, their intolerance of uncertainty decreased (p<0.05) (Table 3). A review of the literature revealed that our findings are compatible and that increasing the level of psychological resilience and psychological well-being reduces the level of uncertainty intolerance and the relationship between them is significant (Çankaya & İbrahimoğlu, 2022; Çevik & Yağmur, 2017; Yu et

al. 2020). The results of Furtado et al. (2021) show that factors such as anxiety and stress in pregnant women have a positive relationship with uncertainty tolerance (Furtado et al., 2021). In fact, it is an undeniable fact that the changes that occur in women's bodies and lives during pregnancy affect their level of psychological resilience and tolerance to uncertainty by causing stress and anxiety.

CONCLUSION

In this study, which was conducted to evaluate the relationship between risk perception during pregnancy and intolerance of uncertainty and psychological resilience level, it was determined that there was a negative and moderately significant relationship between psychological resilience and intolerance of uncertainty in pregnant women, and as the level of psychological resilience increased, the level of intolerance of uncertainty decreased. This study also found that there was a positive and weakly significant relationship between risk perception and uncertainty intolerance, and that the level of uncertainty intolerance increased as risk perception increased. It should be kept in mind that risk perception during pregnancy may affect the emotional state of a woman, and the decision-making process related to pregnancy and childbirth. Pregnant women may experience anxiety due to negative or uncertain situations, and the pregnancy process may be negatively affected. Interventions planned for pregnant women with high-risk perceptions should aim to reduce risk perceptions and increase intolerance of uncertainty and psychological resilience. Increasing psychological resilience will contribute positively to this process by providing a protective effect against psychological outcomes such as depression and anxiety during pregnancy. Therefore, planning interventions to increase psychological resilience and reduce risk perception may provide potential benefits to improve the health and well-being of pregnant women and their babies. In addition, intolerance of uncertainty leads to distressing psychological complexity in pregnant women. It is therefore important for midwives to manage and support women's psychological health during pregnancy and beyond. Pregnant women may not make accurate assessments of risk perception. It is important that midwives provide women with accurate information about what factors to consider when making risk assessments.

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Conflict of Interest

The author declares no potential conflicts of interest with respect to the research, authorship and/or publication of this article.

Author Contributions

Plan, design: SA, ŞKB; **Material, methods and data collection:** SA, ŞKB; **Data analysis and comments:** SA, ŞKB; **Writing and corrections:** SA, ŞKB.

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Fear of Nursing Interventions and Quality of Care in Postoperative Children

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ABSTRACT
Objective: The study aimed at investigating the relationship between the fear of nursing interventions and the quality of care from the perspectives of children hospitalized after surgery. **Materials and Methods**: The sample of this descriptive, cross-sectional study consisted of 103 children in the age group of 6-12 years who were hospitalized in the Pediatric Surgery Ward after surgery between October 2023 and July 2024. **Results**: The mean age of the children included in the study was 9.06±2.08 years. The mean duration of their hospitalization was 3.51±1.06 days. The mean number of their previous hospitalizations was 2.69±3.44. The mean scores obtained from the "Scale to Measure Children's Fear of Nursing Interventions and Instruments Used in the Hospital" and the "Scale for the Evaluation of Quality of Care from the Perspectives of Children" were 25.43±6.76 and 49.80±12.93, respectively. There was a moderate negative correlation between the scores obtained from the two scales. **Conclusion**: Children's fear of nursing interventions and materials used during intervention will decrease as the quality of nursing care they receive increases.
Keywords: Pediatric Surgery, Hospital Materials, Fear, Care, Nurse.

Ameliyat Sonrası Çocuklarda Hemşirelik Girişimlerinden Korkma ve Bakım Kalitesi

ÖZET
Amaç: Çalışmanın amacı, ameliyat sonrası hastanede yatan çocukların gözüyle hemşirelik girişimlerine karşı korkuları ile bakım kalitelerinin arasındaki ilişkinin incelenmesidir. **Gereç ve Yöntem:**. Araştırmanın örneklemini, Ekim 2023-Temmuz 2024 tarihleri arasında, ameliyat sonrası Çocuk Cerrahi Servisi' nde yatan 6-12 yaş arası 103 çocuk oluşturdu**.** Araştırma tanımlayıcı, kesitsel tiptedir. **Bulgular:** Araştırmada, çocukların yaş ortalaması "9.06±2.08"; hastane yatış süresi gün olarak ortalaması "3.51±1.06" ve daha önceden hastanede yatış sayısı ortalaması "2.69±3.44" tür. "Çocuklarda Hemşirelik Girişimleri ve Kullanılan Materyallere Karşı Korku Ölçeği" toplam puan ortalaması "25.43±6.76"; "Çocukların Gözü ile Bakım Kalitesinin Değerlendirilmesi Ölçeği" toplam puan ortalaması "49.80±12.93" olarak saptandı. Bu iki ölçek arasında "negatif" yönde orta düzeyde ilişki olduğu belirlendi. **Sonuç:** Çocukların aldıkları hemşirelik bakım kalitesi düzeyi arttıkça, hemşirelik girişimlerine ve kullanılan materyallere karşı duydukları korku azalacaktır.
Anahtar Kelimeler: Çocuk Cerrahi, Hastane Materyalleri, Korku, Bakım, Hemşire.

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INTRODUCTION

The quality of nursing care is one of the leading factors that determine the quality of health services (Elayan & Ahmad, 2017). Nursing care plays an important role in the outcomes of pediatric patients, both during their hospitalization and after discharge (Elmaoğlu & Özdemir, 2022). Children and their parents are an important part of health services. Therefore, pediatric nurses play a critical role in the provision of care to children (Ullman et al., 2020). There are six basic care quality criteria that pediatric nurses must fulfill while they provide quality care to children (Janhunen et al., 2017). According to these criteria, health care should be "patient-centered, safe, effective, timely, efficient, and equitable" (Becky, 2020). Provision of physical and interactive care practices that prioritize the needs of children and their families are under the responsibility of pediatric nurses. In these approaches, the aim is to place the child and his or her family at the center of care (Turgut & Şahiner, 2024). In the Nursing Regulation, a pediatric nurse's duty is defined as follows: A pediatric nurse is responsible for getting the patient ready for surgery and any related procedures as needed (Nursing Regulation, 2010). Preoperative preparation of children carried out under the leadership of pediatric nurses includes the provision of accurate information to children and their parents to help them predict the process, understand goals and resolve uncertainties. This approach is a strategy aimed at providing control over the unknown (Akgül&Yardımcı, 2023). Children have physical and psychological characteristics different from those of adults. Since their developmental processes are not yet complete, their perception levels, ways of understanding diseases and their reactions to diseases vary according to their developmental levels (Tekinyıldız, 2021). It is stated that school-age children with health concerns experience fear of coming to the hospital and having surgery, fear of healthcare personnel, fear of undergoing the establishment of vascular access, fear of having blood drawn, fear of loss of control and fear of separation from parents (Maraşuna & Eroğlu, 2013). In school-aged children whose cognitive development increases, it is anticipated that their level of information will increase as well. If children become acquainted with the operating room before surgery, or if they receive age-appropriate training, a decrease is observed in their fear and anxiety (Yaz & Yilmaz, 2022; Karaarslan & Ergin, 2024). It is stated that fear and anxiety that cannot be effectively managed in children due to surgical intervention can continue for 6-12 months after discharge (Kostak & Semerci, 2023). Within this context, pediatric nurses undertake important duties in reducing children's hospital-related fears because they are the first people to greet them in the hospital and spend the most time with them (Örsal & Eren, 2023). In the literature, studies in which the relationship between fears of nursing interventions and quality of care especially from the perspective of hospitalized children is investigated are available. However, studies in which the relationship between fears of nursing interventions and quality of care from the perspective of hospitalized children who are to undergo or have undergone surgical procedures is investigated are not available.

Research questions

- What is the level of fear towards nursing interventions from the perspectives of children who are hospitalized after surgery?
- What is the level of the quality of nursing care from the perspectives of children hospitalized after surgery?
- Is there a relationship between the fear of nursing interventions and the quality of care from the perspectives of children hospitalized after surgery?

MATERIALS AND METHODS

Type of the study

The study is a cross-sectional, descriptive study.

Population and sample of the study

The population of the present study consisted of children who underwent surgery in the pediatric surgery department of a university hospital in Manisa, a province in western Türkiye. The study was conducted in the pediatric surgery ward. No sample selection method was implemented in the study. All the children who were hospitalized between the aforementioned dates and who had been in the clinic for at least 2 days after surgery were included in the study. Post hoc power analysis was performed in the G*Power program to determine the sample size of the study. The minimum sample size was determined as 103 (significance level: 0.05, confidence interval: 90%). During this period, children who were hospitalized and underwent surgery, and their parents who agreed to participate in the study were included in the sample. There were no losses during the study period.

This hospital has a 19-bed pediatric surgery unit, and nine nurses working in the unit. Children in the age group of 0-17 years are admitted to the pediatric surgery unit. Surgeries performed in the clinic are as follows: emergency surgery (trauma, appendectomy, and intussusception), same-day surgery (hernia, circumcision, undescended testicle, and hydrocele) and urology surgeries (hypospadias, cystoscopy, vesicoureteral valve-VUR). The study data were collected at a sitting after the children had stayed in the unit for at least 2 days after the surgery.

Data collection tools

The data were collected between October 2023 and July 2024 using the Scale to Measure Children's Fear of Nursing Interventions and Instruments Used in the Hospital, "Child and Parent Information Form" and Scale for the Evaluation of Quality of Care from the Perspectives of Children.

***Child and parent information form*:** The form was prepared by the researchers in line with the results of several studies (Selbes et al., 2021; Semerci et al., 2021; Örsal & Eren, 2023; Karaarslan & Ergin, 2024b). The form consists of 21 items questioning the children's sociodemographic characteristics such as age, sex, family structure, parental education level, etc., and their illness/hospitalization-related characteristics such as whether they or any of their family members were previously hospitalized, and whether they have a relative who is a healthcare professional.

***Scale to measure children's fear of nursing interventions and instruments used in the hospital*:** This self-reporting scale developed by Örsal and Eren (2018) consists of 18 items and the following 2 dimensions: (1) Fear of Frequently Encountered Materials dimension which consists of 10 items, (2) Fear of Infrequently Encountered Materials dimension which consists of 8 items. Responses given to the items are rated on a five-point scale ranging from 1 to 5 (1: I am not afraid, 2: I am a little afraid, 3: I am afraid, 4: I am very afraid, 5: I am extremely afraid. The Cronbach's α value of the scale was 0.931 for the first dimension, 0.89 for the 2nd dimension: and 0.94 for the overall scale in Örsal and Eren's study (Örsal & Eren, 2018), and 0.785 for the overall scale in the present study. As the total score obtained from the scale increases, so does the child's level of fear.

Scale for the Evaluation of Quality of Care from the Perspectives of Children: The scale developed by Yılmaz (2018) is administered to evaluate the quality of care from the perspectives of children who are hospitalized in pediatric clinics and who can express themselves cognitively. The scale has the following three dimensions. "Psychosocial care" dimension (6 items), "Physical care" dimension (5 items) and "Information" dimension (4 items), The Cronbach's α value for the overall scale was 0.86 in Yılmaz's study and 0.911 in the present study.

Ethical considerations

Before the study was conducted, ethics committee approval was obtained (Decision number: 20.478.486/1996, decision date: 27.09.2023). After the parents and children were informed that the data to be obtained from them would be used only for the purpose of this research, their written informed consent was obtained. Those who volunteered to participate in the study were included in the study. The present study was conducted in accordance with the Declaration of Helsinki.

Data analysis

Data were analyzed using the SPSS (Statistical Package for Social Science for Windows) 20.0 software. The data of the study were presented as percentages, arithmetic mean and standard deviation in the descriptive statistics. The Shapiro-Wilk test was used to check whether the quantitative data were normally distributed. Mann-Whitney U test was used for the comparison of two groups, if quantitative variables were not normally distributed, and Spearman Correlation analysis was used to determine the relationships between the scales. Statistical significance level was accepted as $p < 0.05$.

RESULTS

The mean age of the children participating in the study was 9.06±2.08 years, the mean duration of hospitalization was 3.51±1.06 days and the mean number of previous hospitalizations was 2.69±3.44. In the present study, 68.9% of the participating children were boys, 82.5% of the parents interviewed were mothers. Of the mothers, 53.5% had primary school education and 74.8% were unemployed. Of the fathers, 45.6% had primary school education and 91.3% were employed (Table 1). Of the children participating in the study, 79.6% had a nuclear family, 50.5% had families whose income was equal to expenses, 64.1% had been hospitalized previously, 68% had never undergone surgery before, 60.2% had a family member who had been hospitalized previously, and 54.4% had a family member or relative who was a healthcare professional (Table 1). The scores obtained from the two scales used in the present study and their dimensions are shown in Table 2. The mean scores obtained from the overall Scale to Measure Children's Fear of Nursing Interventions and Instruments Used in the Hospital and its Fear of Frequently Encountered Materials and Fear of Infrequently Encountered Materials dimensions were 25.43±6.76, 11.44±2.53 and 13.99±4.88, respectively. The mean scores obtained from the overall Evaluation of Quality of Care from the Perspectives of Children and its Psychosocial Care, Physical Care and Information Dimensions were 49.80±12.93, 15.07±5.99, 20.51±4.44 and 11.27±3.34, respectively. There was a negative, moderate and significant relationship between the two scales. Relationship between the scales and their dimensions are shown in Table 3.

The comparison of the mean scores obtained from the Scale to Measure Children's Fear of Nursing Interventions and Instruments Used in the Hospital and Scale for the Evaluation of Quality of Care from the Perspectives of Children and their dimensions in terms of the participating children's sociodemographic and illness/hospitalization-related characteristics are shown in Table 4. There was a significant relationship between the mean scores obtained from the "Psychosocial Care dimension" of the "Scale for the Evaluation of Quality of Care from the Perspectives of Children", and the sex variable ($p<0.05$). There was a statistically significant relationship between the children's previous hospitalization status and the mean scores obtained from the overall "Scale to Measure Children's Fear of Nursing Interventions and Instruments Used in the Hospital" and its "Fear of Infrequently Encountered Materials" dimension ($p<0.05$). There was a

statistically significant relationship between the variable having a relative who is a healthcare professional and the mean scores obtained from the overall Scale to Measure Children's Fear of Nursing Interventions and Instruments Used in the Hospital and its Psychosocial Care, Physical Care and Information dimensions (Table 4).

Table 1. Descriptive and illness/hospitalization-related characteristics of the participating children (N= 103).

Variables	Mean±SD*	
Age (children) (years)	9.06±2.08 (min.5; max.12)	
Duration of hospitalization (days)	3.51±1.06 (min.1; max.12)	
The number of hospitalizations	2.69±3.44 (min.0; max.15)	
Sex	**Number**	**%**
Girls	32	31.1
Boys	71	68.9
Parents Interviewed		
Mothers	85	82.5
Fathers	18	17.5
Family structure		
Nuclear	82	79.6
Extended	13	12.6
Single-parent	8	7.8
Family's financial status		
Income less than expenses	46	44.7
Income equal to expenses	52	50.5
Income more than expenses	5	4.8
Place of residence		
City	63	61.2
District	38	36.9
Village	2	1.9
Mother's educational status		
Illiterate	3	2.9
Literate but not a graduate of any school	3	2.9
Primary school	55	53.5
High school	23	22.3
Higher education	19	18.4
Mother's employment status		
Employed	26	25.2
Not employed	77	74.8
Father's educational status		
Illiterate	3	2.9
Primary school	47	45.6
High school	35	34.0
Higher education	18	17.5
Father's employment status		
Employed	94	91.3
Not employed	6	5.8
Retired	3	2.9
Previous hospitalization		
Yes	66	64.1
No	37	35.9
Having undergone surgery previously		
Yes	33	32.0
No	70	68.0
Presence of a family member having been hospitalized previously		
Yes	62	60.2
No	41	39.8
Having a family member or relative who is a health professional		
Yes	56	54.4
No	47	45.6

*SD: Standard Deviation

Table 2. Mean scores obtained from the scales administered in the present study.

Scales and Dimensions	X±SD*	Min-Max
Scale to Measure Children's Fear of Nursing Interventions and Instruments Used in the Hospital		
Fear of Frequently Encountered Materials dimension	11.44±2.53	10-24
Fear of Infrequently Encountered Materials dimension	13.99±4.88	8-29
Total	25.43±6.76	18-53
Scale for the Evaluation of Quality of Care from the Perspectives of Children		
Psychosocial Care dimension	15.07±5.99	7-30
Physical Care dimension	20.51±4.44	7-25
Information dimension	11.27±3.34	7-15
Total	49.80±12.93	24-71

*SD: Standard Deviation

Tablo 3. Relationship between the scale for the evaluation of quality of care from the perspectives of children and scale to measure children's fear of nursing interventions and instruments used in the hospital and their dimensions (n=103).

		Fear of frequently encountered materials dimension	Fear of infrequently encountered materials dimension	Scale to measure children's fear of nursing interventions and instruments used in the hospital total
Psychosocial Care dimension	r	-0.0191	-0.0365	-0.0350
	p	**0.000**	**0.054**	**0.000**
Physical Care dimension	r	-0.0236	-0.0311	-0.0332
	p	**0.017**	**0.001**	**0.001**
Information dimension	r	-0.0320	-0.0399	-0.0434
	p	**0.001**	**0.00**	**0.00**
Scale for the Evaluation of Quality of Care from the Perspectives of Children	r	-0.0262	-0.0397	-0.0409
	p	**0.008**	**0.00**	**0.000**

r: Correlation analysis, $p<0.05$ is statistically significant

DISCUSSION

Children may experience psychosocial difficulties during the inpatient treatment process. During this process, understanding, loving and empathic relationships can be established with children through care practices. Children can be encouraged to express their feelings and thoughts about the disease and the hospital, and their adaptation can be improved by making explanations appropriate to their age, and their fears and anxiety can be reduced (Turgut & Şahiner, 2024). The current study is expected to contribute to the literature because it is the first study in which the data was collected based on children's self-reports about their fears of nursing interventions, and the quality of care they receive in the hospital after surgery. In several studies, it has been determined that hospitalized boys' "anger and aggression" scores (Akkavak and Karabudak, 2019) and "anxiety and communication difficulties" scores (Selbes et al., 2021) were higher than were those of girls.

In another study in which the factors affecting the psychosocial adaptation of children receiving inpatient treatment in hospital were investigated, girls experienced "regression" more than did boys (Başay et al., 2020).

In patriarchal societies, boys' expressing their feelings such as anxiety, stress and fear is generally considered as weakness, which causes boys to suppress their emotions and puts them under pressure to appear strong, which, we believe, affected the results of the present study. In a pediatric study in which the postoperative psychosocial symptoms were investigated, boys experienced high levels of communication difficulties, anger and aggression, and their mean score for the overall scale was high (Karaarslan & Ergin, 2024b). In the present study,

consistent with the literature, the psychosocial care scores of the boys were significantly high. Children's views and perceptions about their hospitalization experiences play an important role in monitoring and evaluating the effectiveness and quality of healthcare services. In the present study, there were significant differences between the mean scores obtained from the overall "Scale to Measure Children's Fear of Nursing Interventions and Instruments Used in the Hospital" and its "Fear of Infrequently Encountered Materials" dimension in terms of the variable "having undergone surgery previously". The scores of the children who had previously undergone surgery were higher than were those of the children who had not undergone surgery. The children's post-surgery feelings and thoughts about the hospital were shaped by their previous experiences, which can be interpreted as the fact that children with chronic diseases generally experience fear and anxiety due to having to be hospitalized frequently (Akkavak & Karabudak, 2019). Nursing care practices have many benefits for both children and parents. These practices make supportive nursing care extremely important in ensuring adaptation to illness and hospital, and transition to oral feeding, supporting growth and development, increasing the child's and parent's satisfaction, and relieving pain (Turgut & Şahiner, 2024). Therefore, it is important to question the evaluation made by children who are hospitalized and have had surgery regarding the quality of nursing care provided to them. In their study (2021), Semerci et al. asked children who are hospitalized to evaluate nursing care from their perspectives. It was determined that children who had hospital experience, who had frequent hospitalizations, or who stayed in the hospital for a long time gave high scores to the quality of nursing care. Although there was no significant difference between the groups in the present study, it was observed that children who had not had surgery but had hospital experience obtained higher scores from the Scale for the Evaluation of Quality of Care from the Perspectives of Children". One of the most effective ways to reduce the fear and anxiety experienced by children during hospitalization and surgery is to inform the children about the procedure and to ensure their participation in their care. In the present study, of the participants, those whose relatives were healthcare professionals obtained significantly higher scores from the overall Scale for the Evaluation of Quality of Care from the Perspectives of Children and its Psychosocial, Physical and Information dimensions. Attitudes displayed by children's family and people in their immediate circle also affect their fear of hospitals, nurses, and materials used. It is thought that families should not scare their children with hospitals, nurses and materials, because such approaches can increase children's sense of fear. In Gerçeker et al., study (2021), it was determined that the level of the support given by nurses to parents was high, and that scores obtained from the overall scale and its dimensions such as "providing information and communication, emotional support, respect support and providing quality care" were also high. The results of the present study indicated that the support provided by pediatric nurses to parents reduced the parents' stress, which positively affected the parent-child interaction and reduced the child's fear and stress. In a study in which the family-centered nursing care experiences of parents of hospitalized children were investigated, parents were allowed to stay with their children during the procedures, and nurses provided information about the disease and treatment processes and introduced the service to them. These practices decreased the children's and families' stress and anxiety levels (Garlı & Çınar, 2020). In a study, 76.1% of the pediatric nurses reported that they provided information appropriate to the children's age and development; however, 73.9% of school-aged children reported that they received information more than they needed (Akkoyun & Arslan, 2022). With recent advances in technology, live, immersive and virtual reality systems are being used especially when providing preoperative information to pediatric patients (Ryu et al., 2018), because these systems make it possible for children to be informed about potentially frightening and stressful situations and help them realize that their imaginary fears about these situations in the hospital are not real (Karaarslan & Ergin, 2024a).

As demonstrated in several studies, real or animated educational videos prepared to provide children with information or to distract their attention are effective in reducing their fear and anxiety levels (Ryu et al., 2018; Yaz & Yılmaz, 2022; Kostak & Semerci, 2023; Karaarslan & Ergin, 2024a). In the present study, "negative" relationship was determined between the self-report results of the children evaluating the quality of postoperative care, and their fears. Children's and their parents' being adequately informed and encouraged about the surgical process, and having the feeling that they are valued increase their satisfaction of care and improve their trust in pediatric nurses who provide the health service (Pazarcıkçı & Efe, 2023). Invasive procedures such as blood drawing, establishment of vascular access, surgical interventions, etc. performed for diagnosis and treatment cause pain and fear (Turgut & Şahiner, 2024). In a study, it was revealed that hospitalization caused "mild" psychosocial symptoms in school-age children, and that hospitalized children experienced anxiety, hopelessness, and regression (Üstün et al., 2021). In another study in which hospitalized children in the age group of 7-12 years evaluated the hospital and the nurse, the children experienced emotions such as fear, excitement, and embarrassment (Akkavak & Karabudak, 2019). In the present study, the participating children's levels of fear of nursing interventions and materials used during interventions were moderate after surgery.

Table 4. Comparison of the mean scores obtained from the "Scale for the Evaluation of Quality of Care from the Perspectives of Children" and its dimensions in terms of the participating children's illness/hospitalization-related characteristics (n= 103)

Variables	Number	Fear of frequently encountered materials dimension	Fear of infrequently encountered materials dimension	Scale total	Psychosocial care dimension	Physical care Dimension	Information dimension	Scale total
Sex (Children)		**X± SD**	**X± SD**	**X± SD**	**X± SD**	**X± SD**	**X± SD**	**X± SD**
Girls	32	*11.44*±0.28	*15.68*±0.79	*27.13*±0.97	*12.03*±1.04	*19.44*±1.02	*10.86*±0.66	*45.03±2.60*
Boys	71	*12.18*±0.40	*16.00*±0.59	*28.18*±0.91	*15.39*±0.63	*20.45*±0.47	*11.04*±0.39	*49.80*±1.38
Test; p value		MWU:-.465 p:0.642	MWU:-.122 p:0.903	MWU:-.391 p:0.643	**MWU:-2.850 p:0.004**	MWU:-.025 p:0.980	MWU:-.043 p:0.966	MWU:-1.337 p:0.181
Person accompanying the child								
Mother	85	*12.01*±0.35	*16.01*±0.56	*28.02*±0.83	14.08±0.61	*20.28*±0.47	*11.15*±0.34	48.34±1.33
Father	18	*11.70*±0.36	*15.41*±0.71	*27.11*±0.68	*15.64*±1.36	*19.52*±1.32	*10.23*±1.09	*48.35*±3.65
Test; p value		MWU:-1.955 p:0.051	MWU:-.288 p:0.7873	MWU:-.821 p:0.411	MWU:-.798 p:0.425	MWU:-.429 p:0.668	MWU:-.359 p:0.720	MWU:-.096 p:0.924
Previous hospitalization								
Yes	66	*11.78*±0.30	*15.37*±0.55	*27.15*±0.75	*14.25*±0.59	*20.06*±0.52	*10.78*±0.40	*47.96*±1.39
No	37	*12.32*±0.66	*17.00*±0.89	*29.32*±1.45	*14.61*±1.22	*20.32*±0.89	*11.41*±0.61	*49.12*±2.63
Test; p value		MWU:-.596 p:0.551	MWU:-1.000 p:0.317	MWU:-1.145 p:0.252	MWU:-.770 p:0.441	MWU:-1.732 p:0.083	MWU:-1.577 p:0.115	MWU:-1.600 p:0.110
Having undergone surgery previously								
Yes	33	*11.46±0.29*	*14.24*±0.57	*25.71*±0.77	*13.81*±0.90	*20.06*±0.77	*10.96*±0.55	*48.03*±1.91
No	70	*11.40*±0.45	*13.54*±0.87	24.94±1.25	*14.66*±0.71	*20.19*±0.56	*11.00*±0.43	*48.51*±1.65
Test; p value		MWU:-1.543 p:0.123	**MWU:-2.027 p:0.043**	**MWU:-2.503 p:0.012**	MWU:-1.626 p:0.104	MWU:-1.485 p:0.137	MWU:-.894 p:0.371	MWU:-.934 p:0.350
Presence of a family member having been hospitalized previously								
Yes	62	*12.21*±0.51	*16.03*±0.81	*28.24*±1.12	*13.81*±0.90	*20.06*±0.77	*10.96*±0.55	*48.03*±1.91
No	41	*11.820*±0.36	15.83±0.59	*27.66*±0.89	*14.66*±0.71	*2019*±0.56	*11.00*±0.43	*48.51*±1.65
Test; p value		MWU:-.584 p:0.559	MWU:-.766 p:0.444	MWU:-.461 p:0.645	MWU:-.237 p:0.813	MWU:-1.667 p:0.095	MWU:-1.335 p:0.182	MWU:-1.092 p:0275
Having a family member or relative who is a health professional								
Yes	56	*11.37*±0.34	*13.85*±0.69	*25.23*±0.93	*16.41*±0.88	*21.16*±0.64	*12.01*±0.41	*52.67*±1.88
No	47	*11.53*±0.36	*14.14*±0.65	*25.68*±0.95	*13.48*±0.69	*19.74*±0.55	*10.38*±0.49	*46.38*±1.52
Test; p value		MWU:-.693 p:0.488	MWU:-.440 p:0.660	MWU:-.383 p:0.702	**MWU:-1.374 p:0.024**	**MWU:-2.846 p:0.0504**	**MWU:-2.684 p:0.007**	**MWU:-2.405 p:0.016**

The results of the present study are consistent with those of studies in the literature (Akkavak & Karabudak, 2019; Üstün et al., 2021; Pazarcıkçı & Efe, 2023) and it was concluded that nursing care reduced children's fear of medical interventions, and that pediatric nurses should assess the physical and psychosocial status of children, should provide children with information about the disease and procedures to be performed, and should provide psychological support to them.

Recommendations

In line with these results, it is recommended that pediatric nurses should inform children about their disease, its treatment and surgical unit where they stay as soon as they are admitted to the hospital, and that they should display a holistic approach towards children by taking their psychosocial status into account. It is also recommended that children should be trained to reduce their fear of nursing interventions and materials used during interventions in advance.

Limitation of the study

The fact that study was conducted only with children hospitalized in the pediatric surgery ward of a university hospital is the limitation of the study. Therefore, the results obtained from the present study are applicable only to children who underwent surgery in this hospital and they cannot be generalized to all children undergoing surgery in other hospitals.

CONCLUSION

In the present study, the scores obtained from the Scale for the Evaluation of Quality of Care from the Perspectives of Children and Scale to Measure Children's Fear of Nursing Interventions and Instruments Used in the Hospital were at a moderate level. However, the level of quality of nursing care evaluated by the participating children hospitalized after surgery was high. There was a negative, moderate and significant relationship between the levels of the quality of care evaluated by children, and their fear of nursing interventions and materials used in the interventions. Pediatric nursing care is a way of providing holistic, child and family-centered, individualized care in line with children's health care needs. It is the responsibility of pediatric nurses to develop and evaluate the effectiveness of surgery preparation programs, and implement them by taking children's age-related characteristics into account. Pediatric nurses should be aware of how important the support they provide is. New research should be planned not only to develop supportive nursing care but also to evaluate the effectiveness of nursing interventions aimed at reducing children's fear and stress.

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Conflict of interest

There is no conflict of interest between the authors.

Author contributions

Plan, design: DK, AK, ÖSM; **Material, methods and data collection:** AK, DK, ÖSM; **Data analysis and comments:** DK; **Writing and corrections:** DK, ÖSM, AK.

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Ethical Approval

Ethical committee: Manisa Celal Bayar University Health Sciences Noninvasive Clinical Research Ethics Committee

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Evaluation of Cervical Mobility, Sleep Quality, and Function in Chronic Neck Pain

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ABSTRACT

Objective: Chronic neck pain (CNP) is a common issue requiring a biopsychosocial approach. This study aimed to explore the relationship between pain, cervical mobility, sleep quality, and functional status, comparing these variables with healthy controls. **Materials and Methods:** Sixty-five participants with CNP and sixty-five controls were included. Neck pain at rest and during activity was measured using the Visual Analog Scale (VAS Cervical mobility was assessed in all planes of motion using a universal goniometer to measure the active cervical range of motion (C-ROM). The Pittsburgh Sleep Quality Index (PSQI) and Neck Disability Index (NDI) were used to evaluate sleep quality and neck-related functional status. **Results:** Cervical mobility showed significant differences in C-ROM for flexion, extension, and lateral flexion ($p<0.05$), while no significant differences were found in rotation between groups ($p>0.05$). Additionally, the CNP group exhibited higher disability levels and poorer sleep quality compared to the controls ($p<0.001$. In the CNP group reduced C-ROM in flexion, extension, and left lateral flexion showed a weak negative correlation with PSQI score ($p<0.05$). NDI was significantly associated with C-ROM in all planes ($p<0.05$). Moreover, NDI exhibited a strong positive correlation with the PSQI score ($r=0.612$; $p<0.001$). **Conclusion:** CNP individuals experience a negative status on cervical mobility, sleep quality, and functional status compared to healthy individuals. A significant relationship was also found between increased neck disability and poorer sleep quality. Treating sleep disturbances may help alleviate neck disability and improve overall health.

Keywords: Pain, Neck, Range of Motion, Sleep Quality, Functional Status.

Kronik Boyun Ağrısında Servikal Mobilite, Uyku Kalitesi ve Fonksiyonun Değerlendirilmesi

ÖZ

Amaç: Kronik boyun ağrısı (KBA), biyopsikososyal yaklaşım gerektiren yaygın bir sorundur. Bu çalışmanın amacı ağrı, servikal mobilite, uyku kalitesi ve fonksiyonel durum arasındaki ilişkiyi sağlıklı kontrollerle karşılaştırarak incelemektir. **Gereç ve Yöntemler:** Altmış beş KBA'lı katılımcı ve altmış beş kontrol çalışmaya dahil edildi. Boyun ağrısı istirahatte ve aktivite sırasında Görsel Analog Skala (GAS) kullanılarak ölçüldü. Servikal mobilite, aktif servikal eklem hareket açıklığı (S-EHA) ölçmek için universal bir gonyometre kullanılarak tüm hareket düzlemlerinde değerlendirildi. Uyku kalitesi ve boyun ile ilgili fonksiyonel durumu değerlendirmek için Pittsburgh Uyku Kalitesi İndeksi (PUKİ) ve Boyun Özürlülük İndeksi (BÖİ) kullanıldı. **Bulgular**: Servikal mobilitede gruplar arasında, fleksiyon, ekstansiyon ve lateral fleksiyon için S-EHA değerlerinde anlamlı farklar bulundu ($p<0.05$), ancak rotasyon değerlerinde anlamlı fark saptanmadı ($p>0.05$). Ayrıca, KBA'lı grupta kontrol grubuna kıyasla daha yüksek dizabilite düzeyleri ve daha kötü uyku kalitesi gözlendi ($p<0.001$). KBA'lı grupta, fleksiyon, ekstansiyon ve sol lateral fleksiyondaki azalmış S-EHA ile PUKİ skoru arasında zayıf negatif korelasyon bulundu ($p<0.05$). BÖİ, tüm düzlemlerdeki S-EHA ile anlamlı bir ilişki gösterdi ($p<0.05$). Bunun yanı sıra, NDI ile PSQI skoru arasında güçlü pozitif bir korelasyon saptandı ($r=0.612$; $p<0.001$). **Sonuç:** KBA olan bireyler, sağlıklı bireylere kıyasla servikal hareketlilik, uyku kalitesi ve fonksiyonel durum bakımından daha fazla kısıtlılık deneyimlerler. Ayrıca, artan boyun sakatlığı ile daha düşük uyku kalitesi arasında önemli bir ilişki olduğu tespit edilmiştir. Uyku bozukluklarının tedavi edilmesi, boyun sakatlığının hafifletilmesine ve genel sağlığın iyileştirilmesine katkı sağlayabilir.

Anahtar kelimeler: Ağrı, Boyun, Eklem Hareket Açıklığı, Uyku Kalitesi, Fonksiyonel Durum.

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INTRODUCTION

The cervical spine serves as a mobile support for vital functions of the head and upper extremities, and chronic pain in this region negatively affects general health. Chronic neck pain (CNP) is one of the most commonly reported musculoskeletal disorders in the adult population and is located between the lateral borders of the neck and occiput and the first thoracic vertebra, lasting longer than three months (Kazeminasab et al., 2022). Due to the lack of specific pathologic findings in its diagnosis, CNP is often categorized as nonspecific neck pain associated with a range of biomechanical, functional, proprioceptive, and postural disturbances. Furthermore, CNP is a multidimensional health issue influenced by various psychosocial, emotional, and behavioral factors (Öksüz & Atılgan, 2017).

Biomechanical changes in the cervical spine, such as reduced range of motion and alterations in spinal curvature, have been identified as key contributors to neck pain (Mohammad et al., 2015). Similarly, cervical range of motion (C-ROM) is lower in patients with neck pain than in those without neck pain (Farooq et al., 2018). In addition, decreased range of motion may increase the risk of developing neck pain and is considered a negative prognostic factor in the recovery of patients with neck pain (Walton et al., 2013). A 16-year prospective study conducted to evaluate the possible relationship between C-ROM and the development of neck pain found no relationship between cervical mobility and the occurrence of neck pain and injury later in life (Multanen et al., 2021). The heterogeneity in study results underscores the need for further research to clarify how C-ROMs influence neck pain and recovery, and to better differentiate between individuals with CNP and healthy individuals.

Sleep quality, which affects nearly all physiological functions, is also associated with CNP. Current studies emphasize the bidirectional correlation between CNP and sleep quality, indicating that inadequate sleep and poor sleep position may exacerbate pain by affecting neck muscle relaxation (Ateş et al., 2023). Additionally, constant pain in the cervical region rises later in the day, making it difficult to transition into deep sleep and, as a result, affecting sleep quality (Andreucci et al., 2020). Previous studies have demonstrated that chronic pain and inadequate sleep negatively impact functional status by impeding participation in daily, productivity, and leisure activities (Chang et al., 2022). However, there is still a need to explore how these factors interact within the context of CNP, particularly how they influence variations in the functional status.

The literature includes numerous studies on CNP with various etiological factors. However, owing to inconsistent findings in previous research, understanding the complex relationships associated with CNP remains challenging. Our study aimed to examine the relationship between pain, cervical mobility, sleep quality, and functional status, and compare these parameters with those of healthy controls. By incorporating healthy individuals into these comparisons, we aimed to gain a deeper understanding of these complex effects and provide a more comprehensive perspective on the overall impact of CNP. Additionally, these evaluations may provide valuable insights that could aid in the development of more effective rehabilitation strategies.

MATERIALS AND METHODS

Study design

This study was designed as a cross-sectional observational investigation conducted between July and September 2024.

Setting

This study was conducted at the Department of Physiotherapy and Rehabilitation of XXX. Participants were recruited based on a diagnosis of chronic CNP confirmed by radiological examination by a specialist physician. The control group (CG) consisted of healthy relatives of patients with CNP matched for age and sex.

Participants

Participants with CNP (defined as pain persisting for over 3 months, with a Visual Analog Scale (VAS) score at rest of ≥3) and their relatives serving as healthy controls were included in the study (Sarig Bahat et al., 2014). Eligibility required participants to be between 18 and 55 years of age, voluntarily consent to participate, and have experienced persistent cervical pain for at least 3 months (for the Chronic Neck Pain Group, CNPG).

Participants were excluded if they had a history of neck trauma or other cervical spine conditions, such as radiculopathy; prior surgical interventions involving the head, face, cervical spine, upper or lower extremities; cervical disc herniation; degenerative spinal conditions; any rheumatological or cardiovascular diseases; chronic neurological or psychiatric disorders; substance abuse; anemia; or diabetes.

Measurement

Sociodemographic data, including age, sex, height, weight, BMI, and occupation of the participants, were collected. The severity of neck pain at rest and during activity was evaluated using a Visual Analog Scale (VAS), a 10 cm line where 0 represents no neck pain and 10 represents unbearable neck pain. Participants marked a point on the line reflecting their level of neck pain (Begum & Hossain, 2019). Cervical mobility was assessed using a universal goniometer in three planes: lateral flexion (frontal plane), axial rotation to both right and left (horizontal plane), and flexion-extension (sagittal plane). All measurements were conducted by the same physiotherapist to ensure consistency using the American Association of Orthopaedic Surgeons (AAOS) values as a reference. The participants were asked to wear comfortable clothing, and the physiotherapist demonstrated the movements before

taking the measurements (Dos Santos et al., 2016). Sleep quality was assessed using the Pittsburgh Sleep Quality Index (PSQI), a 19-item self-report questionnaire that assesses various aspects of sleep. The PSQI includes seven components: subjective sleep quality, sleep latency, total sleep duration, sleep efficiency, sleep disturbances, sleep medication use, and daytime dysfunction. The total score ranges from 0 to 21, with higher scores indicating poorer sleep quality and a score above 8.0, suggesting significant sleep issues (Agargün et al., 1996). Functional status was assessed using the Neck Disability Index (NDI), which consists of 10 questions related to neck pain, functional activities, self-care, and quality of life. Each question is rated on a scale of 0 to 5, where 0 indicates no disability and 5 indicates complete disability. The scores for each item were summed, with the total score ranging from 0 to 50. Scores were categorized as follows: 0-4 points for no disability, 5-14 points for mild disability, 15-24 points for moderate disability, 25-34 points for severe disability, and ≥35 points for complete disability (Aslan et al., 2008).

Study size

The sample size was estimated using the software program G*Power (version 3.0.10) (Faul et al., 2007). The calculation was based on correlation analysis between the C-ROM and NDI. A correlation coefficient of r=0.568, derived from the study by Aimi et al. (2019), was used with a two-tailed test, an alpha level of 0.05, and a desired statistical power of 0.99. This analysis required a minimum of 41 participants (Aimi et al., 2019). To ensure robustness, 65 participants were included in each group, which exceeded the minimum requirement while maintaining the integrity of the study.

Statistical analysis

Statistical analysis of the data was conducted using Statistical Package for Social Sciences (SPSS) version 21.0. Data for measurable variables are presented as mean ± standard deviation (X±SD), and as numbers and (%) for categorical variables. The chi-square test was used for intergroup comparisons of categorical variables. The Shapiro-Wilk test was used to confirm a normal distribution. An independent t-test was employed based on the distribution normality of the data for each outcome between the groups. The correlation between scale scores was evaluated using Pearson correlation analysis. The correlation coefficients were labeled as follows: 0-0.2 very weak, 0.2-0.4 weak, 0.4-0.6 moderate, 0.6-0.8 strong, and "0.8" and above as very strong (Schober et al., 2018). The significance level was set at $p<0.05$.

Ethical considerations

Ethics committee approval for this study was obtained from the Non-Invasive Scientific Research Ethics Committee at Istanbul Atlas University (Decision No: E-22686390-050.99-42833, Approval Date: 14.05.2024). The study was conducted following the Declaration of Helsinki and informed consent was obtained from all participants before data collection.

RESULTS

The study sample consisted of participants with CNPG (n=65) and CG (n=65), with a mean age of 42.26±10.83 and 42.92±11.00 years, respectively. A comparison of the demographic data for these individuals is presented in Table 1. Among the participants in both groups, the majority were housewives, while a smaller proportion engaged in sedentary jobs (e.g., office workers, desk-based roles). There were no significant differences in baseline demographics between the groups ($p>0.05$).

Table 1. Baseline demographics of participants in the chronic neck pain and non-chronic neck pain groups (n=130).

Parameters	CNPG (n=65) Mean±SD	CG (n=65) Mean±SD	t	p
Age (Years)	42.26±10.83	42.92±11.00	-0.337	0.736
Height (cm)	163.88±7.31	165.48±7.87	-1.182	0.239
Weight (kg)	73.86±14.98	73.51±16.45	0.126	0.9
BMI (kg/m2)	27.58±5.49	26.93±6.34	0.615	0.54
	n(%)	**n(%)**		**χ2**
Sex				
Female	51(73)	52(75)	-	0.969
Male	14(27)	13(25)		
Occupation				
Housewife	42(64.6)	40(61.5)	-	0.7160
Sedentary jobs	23(35.4)	25(38.5)		

BMI: Body Mass Index, χ2: Chi- square Test, significance level $p<0.05$.

A comparison of pain status, cervical mobility, sleep quality, and neck disability between the groups is shown in Table 2. Within the CNPG mean pain intensity during rest was 6.43(95% confidence interval [CI], 5.25-6.27), and mean pain intensity during activity was 7.15(95% CI, 3.91-5.35). The

mean pain intensity at rest was 0.67±1.06 and the mean pain intensity during activity was 2.52±1.79 in the CG. The mean PSQI score of the CNPG was 8.69, indicating poor sleep quality (95% CI, 1.39-3.996). In the NDI score, participants with CNPG had a moderate disability score (20.75±10.04), while the CG had a mild disability score (9.21±6.19). There were statistically significant differences between groups in VAS_{rest}, ($p<0.001$), $VAS_{activity}$ ($p<0.001$), PSQI ($p<0.001$), and NDI ($p<0.001$) scores. A statistically significant difference was observed in the active C-ROM scores for flexion ($p<0.001$), extension ($p<0.001$), right lateral flexion ($p=0.002$), and left lateral flexion ($p<0.001$). However, no significant differences were found between the groups in the rotation C-ROM ($p>0.05$).

Table 2. Comparison of pain status, cervical mobility, sleep quality, and neck disability between the chronic neck pain and non-chronic neck pain groups (n=130).

Parameters	CNPG (n=65) Mean±SD	CG (n=65) Mean±SD	t	p	Cohen's d	95% Confidence Interval of the Difference	
						Lower	Upper
VAS_{rest}	6.43±1.73	0.67±1.06	22.663	<0.001	4.01	5.25	6.27
$VAS_{activity}$	7.15±2.24	2.52±1.79	12.824	<0.001	2.28	3.91	5.35
C-ROM Flexion	41.18±5.80	44.62±1.29	-4.657	<0.001	0.81	-4.94	-1.93
C-ROM Extension	39.68±7.81	43.62±3.54	-3.690	<0.001	0.64	-6.11	-1.78
C-ROM Lateral Flexion-R	37.62±7.38	41.34±5.84	-3.156	0.002	0.56	-6.09	-1.37
C-ROM Lateral Flexion-L	36.12±7.86	41.77±5.34	-4.741	<0.001	0.84	-8.03	-3.26
C-ROM Rotation-R	55.28±8.27	57.62±4.71	-1.970	0.056	0.34	-4.74	0.050
C-ROM Rotation-L	55.03±8.59	57.62±4.71	-2.080	0.052	0.37	-5.06	0.126
PSQI	8.69±4.38	6.00±2.77	4.145	<0.001	0.73	1.39	3.93
NDI	20.75±10.04	9.21±6.19	7.814	<0.001	1.38	8.58	14.51

CNPG: Chronic Neck Pain Group, CG: Control Group, C-ROM: Cervical Range of Motion, NDI: Neck Disability Index, VAS: Visual Analog Scale, PSQI: Pittsburg Sleep Quality Index, R: Right, L: Left. Significance level $p<0.05$.

Table 3 summarizes the cross-correlations among the study variables in participants with CNPG. The VAS scores at rest and during activity were not correlated with the C-ROM, PSQI, or NDI scores ($p>0.05$). Reduced C-ROM, particularly for flexion ($r=-0.311$; $p=0.012$), extension ($r=-0.396$; $p=0.001$), and left lateral flexion ($r=-0.306$; $p=0.013$), showed a weak but significant negative correlation with the PSQI score. The NDI was significantly correlated with the C-ROM in all planes ($p<0.05$). In addition, the NDI also showed a strong positive correlation with the PSQI score ($r=0.612$, $p<0.001$); the worse the neck disability, the worse the sleep quality.

The post hoc power analysis for the correlation coefficient between C-ROM (extension) and NDI ($r=0.389$), conducted with a sample size of 65 participants and a significance level of $\alpha=0.05$, demonstrated that the study achieved a power of 90.3%. The analysis was based on a two-tailed hypothesis and was conducted in alignment with the parameters of the a priori power analysis.

Table 3: Correlations among study variables in the CNPG (n=65)

			VAS		C-ROM						PSQI	NDI
			Rest	Activity	Flexion	Extension	Lateral Flexion -R	Lateral Flexion -L	Rotation -R	Rotation -L		
VAS	Rest	**r**		0.224	-0.066	-0.091	0.007	-0.079	-0.037	-0.082	0.042	0.221
		p		0.073	0.604	0.470	0.956	0.534	0.771	0.517	0.737	0.077
	Activity	**r**			-0.042	-0.115	0.037	-0.076	0.184	0.170	0.118	0.170
		p			0.717	0.363	0.772	0.546	0.143	0.176	0.351	0.176
C-ROM	Flexion	**r**				0.453	0.272	0.581	0.652	0.526	-0.311	-0.441
		p				**<0.001**	**0.028**	**<0.001**	**<0.001**	**<0.001**	**0.012**	**<0.001**
	Extension	**r**					0.271	0.416	0.430	0.597	-0.396	-0.389
		p					**0.029**	**0.001**	**<0.001**	**<0.001**	**0.001**	**0.001**
	Lateral Flexion -R	**r**						0.561	0.169	0.223	-0.242	-0.270
		p						**<0.001**	0.178	0.074	0.052	**0.030**
	Lateral Flexion -L	**r**							0.363	0.419	-0.306	-0.487
		p							**0.003**	**0.001**	**0.013**	**<0.001**
	Rotation -R	**r**								0.718	-0.212	-0.324
		p								**<0.001**	0.090	**0.008**
	Rotation -L	**r**									-0.187	-0.313
		p									0.136	**0.011**
PSQI		**r**										0.612
		p										**<0.001**

r=Pearson Correlation Coefficient, CNPG: Chronic Neck Pain Group, C-ROM: Cervical Range of Motion, NDI: Neck Disability Index, VAS: Visual Analog Scale, PSQI: Pittsburg Sleep Quality Index, R: Right, L: Left. Significance level p<0.05.

DISCUSSION

The current study found that participants with CNP experienced greater pain, limited C-ROM in the sagittal and frontal planes, poorer sleep quality, and higher neck disability than the control group. In the CNPG, no significant relationship was found between pain and the other parameters. Reduced cervical mobility is linked to higher disability; however, these findings do not extend to sleep quality.

CNP is a prevalent condition that affects a significant portion of the population and leads to discomfort, functional limitations, and reduced quality of life (Öksüz & Atılgan, 2017). Gender differences have been identified as key factors influencing the prevalence, intensity, and impact of CNP (Umeda & Kim, 2019). Studies consistently report that female individuals tend to experience more intense pain and higher levels of disability. Hormonal factors, as well as psychological distress, such as anxiety and depression, have been reported to play an important role in these outcomes (Elbinoune et al., 2016; Mazza et al., 2020). In our study, because sex-specific factors may have influenced pain perception and disability, the predominantly female sample may have contributed to the observed results.

Pain at rest and during activity is one of the main complaints of individuals with CNP (Lin et al., 2024). In the CNPG, the C-ROM decreased and the mean NDI score showed moderate disability, which is consistent with the literature (Ferreira et al., 2021). In addition, the PSQI score in our study indicates low sleep quality, which is consistent with other reports conducted with participants experiencing chronic pain (Husak & Bair, 2020).

In our study, healthy controls showed significantly greater C-ROM in all movements except the transverse plane. In a cross-sectional study of 102 patients with neck pain, Rudolfsson et al. reported that active C-ROM was limited to extension and flexion at the cervical level (Rudolfsson et al., 2012). A recent study similarly reported that individuals with neck pain had a lower C-ROM in all planes compared to their control peers (Özgören et al., 2022). Reduced C-ROM is suggested as a common finding in people with CNP (da Silva et al., 2018), yet results in the literature remain controversial. It seems possible that These results may be due to the heterogeneity of the neck pain group characteristics and subjective aspects of pain. Tao et al. also reported that possible degeneration in the cervical vertebrae is mostly seen at the C4, C5, and C6 levels, and since cervical rotation movement mainly occurs in–C1-C2, it may be the case in our study finding regarding rotation C-ROM (Tao et al., 2021).

In our study, no relationship was found between pain severity during rest and activity with other parameters. Similarly, Kyrosis et al. (2024) reported no significant association between pain intensity and disability in patients with chronic non-specific neck pain (Kyrosis et al. 2024). In contrast, studies involving patients with whiplash syndrome observed a strong association between neck disability and pain (Lee et al., 2015). While many studies show a strong link between disability and pain (Zetterqvist et al., 2017), as well as between sleep and pain (Lee & Oh, 2022), pain is also influenced by various psychological, physical, and social factors. Thus, there is no linear relationship between disability and pain. Considering the multidimensional nature of pain, future studies that evaluate several factors (e.g., fatigue, rumination, catastrophization) related to pain may contribute to the understanding of the relationship between pain and disability.

The relationship between self-rated disability, sleep quality, and cervical mobility in neck pain is lacking in the literature, and studies specifically examining the relationship between sleep quality and C-ROM are limited. However, Beltran-Alacreu et al. compared the C-ROM according to neck disability level and reported that moderate and severe disability was associated with a decrease in range of motion (Beltran-Alacreu et al., 2018). Meisingset et al. also demonstrated that a decreased C-ROM correlates with a higher level of disability (Meisingset et al., 2016). Accordingly, the relationship between neck disability and cervical mobility observed in this study supports the present results. Although no significant relationship was found between sleep quality and C-ROM in this study, these findings may suggest that improvements in cervical mobility could eventually affect functional status, or vice versa. Therefore, therapeutic interventions and patient education sessions should be designed to restore cervical mobility as much as possible.

Similar to previous studies, a moderate positive correlation was found between neck disability and sleep quality (Lee & Oh, 2022). In a study examining pain, disability, and sleep quality in patients with neck pain, Munoz et al. (2012) found that patients with neck pain have poorer sleep quality than healthy individuals. According to study results by Kovacs et al. neck pain-related disability is less likely to improve if they experience poor sleep quality (Kovacs et al., 2015). Hence, it could conceivably be hypothesized that sleep quality may directly or indirectly affect functional status. The contribution of healthy sleep to maintaining activities of daily living (Kohyama, 2021) and clinical studies on relaxation, sleep hygiene, and ergonomics in individuals with CNP may help to understand this relationship in greater depth.

Study limitations and strengths

The present study had several limitations. The cross-sectional design did not allow the establishment of a

cause-and-effect relationship between neck disability and other variables. While the study analyzed contributors to CNP and neck disability, such as neck ROM and sleep quality, it did not evaluate smartphone addiction, which is a recognized factor that influences both neck pain and sleep disturbances. Future studies should consider incorporating smartphone usage habits to provide a more comprehensive understanding of contributors to CNP.

CONCLUSION

This study emphasizes the relationship between neck-related disability, cervical ROM, and sleep quality in individuals with chronic neck pain. Moreover, reduced sleep quality may be a main cause of neck disability. Therefore, we suggest that sleep quality strategies should be addressed to improve the functional status of individuals with neck pain. In addition, exercises to increase mobility in the neck area may contribute to improvement in individuals with chronic neck pain.

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Conflict of Interest

The authors declare no potential conflicts of interest related to the research, authorship, and/or publication of this article.

Author Contributions

Plan, design: GD; **Material, methods and data collection:** GD, SÖ; **Data analysis and comments:** GD, ŞÖ; **Writing and corrections:** GD, ŞÖ.

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Ethical Approval

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Evaluation of Basic and Advanced Life Support Knowledge of Health Workers

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ABSTRACT
Objective: Our aim was to assess the knowledge and skill levels of health workers in our hospital in relation to basic and advanced life support and to see if there was a difference before and after the training. **Materials and Methods:** The training was administered in the light of the updates in the Universal Basic and Advanced Life Support guidelines, and according to the AHA guidelines, with one day of theory and one day of practice. After the training, evaluation was done with the post-test. The demographic information of the participants, the distribution of tasks and the changes between the pre-test and the post-test according to their professional status were statistically evaluated. **Results:** We look at the training in both basic life support and advanced life support the level of knowledge of the participants increased. **Conclusion:** When we evaluate the changes in the knowledge levels of the participants after the course, we can say that the level of knowledge and awareness was limited before the training. We think that trainings should be repeated at certain intervals.
Keywords: Basic Life Support, Advanced Life Support, Education, Health Personnel.

Sağlık Çalışanlarının Temel ve İleri Yaşam Desteği Bilgilerinin Değerlendirilmesi

ÖZ
Amaç: Hastanemizdeki sağlık çalışmalarının temel ve ileri yaşam desteği ile ilgili bilgi ve beceri düzeylerini değerlendirmek ve eğitim öncesi ve sonrasında bir fark olup olmadığını görmektir. **Gereç ve Yöntem:** Eğitim, Evrensel Temel ve ileri Yaşam Desteği kılavuzundaki güncellemeler ışığında ve AHA kılavuzuna göre bir gün teorik ve bir gün pratik uygulama olarak anlatılmıştır. Eğitim sonrasında son test ile değerlendirme yapılmıştır. Katılımcıların demografik bilgileri, görev dağılımları ve mesleki durumlarına göre ön test ve son test arasındaki değişimler istatistiksel olarak değerlendirildi. **Bulgular:** "Hem temel yaşam desteği hem de ileri yaşam desteği eğitimlerine baktığımızda katılımcıların bilgi düzeyinin arttığı görülmektedir. **Sonuç:** Kurs sonrası katılımcıların bilgi düzeylerindeki değişimleri değerlendirdiğimizde bilgi ve farkındalık düzeyinin eğitimden önce sınırlı olduğunu söyleyebiliriz. Eğitimlerin belirli aralıklarla tekrarlanması gerektiğini düşünüyoruz.
Anahtar Kelimeler: Temel Yaşam Desteği, İleri Yaşam Desteği, Eğitim, Sağlık Personeli.

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INTRODUCTION

Cardiopulmonary arrest is the sudden cessation of respiration and circulation due to different reasons. (Balci, 2011) If cardiopulmonary resuscitation (CPR) is not applied immediately to a patient with cardiopulmonary arrest, the brain will start to get damaged within minutes after respiratory and circulatory arrest. For this reason, CPR should be started immediately after the heartbeat stops. (NÖ., 1998.) Basic Life Support (BLS) and Advanced Life Support (ALS), which are the stages of CPR, are vital practices (American Heart Association, 2010).

It is known that immediate initiation of CPR to every patient who is evaluated as suffering from a cardiac arrest increases the probability of survival of the patient, and that every minute delayed for each of the steps of CPR and ALS decreases the chance of survival by 5.5% (Larsen, 1993). It is known that in approximately 84% of in-hospital cardiopulmonary arrests, clinical findings progressively worsen in the last eight hours and in-hospital morbidity and mortality increase, mostly due to deficiencies in rapid diagnostic and therapeutic approaches (Hodgetts, 2002). Therefore, it is reported that the primary and most important approach for the prevention of cardiopulmonary arrests in the hospital depends on the in-hospital action plan for early recognition, treatment and early transfer of high-risk patients to intensive care. The level of knowledge and skill in CPR of the healthcare worker who first encounter a patient who acutely deteriorates or has cardiopulmonary arrest in the hospital is the most important criteria for providing rapid and correct intervention (Swor, 2006).

Studies have shown that rapidly initiated and effectively applied CPR increases the likelihood of survival, while delay decreases the patient's chance of survival (Baskett, 2008). However, many studies show that knowledge and application skills of CPR are not widespread enough among healthcare worker, and that training programs are needed (Demirkıran et al., 2003).

In healthcare organizations, especially the personnel responsible for the care and treatment of patients should receive CPR training and update their knowledge by repeating it at regular intervals. Therefore, it is recommended that CPR training should be received by both health care workers and health care support personnel (Baskett, 2005).

In our hospital, the first intervention in cardiopulmonary arrest is usually performed by the nurse, paramedic, emergency medical technician or physician following a patient. In addition, unlike other healthcare organizations, the hospital resuscitation (Code Blue) team consists of Emergency Medicine assistants. After taking over a patient, the team continues basic and advanced life support practices. Our plan of organizing training is to provide the personnel who will make the first intervention to a patient with cardiopulmonary arrest until the resuscitation team arrives with the ability to make the correct diagnosis, to apply basic life support steps quickly and correctly, and to perform safe defibrillation.

This study aims to evaluate the level of knowledge of all healthcare personnel working in university hospitals, to examine the effectiveness of training programs, and to make recommendations for the improvement of training programs in the light of the findings obtained.

MATERIALS AND METHODS

After obtaining approval from Balikesir University (25/6/2024, decision no: 2024/93), BLS-ALS training was conducted at Balikesir University Seminar Hall, on 16.07.2024-17.07.2024 under the coordination and responsibility of the hospital education commission. BLS and ALS knowledge of health and non-health worker (secretary, security, etc.) working in Balikesir University was evaluated by pre-test and post-test.

The knowledge assessment questionnaire was prepared by the researchers using the current data of the American College of Cardiology (AHA) and the European Resuscitation Council (ERC) to assess the level of cardiopulmonary resuscitation knowledge to be used in pretest and posttest. 2023 AHA (American Heart Association) guidelines were used in theoretical lectures and practices. Assessment test questions were created separately for CPR and ALS. The evaluation test was made out of 10 questions before and after the training. The questions were multiple-choice, and the evaluation was calculated by giving 1 point for each correct answer and 0 point for each incorrect answer. The lowest score was 0 and the highest score was 10. The courses were taught by emergency medicine residents and faculty members. The same instructors gave assessment exams at the beginning and at the end of the training.

Training dates were planned so as not to affect the participants' working time. A total of 113 people including physicians, nurses, emergency medical technicians, medical secretaries, security, personnel, pharmacists, audiometrists, elderly-care workers, midwives, IT technicians and other technicians participated in the trainings. The BLS training was attended by 45 people and the ALS training by 88 people.

Adult and pediatric half-body training manikins (Simulaids) were used for the applications.

Statistical analysis

Quantitative analysis methods were used in the evaluation of the data. SPSS26.0 (Statistical Package for the Social Science) software program was used during the analysis. Descriptive statistics, difference analysis (t test and ANOVA) and Wilcoxon Test were performed in this program. Frequency, percentage, mean and median values were calculated. Wilcoxon Test was used to evaluate the difference between pre-

test and post-test results. $p<0.05$ was considered statistically significant.

RESULTS

45 people participated in the BLS training held on 16.7.2024-17.7.2024 in the meeting hall. In the ALS training, there were 88 people in total with the participation of the members of the same professions. The majority of the participants were between 26-45 years of age. Female participants had a higher proportion than male participants in both types of training. In terms of working period, it was determined that the majority of the participants had a working period of 5-10 years (28.9%).

The participants were nurses (28.9%) and medical secretaries (17.8%) and staff (17.8%), respectively (Table 1).

Table 1. Sociodemographic characteristics of the participants.

Variables		Basic life support		Advanced life support	
		n	%	n	%
Age	18-25 years old	4	8.9	23	26.1
	26-35 years old	16	35.6	35	39.8
	36-45 years old	18	40	27	30.7
	46-60 years old	7	15.6	3	3.4
Sex	Male	14	31.1	17	19.3
	Woman	31	68.9	71	80.7
Working period	1-3 years	9	20	25	28.41
	3-5 years	2	4.4	11	12.50
	5-10 years	13	28.9	18	20.45
	10-15 years	8	17.8	14	15.91
	15 years and above	13	28.9	13	14.77
Receiving basic / advanced life support training	Yes	19	42.2	67	76.1
	No	26	57.8	21	23.9
Profession	Nurse	13	28.9	63	71.6
	EMT	2	4.4	3	3.4
	Medical Secretary	8	17.8	-	-
	Security	3	6.7	-	-
	Staff	8	17.8	-	-
	Pharmacist	1	2.2	-	-
	Audiometrist	2	4.4	-	-
	Elderly Care	1	2.2	-	-
	Midwife	1	2.2	-	-
	Data Processing Technician	2	4.4	-	-
	Doctor	2	4.4	-	-
	Technician	2	4.4	22	90.9
Total		45	100	88	100

When it was examined whether the participants had received basic life support training before, it was seen that 57.8% had not received any training before (Table 1). Looking at the answers they gave to the questions of the BLS test, it was seen that the most correct answers were given to the question " What is Basic Life Support?" both in the pre-test (82.22%) and post-test (97.78%). The question with the least number of correct answers in the pre-test was "How many cm should the sternum be lowered in heart massage for adults?" (24.44%). In the post-test, this rate increased to 86.67%. In the post-test, the least correct answer was the question "In which of the following is the correct order of application of basic life support for an adult patient / injured person?" (80%). While the correct response rate was 46.67% in the pre-test for the question "How many times per minute should CPR be performed in adults?", this rate increased to 93.33% in the post-test (Table 2). Although 76.1% of the participants stated that they had received ALS training before, it shows that there was a significant improvement in their knowledge level with the training (Table 1-3). In the question "What should be the dose and form of adrenaline administration in anaphylaxis in adult patients?", while the correct response rate was 19.32% in the pre-test, this rate increased to 77.27% in the post-test. This shows how effective the training program was in helping the participants learn the critical information. In the question "When is Amiodarone used in adult advanced life support?", the correct response rate increased from 44.32% in the pre-test to 95.45% in the post-test, and the level of knowledge appears to have increased significantly.

Table 2. Distribution of participants' responses to basic life support test questions.

Distribution of responses to basic life support test questions	Pre-Test				Post-Test			
	That's right		Wrong		That's right		Wrong	
Questions (n=45)	n	%	n	%	n	%	n	%
What is Basic Life Support?	37	82.22	8	17.78	44	97.78	1	2.22
How many times per minute should CPR be performed in adults?	21	46.67	24	53.33	42	93.33	3	6.67
Which of the following is the area to perform CPR on adult victims?	16	35.56	29	64.44	37	82.22	8	17.78
Which of the following is the first step in assessing the victim?	27	60.00	18	40.00	43	95.56	2	4.44
How to make the most accurate respiratory assessment in basic life support?	36	80.00	9	20.00	44	97.78	1	2.22
How many cm should the sternum be lowered during CPR in adults?	11	24.44	34	75.56	39	86.67	6	13.33
How many breaths and heart massage does 1 round of basic life support consist of?	33	73.33	12	26.67	44	97.78	1	2.22
In which of the following is the basic life support application sequence for an adult patient / casualty given correctly?	17	37.78	28	62.22	36	80.00	9	20.00
Which device can be used during Basic Life Support?	15	33.33	25	55.56	41	91.11	4	8.89
Which procedure is incorrect when the airway is obstructed by a foreign body?	28	62.22	17	37.78	43	95.56	2	4.44

Note: Percentage of rows used

For the question "If defibrillation will be applied to the patient during adult advanced life support and the amount of energy recommended by the device is unknown, how many joules should be preferred?"; the correct response rate increased from 15.91% in the pre-test to 92.05% in the post-test (Table 3). As a result, it is seen in Table 3 data that the level of knowledge of the participants increased significantly with the training.

Table 3. Distribution of participants' responses to advanced life support test questions.

Distribution of Responses to Advanced Life Support Test Questions (n=88)	Pre-Test				Post-Test			
	That's right		Wrong		That's right		Wrong	
	n	%	n	%	n	%	n	%
What should be the dose and form of adrenaline administration in anaphylaxis in adult patients?	17	19.32	71	80.68	68	77.27	20	22.73
What should be the frequency of adrenaline administration during adult CPR?	70	79.55	18	20.45	83	94.32	5	5.68
Which of the following drugs is not administered by reconstitution with SF?	24	27.27	64	72.73	78	88.64	10	11.36
When is Amiodarone used in adult advanced life support?	39	44.32	49	55.68	84	95.45	4	4.55
Which of the above rhythms can be defibrillated?	62	70.45	26	29.55	84	95.45	4	4.55
Which of the following information about adult advanced life support is incorrect?	42	47.73	46	52.27	80	90.91	8	9.09
What is the in-hospital code blue number?	85	96.59	3	3.41	88	100.0	0	0.00
Which of the following options is not among the reversible causes in adult advanced life support?	36	40.91	52	59.09	84	95.45	4	4.55
If the defibrillation procedure will be applied to the patient during adult advanced life support application and the amount of energy recommended by the device is unknown, how many joules should be preferred?	14	15.91	74	84.09	81	92.05	7	7.95
How often should pulse control be performed during cardiopulmonary resuscitation?	33	37.50	55	62.50	83	94.32	5	5.68

Note: Percentage of rows used.

In Table 4, the results of the Wilcoxon test were presented to evaluate the difference between the pre-test and post-test results of the participants. While the mean score before the training (pre-test) was 5.47, the mean score after the training (post-test) was found to be 9.18. Standard deviation values show that the post-

test was more homogeneously distributed. Z and P values confirm that the training program was effective. The knowledge level of the participants increased with the training.

Table 4. Wilcoxon test between basic life support pre-test and post-test results.

	n	Average	Standard Deviation	Minimum	Maximum	**Z	*p
First Test	45	5.47	2.42	1	10	**-5.609**	**0.00**
Post Test	45	9.18	1.03	5	10		

*p: <0.05 statistically significant,**z: below average (-), above average (+)

In Table 5, while the average score before the BLS training (pre-test) was 4.81, the average score after the training (post-test) was found to be 9.28. This shows that the training program significantly increased the knowledge level of the participants. Z and P values confirm that the training program was effective.

Table 5. Wilcoxon test between advanced life support pre-test and post-test results.

	n	Average	Standard Deviation	Minimum	Maximum	**Z	*p
First Test	88	4.81	1.73	1	10	**-8.087**	**0.00**
Post Test	88	9.28	1.23	4	10		

*p: <0.05 statistically significant,**z: below average (-), above average (+)

DISCUSSION

In-hospital cardiac arrest and out-of-hospital cardiac arrest are global health problems. In the prevention and treatment of cardiopulmonary arrest, it is known that it is very important for healthcare professionals to have sufficient knowledge and skills about Basic Life Support (BLS) and Advanced Life Support (ALS). Current guidelines and studies show that early initiation of CPR increases survival (Baskett P, 2008), and performing CPR by people who do not have sufficient knowledge and experience increases mortality. Therefore, all healthcare workers should be able to recognize cardiopulmonary arrest, call for help and start CPR early and effectively. If they do not have sufficient knowledge on this subject, the chance of saving any patient decreases (Madden, 2006). In our study, it is shown that the knowledge and skill levels of the participants increased significantly with BLS and ALS training programs.

This difference between the pre-training and post-training tests clearly demonstrates the effectiveness of the trainings. For the questions "What is Basic Life Support?" and "How to make the most accurate respiratory assessment in the application of basic life support?" asked in our training questionnaire, the correct response rates increased to 97.78% in the post-test, indicating that the participants better understood the basic concepts. The pre-test results show that the participants initially had some significant knowledge gaps in basic life support. In another question "How many times per minute should CPR be performed in adults?", the correct response rate was 46.67% in the pre-test, but this rate increased to 93.33% in the post-test, which demonstrates how effective the training program was in helping the participants learn the correct practices. In addition, the correct response rate for the question "How many cm should the sternum go down during CPR for adults?" increased from 24.44% in the pre-test to 86.67% in the post-test, which shows that critical details and practices were adopted and learned by the participants during the training process. In the question "What should the dose and form of adrenaline administration in anaphylaxis be in adult patients?", the correct response rate was 19.32% in the pre-test, yet it increased to 77.27% in the post-test. This shows how effective the training program was in helping the participants learn the critical information. On the other hand, in the question "When is Amiodarone used in adult advanced life support?", the correct response rate increased from 44.32% in the pre-test to 95.45% in the post-test. This result shows that the knowledge level of the participants on critical drug use and timing of administration increased significantly. Similarly, in the question "If defibrillation will be applied to the patient during adult advanced life support application and the amount of energy recommended by the device is unknown, how many joules should be preferred?", the correct response rate increased from 15.91% in the pre-test to 92.05% in the post-test. This shows that the knowledge level of the participants about the correct application of the defibrillation procedure has increased significantly.

In our study, most of the participants in the training were nurses. In the studies conducted, auxiliary healthcare worker, especially nurses, are the first people to encounter cardiopulmonary arrest and if they are not competent in this regard, the chance of saving patients decreases (Madden, 2006; Herlitz, 2005). Therefore, it is recommended that both healthcare and allied healthcare worker receive CPR training. 58.9% of health care workers were found to follow current CPR information (Josipovic , 2008). In the study by Çelikli et al. in 2012, the rate of healthcare workers following current BLS

information was found to be 34.7% and it was emphasized that it is important to update the level of knowledge (Çelikli et al., 2012). In our study, although there was a group of healthcare workers who had received previous training, it was observed that the rate of following current information was low in accordance with the literature. As a result, it was observed that the participants were less likely to follow current information, and they should keep their CPR knowledge and skills up to date with theoretical and practical applications. Therefore, repeating CPR and IED training programs at regular intervals will ensure that knowledge and skills are kept up to date.

As in the rest of the world, the proportion of people trained in CPR/ICCA is low in our country (Pehlivan M, 2019) In 2019, the International Liaison Committee on Resuscitation (ILCOR) launched a worldwide initiative to increase overall survival rates with the words "Every citizen of the world can save a life - CHECK-CALL-PRESS" (Böttiger, 2020). In previous studies, it has been observed that participants who are not health specialists have a desire to receive and apply CPR training (Demirkıran, 2003). In the study conducted by Özdinç et al. in 2014, significant increases were observed in the knowledge levels of police candidates after CPR training programs. In the study conducted by Demirkıran et al. in 2003, significant increases were observed in the knowledge levels of first-year medical faculty students after CPR training programs (Demirkıran et al., 2003). In our study, it was observed that the knowledge level of health support personnel, especially nurses, who received training increased after the training. In the study by Kaan et al. in 2010, the rate of performing BLS applications in the correct order increased after the training and it shows that healthcare worker need continuous trainings to maintain and increase their knowledge levels (Kaan NM, 2010). In our study, unlike other studies, ALS was also given at the same time, and a significant increase was observed in the level of knowledge and skills after the training. As seen in the study by Tuncar and Beştemir (2022), it is emphasized that success rates increase with ALS training, and how important the trainings are (Tuncar, 2022)

In the study of Yalçın et al. (2020), the increase in the level of knowledge of the health and health support personnel working in the emergency department was evaluated, and while there was no significant difference in the knowledge levels of specialist and general practitioners and emergency medical technicians before and after training, a significant difference was found in other occupational groups after training ($p<0.05$) (Yalçın, 2020). In addition, a Danish study has shown a significant association between mandatory CPR training provided to the community and survival (Jensen, 2023).

In a study conducted in Switzerland, it was reported that 19% of the population received basic life support training (UK, 1998).

The content and application methods of CPR and IBA training programs play a critical role in the knowledge and skill acquisition of participants. In a study conducted at Ege University, it was reported that the rate of responding correctly to the content of CPR applications differed according to the field of study ($p<0.001$) (Özdinç, 2014).

This shows that the content of training programs should be shaped according to the needs and professional requirements of the participants.

Limitations

The limited number of participants in the study and the fact that it was conducted in a single center constitute the limitations.

CONCLUSION

Basic life support and advanced life support can be encountered in all areas of life. Not only healthcare professionals but also all segments of the society need to learn especially CPR. According to the results of our survey, it is seen that the majority of healthcare professionals have inadequate knowledge about BLS and ALS, but with the trainings given and planned to be given in the future, it will provide a significant increase in their level of knowledge. As a result, repeating training programs at regular intervals will contribute to the preservation and updating of knowledge and skills. In addition, it will be useful to increase awareness about the subject by providing training to a wider population with participation from different professional groups and different segments of society.

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Conflict of Interest

The author declares no potential conflicts of interest with respect to the research, authorship and/or publication of this article.

Author Contributions

Plan, design: RK, MF; **Material, methods and data collection:** MF, RK, MÇ, BÖ; **Data analysis and comments:** RK, SS; **Writing and corrections:** BÇ, MF.

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Ethical Approval

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The Impact of Patients' Pain Level on the Anxiety Levels of Themselves and Their Attendants

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ABSTRACT
Objective: Pain is a major obstacle for people to perform their daily duties and a condition deteriorating the quality of life. The present study aimed to investigate the effects of pain on anxiety levels. **Materials and Methods:** The study included patients who had thoracic trauma or thoracic surgery between January 01, 2023, and July 01, 2023, and their relatives who stayed with them as primary attendants. Demographic data from all volunteers included in the study were collected, and a visual analog scale (VAS) was administered to trauma patients on the first day after trauma and to surgical patients on postoperative day 1. The Beck Anxiety Inventory (BAI) was administered to both patients and their attendants, and anxiety scores were determined. The anxiety levels were categorized as mild, moderate, and severe anxiety. **Results:** A total of 174 patients and 174 primary attendants were enrolled in the study. The mean VAS scores of the patients were 6.06 for males and 6.56 for females. A statistically significant relationship was observed between the VAS and BAI scores of the patients. There was also a significant relationship between the patients and their attendants regarding BAI scores. **Conclusion:** Pain in patients can cause anxiety, although not severe, for both patients and their caregivers.
Keywords: Anxiety, Pain, Trauma, Malignancy.

Hastalarının Ağrı Düzeylerinin, Kendileri ve Refakatçilerinin Anksiyete Düzeylerine Etkisi

ÖZ
Amaç: Ağrı, insanların günlük görevlerini yerine getirmelerinin önünde büyük bir engel ve yaşam kalitelerini bozan bir durumdur. Ağrının kaygı düzeyleri üzerindeki etkilerini ortaya koymayı amaçladık. **Gereç ve Yöntem:** Çalışmaya 01.01.2023-01.07.2023 tarihleri arasında göğüs travması veya göğüs cerrahisi geçiren hastalar ve yanında kalan yakınları birincil refakatçi olarak dahil edildi. Çalışmaya dahil edilen tüm gönüllülerden demografik veriler toplandı ve travma sonrası ilk gün travma hastalarına ve ameliyat sonrası 1. gün cerrahi hastalara görsel analog skala (VAS) uygulandı. Hem hastalara hem de refakatçilerine Beck Anksiyete Envanteri (BAÖ) uygulandı ve anksiyete puanları belirlendi. Kaygı düzeylerini hafif, orta, şiddetli kaygı olarak sınıflandırdık. **Bulgular:** Çalışmaya toplam 174 hasta ve 174 primer refakatçi dahil edildi. Hastaların VAS skor ortalamaları erkeklerde 6.06, kadınlarda 6.56 idi. Hastaların VAS ile BAÖ skorları arasında anlamlı bir ilişki olduğu gözlemlendi. Hastalar ile yakınları arasında da BAÖ skorları açısından anlamlı bir ilişki mevcuttu. **Sonuç:** Hastalarda ağrı hem hastalar hem de bakım verenler için şiddetli olmasa da anksiyeteye neden olabilir.
Anahtar Kelimeler: Anksiyete, Ağrı, Travma, Malignite.

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INTRODUCTION

Being healthy is defined as being in a state of complete physical, social, and mental well-being. Diseases affect people negatively biologically, psychologically, and socially (Gök & Hergül, 2020; Kutlu et al., 2016; Oflaz & Vural, 2010). Nevertheless, surgical treatment methods are procedures that negatively affect the well-being of patients (Batista dos Santos et al., 2014; Oral et al., 2022). Surgical procedures cause deterioration in well-being, particularly by causing an increase in anxiety levels in patients. Hospitalization, uncertainty in the post-procedure period, post-procedure pain, and the surgeon's attitude play a critical role in patients' anxiety levels about the procedure (Gök & Hergül, 2020; Oral et al., 2022). The resulting anxiety negatively affects the patient's recovery process, causes prolonged hospitalization, and even leads to the development of morbidity and mortality with psychological disorders after discharge (Basak et al., 2015; Gök & Hergül, 2020; Kutlu et al., 2016; Shoar et al., 2016).

The present study, in accordance with the literature, aimed to evaluate the pain levels of patients who were hospitalized in our clinic for trauma or surgical treatment and the anxiety levels of the patients and their relatives who stayed with them as attendants.

MATERIALS AND METHODS

Patients over the age of 18 who had chest trauma or underwent a thoracic surgery operation between January 01, 2023, and July 01, 2023, and their primary attendants were included in the study. Patients with previously known psychiatric disorders before hospitalization, patients using an anxiolytic treatment for various reasons, patients who could not use the analgesic treatment protocol we applied routinely or patients who were treated outside of routine protocol were excluded from the study. Moreover, when a patient or a relative of the patient did not want to participate in the study, those were not included as well. Our team collected demographic information of all volunteers included in the study, and asked trauma patients on the first day after trauma and surgery patients on the first postoperative day to classify the pain on a visual analog scale (VAS). The VAS score ranged from “0” as “no pain” to “10” as “extremely severe pain.”

There is an analgesia protocol routinely used in our clinic. Accordingly, if there is no contraindication, patients are administered 50 mg diclofenac sodium twice a day and 500 mg paracetamol three times a day. Furthermore, 100 mg tramadol is administered to patients twice a day in the first 24 hours.

Subsequently, patients and their attendants were administered the Beck Anxiety Inventory (BAI), an inventory introduced by Beck in 1988 to reveal the anxiety levels of individuals, which determined their anxiety scores. (Beck et al., 1988). In this scale, there are 21 items, each of which is scored between 0 and 3 points. BAI was applied to all patients and their relatives by a surgeon working in the clinic in an interviewer-administered manner. The total score calculated by summing these items determines the anxiety levels, and according to the BAI, it is categorized as “no anxiety” for scores 0-8, “mild anxiety” for 8-15 points, “moderate anxiety” for 16-25 points, and “severe anxiety” for 25-63 points. Patients were categorized according to the surgical methods and trauma, and evaluated statistically according to the diagnosis, procedure, pain scores, and anxiety levels of the patients and their attendants.

Statistical analysis

SPSS (Statistical Package for the Social Sciences Version 22.0; SPSS Inc. Chicago, IL, USA) program statistically analyzed the data. Numbers (n) and percentages (%) presented the categorical data. Shapiro-Wilk test measured the normality distribution assumption of continuous data. Mean ± standard deviation (SD) values demonstrated the normally distributed continuous data and median (25-75th percentiles) values presented the data without normal distribution. The relationship between continuous and categorical (dichotomous) variables was determined by Independent Samples t-test and Mann Whitney-U test according to appropriateness. The relationships between continuous and more than two categorical variables were examined by the one-way ANOVA test and Kruskal-Wallis test, as appropriate. When significance was observed in the one-way ANOVA test, Tukey and Games-Howel tests were applied in post hoc pairwise group comparisons in accordance with variance homogeneity. The relationships between continuous data were analyzed by Spearman correlation analysis. A partial correlation test was applied to suppress multicollinearity in the relationships between continuous data. The statistical significance was considered for p-values below 0.05. This study was performed following the approval of the Izmir Katip Çelebi University Non-Interventional Clinical Research Ethics Committee with the decision number 583 in 2022.

RESULTS

A total of 174 patients (120 males (69%) and 54 females (31%)) and 174 primary attendants (50 males (28.7%) and 124 females (71.3%)) were included in our study. Descriptive data of 174 patients and 174 attendants of the study are summarized (Table 1).

The mean VAS scores of the patients were 6.06±2.09 for males and 6.56±1.92 for females. The analysis of the factors affecting the VAS score of the patients is presented (Table 2).

Table 1. The descriptive statistics of the study population.

		N (%)
Patients' Age (years)		52.31±18.53*
Patients' Gender	Male	120 (69.0%)
	Female	54 (31.0%)
Patients' Educational Status	No Formal Education	6 (3.4%)
	Primary School Graduate	57 (32.8%)
	Middle School Graduate	38 (21.8%)
	High School Graduate	59 (33.9%)
	University Graduate	14 (8.0%)
Patients' Employment Status	Unemployed	122 (70.1%)
	Employed	52 (29.9%)
Attendants' Age (/year)		48.14±12.36*
Attendants' Gender	Male	50 (28.7%)
	Female	124 (71.3%)
Attendants' Educational Status	No Formal Education	4 (2.3%)
	Primary School Graduate	43 (24.7%)
	Middle School Graduate	46 (26.4%)
	High School Graduate	59 (33.9%)
	University Graduate	22 (12.6%)
Attendants' Employment Status	Unemployed	114 (65.5%)
	Employed	60 (34.5%)
Hospitalization Reason	Non-Traumatic Etiology	40 (23.0%)
	Malignancy	45 (25.9%)
	Trauma	89 (51.1%)
Treatment	Medical treatment	63 (36.2%)
	Surgical operation	86 (49.4%)
	Tube Thoracostomy	25 (14.4%)
VAS Score		6.21±2.05*
Patients' BAI Score		6.0 (3.0-10.0)**
Patients' BAI Level	No anxiety	109 (62.6%)
	Mild anxiety	46 (26.4%)
	Moderate anxiety	15 (8.6%)
	Severe anxiety	4 (2.3%)
Attendants' BAI Score		3.0 (0.0-6.0)**
Attendants' BAI Level	No anxiety	140 (80.5%)
	Mild anxiety	21 (12.1%)
	Moderate anxiety	7 (4.0%)
	Severe anxiety	6 (3.4%)

*Mean±SD; **Median (25th- 75th percentile); BAI: Beck Anxiety Inventory; VAS: Visual Analogue Scale.

Table 2. The distribution and difference analysis of VAS scores according to various parameters.

		VAS score Mean±SD	p
Patient's Gender	Male	6.06±2.09	0.140*
	Female	6.56±1.92	
Patient's Educational Status	No Formal Education	7.00±2.37	0.877**
	Primary School Graduate	6.22±1.89	
	Middle School Graduate	6.13±2.18	
	High School Graduate	6.24±2.16	
	University Graduate	5.93±1.90	
Patient's Employment Status	Unemployed	6.17±2.13	0.691*
	Employed	6.31±1.87	
Hospitalization Reason	Non-Traumatic Etiology	6.80±1.81	**0.034****
	Malignancy	5.64±2.52	**1-2(0.028)**
	Trauma	6.24±1.83	
Treatment	Medical treatment	6.18±1.81	0.401**
	Surgical operation	6.09±2.29	
	Tube Thoracostomy	6.72±1.70	

*Independent Samples t-Test; **One-way ANOVA test; VAS: Visual Analogue Scale.

In the distribution of VAS scores according to gender, educational status, employment status, and treatment options, no statistically significant difference was observed. The causes of hospitalization statistically significantly differed regarding VAS score distribution. According to the post-hoc pairwise group comparison, statistically significantly higher VAS scores were determined in patients hospitalized for non-traumatic etiology than in patients hospitalized for malignant diseases. According to the correlation analysis for the relationship between VAS score and age, no statistically significant correlation was determined (r:-0.113; p:0.138).

While evaluating the relationship between VAS scores and BAI scores in patients and their attendants, we observed a statistically significant correlation between VAS scores and BAI scores in patients, and a less statistically significant correlation between BAI scores in attendants in the same direction. (Table 3, Figure 1).

Table 3. The correlation between VAS scores and BAI scores.

	VAS scores	
	r	**p**
BAI score in patients	0.322	0.001
BAI score in attendants	0.172	0.023

BAI: Beck Anxiety Inventory; **VAS:** Visual Analogue Scale; **r:** Spearman correlation coefficient.

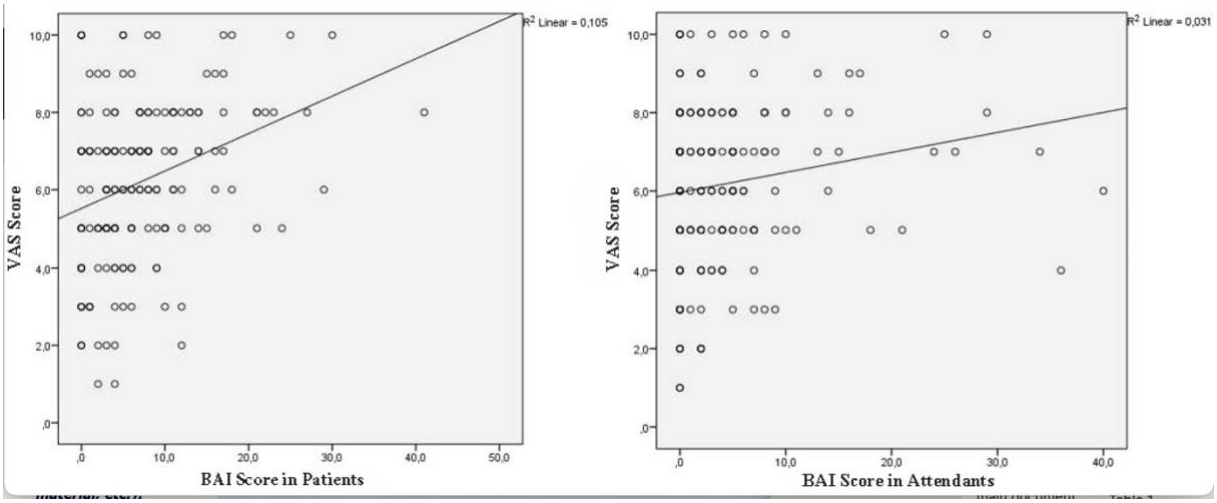

Figure 1: The distribution between VAS scores and BAI scores.

A statistically significant correlation was also determined between the BAI scores of the patients and their attendants (r:0.514; p:0.001). The likely reason for the less statistically significant correlation between VAS scores and BAI scores in companions was the distribution of BAI scores in patients. According to the partial correlation analysis, when the BAI scores of the patients were excluded, a statistically significant correlation was not observed between the VAS scores of the companions and the BAI scores of the companions (r: 0.008; p: 0.918).

Patients and attendants groups according to the BAI scores and the distribution of VAS scores between the groups is presented in Table 4. Accordingly, there was no statistically significant difference between BAI levels in the participants regarding the distribution of VAS scores. A significant difference was detected in the distribution of VAS scores between BAI levels in patients. According to post-hoc pairwise analyses, VAS scores were significantly higher in patients with moderate anxiety than in patients without anxiety.

Table 4. The distribution of VAS scores in patients and attendants according to the level of BAI.

		VAS score Mean ± SD	p
BAI level in patients	**No anxiety**	5.79±2.08	**0.001*** **1-3(0.001)**
	Mild anxiety	6.52±1.76	
	Moderate anxiety	7.87±1.64	
	Severe anxiety	8.00±1.63	
BAI level in attendants	**No anxiety**	6.01±2.04	0.050*
	Mild anxiety	6.91±1.92	
	Moderate anxiety	7.57±1.99	
	Severe anxiety	7.00±2.00	

***One-way ANOVA test; BAI:** Beck Anxiety Inventory; **VAS:** Visual Analogue Scale

BAI scores of patients and their attendants were evaluated according to various parameters. The patients and their attendants were evaluated multivariately in terms of age, gender, education level, employment status, the reason for hospitalization, and treatment parameters. According to this, no statistically significant difference was observed between the groups regarding the distribution of BAI scores among the parameters.

DISCUSSION

Pain is a multifaceted, discrepant, and individualized condition that may lead to long-term anxiety and depression in patients. Pain itself and the emotional states it causes frequently lead to hospital admissions (Ahmed et al., 2013; Garbi Mde et al., 2014; Kosson et al., 2018). In the present study, it was aimed to investigate the relationship between pain and anxiety in patients with traumatic or surgical pain. Although the majority of the patients who participated in our study did not have anxiety, it was observed that the level of anxiety and pain status were related in patients with anxiety. Another study demonstrated no relationship between labor pain and anxiety in their study of pregnant patients (Mete et al., 2016). Unlike our study, they used a state-trait anxiety inventory to determine the level of anxiety. Dutucu et al. (2022) also revealed a mild correlation between pain experienced during mammography and state-trait anxiety scores. Ulusoy et al. (2015) determined a significant correlation between pain and dissociative symptoms and depression in their study of patients with chronic migraine, and although there was a proportional increase in anxiety, the difference was not statistically significant. However, a similar study showed that pain that could not be treated effectively even one year after surgery negatively affected anxiety and increased the level of anxiety (Geng et al., 2022).

There was no statistically significant difference in the anxiety levels of the patients regarding gender, education level, employment status, and pain in this study. Ulusoy et al. (Ulusoy et al., 2015) also observed no significant correlation between sociodemographic data and patients' dissociative symptoms and anxiety in their study. Another study demonstrated that anxiety and depression levels in patients increased as the level of education increased. They also reported that the level of anxiety was higher in the non-working population, but there was no statistically significant difference (Gök & Hergül, 2020).

Oral et al. (Oral et al., 2022) reported that the level of pain and anxiety in patients hospitalized in surgical clinics disrupted the sleep patterns of the patients. In addition, studies have indicated that disrupted sleep patterns lead to an increase in postoperative pain and anxiety levels (Çam Yanık & Altun Uğraş, 2020).

In their study, Yazıcı et al. (2003) evaluated the localization of pain and the duration of pain, as well as the quality of life and anxiety of the people. In their studies, it was revealed that patients' pain localization, gender, and age characteristics affected their quality of life. On the other hand, it was demonstrated that gender and age were significantly effective on anxiety, and education did not affect them. However, when the depression scores were examined, the level of education was significant. The quality of life was determined to be deteriorated significantly in patient groups with high anxiety and depression scores.

A study in the literature compared people with chronic physical disabilities and healthy people in terms of pain, anxiety, and depression, and determined that there were significantly higher rates in people with chronic physical disabilities in the scales they applied. In subgroup studies, it was demonstrated that pain was significantly associated with anxiety and depression in healthy individuals. They also revealed that anxiety and depression significantly affected the quality of life. It has also been reported that there is a significant relationship between age, pain, anxiety, and depression in people with chronic physical disabilities (Tarsuslu et al., 2010).

Demir et al. (2010) applied an anxiety scale to patients who underwent cardiac surgery. They did not detect a significant difference in anxiety in terms of age, gender, marital status, income level, occupation,

and place of birth in patients whose anxiety levels were measured with the state-trait anxiety inventory (STAI), which is accepted as the gold standard before surgery. However, a significant decrease was observed in anxiety scores after the information in the patients. It is very natural for patients who would undergo major surgery regardless of pain to develop anxiety, and in these cases, informing the patient in advance about all the physiological effects related to surgery that may be experienced is the situation that reduces anticipatory anxiety the most.

Köksal & Aslan, (2017), approached the relationship between pain and anxiety from a different perspective in their study. They evaluated the pain status of patients diagnosed with major depressive and anxiety disorders. While there was no significant relationship between age, gender, working status, and pain symptoms in patients diagnosed with major depressive disorder, it has been observed that working status significantly increases pain symptoms in patients with anxiety disorders. In both groups of patients, the severity of pain increased significantly as the score increased in the depression and anxiety scales applied. In both groups, pain symptoms were less as the level of education increased. This study also indicates that in the case of underlying anxiety or depression, the perception of pain is higher. In other words, there is a mutual positive correlation between pain and the patient's anxiety and depression.

Elbi (2017) mentioned biopsychosocial factors in the perception of pain in her review article. It was reported that many factors affected the perception of pain: family, work, culture, and environmental factors as social factors; personal characteristics and known psychiatric disorders as psychological factors; and the location of the lesion, the severity, location and duration of the pain as biological factor. They stated that pain, which does not have a concrete indicator, was expressed by the patient with various verbal and behavioral reactions, and that apathy and excessive interest affected pain behavior. It was also indicated that the patient's environmental factors as well as medical personnel were effective in this perception.

The present study aimed to determine how the pain and anxiety levels of the patients and the anxiety levels of their attendants were affected and to reveal the effect of the anxiety levels of the attendants on the patients. In our study, it was demonstrated that the pain level of the patients affected the anxiety levels of the attendants, but the correlation level was low. A statistically significant relationship could not be detected in anxiety levels between patients and their attendants.

Limitations

The greatest limitation of the study was that it was a study performed in an isolated patient group and on a voluntary basis. Thus, we could not evaluate all the factors that could create anxiety.

CONCLUSION

In conclusion, pain, which is the most common symptom before or after treatment in surgical clinics, significantly affected the anxiety level of patients. In addition, it had a negative impact on the anxiety level of patients' attendants. Anxiety leads to an emotional state that negatively impacts the healing process of patients. Therefore, effective analgesic treatment can accelerate the healing process by reducing anxiety in patients and their relatives.

Conflict of interest

The authors declare that they have no conflicts of interest regarding the study.

Author Contributions

Plan, design: MK, ÖK; **Material, methods and data collection:** MK, ZS, ÖK, BÇS, MÜ; **Data analysis and comments:** MK, ACY; **Writing and corrections:** MK, ACY, AA, EB.

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Ethical Approval

Institution: İzmir Katip Çelebi University Ethics Committee
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The Relationship Between Parenting Confidence and Attachment in Fathers of Preterm Infants: A Cross-Sectional Study

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ABSTRACT
Objective: The aim of this study was to investigate the relationship between parenting confidence and attachment in fathers of preterm infants. **Materials and Methods:** This cross-sectional study was conducted with fathers of preterm infants between the ages of 6-12 months at the time of data collection (n=149). The data were collected using the Sociodemographic Questionnaire Form, Paternal-Infant Attachment Scale (PIAS) and Karitane Parenting Confidence Scale (KPCS). **Results:** The average age of the fathers participating in the study was 25.75±4.64 years. It was found that the fathers who felt ready to be a father during pregnancy, who held their baby as soon as it was born, and who participated in the care of their children had statistically significantly higher mean PIAS and KPCS scores than the other group ($p<0.05$). There was a statistically significant positive correlation between the mean PIAS and KPCS scores of the fathers ($r=0.43$, $p=0.000$). **Conclusion:** It can be said that as fathers' confidence in parenting increased, their attachment to their children also increased. Fathers should be made aware of the importance of the father-infant relationship in the healthy growth and development of children.
Keywords: Attachment, Confidence, Infant, Father, Parenting, Nursing.

Preterm Bebeklerin Babalarında Ebeveynlik Güveni ve Bağlanma Arasındaki İlişki: Kesitsel Bir Çalışma

Amaç: Bu çalışmanın amacı preterm bebeklerin babalarında ebeveynlik güveni ve bağlanma arasındaki ilişkinin incelenmesidir. **Gereç ve Yöntem:** Bu kesitsel çalışma, verilerin toplandığı tarihte 6-12 ay aralığında olan preterm bebeğe sahip babalar ile yürütülmüştür (n=149). Veriler Sosyodemografik Anket Formu, Baba-Bebek Bağlanma Ölçeği (B-BBÖ) ve Karitane Ebeveyn Kendine Güven Ölçeği (KEKGÖ) kullanılarak toplanmıştır. **Bulgular:** Araştırmaya katılan babaların yaş ortalaması 25.75±4.64 yıldır. Prenatal dönemde kendini baba olmaya hazır hisseden, bebeğini doğar doğmaz kucağına alan ve çocuğunun bakımına katılan babaların B-BBÖ ve KEKGÖ ölçek puan ortalamalarının diğer gruba göre istatistiksel olarak anlamlı düzeyde yüksek olduğu bulunmuştur ($p<0.05$). Babaların B-BBÖ ve KEKGÖ puan ortalamaları arasında pozitif yönde istatistiksel olarak anlamlı düzeyde bir ilişki saptanmıştır ($r=0.43$, $p=0.000$). **Sonuç:** Babaların ebeveynlik konusunda kendilerine olan güvenleri arttıkça çocuklarına olan bağlanma düzeylerinin de arttığı söylenebilir. Çocukların sağlıklı büyüme ve gelişmesinde baba-bebek ilişkisinin önemi konusunda babalar bilinçlendirilmelidir.
Anahtar Kelimeler: Bağlanma, Güven, Bebek, Baba, Ebeveynlik, Hemşirelik.

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INTRODUCTION

Parenting confidence is defined as an internal belief or judgment about being successful and capable in parenting roles (Vance & Brandon, 2017). A confident parent is more empowered to manage their parenting-related roles and often perceives these demands as less stressful than other parents (Vance et al., 2021). Parental confidence contributes to the parent-infant relationship and infant development in multiple ways. However, parenting confidence may vary according to the individual, situation and time (Seetharaman et al., 2022). Mothers and fathers who are confident in parenting can spend more time with their children (Li & Guo, 2023). Infants are dependent on their parents' ability to actively support their development, especially in the first year of life (Seetharaman et al., 2022). In focus group discussions with parents and health professionals, parenting confidence was found to consist of the themes of being able to feed the baby, establishing sleep routines, interpreting the cause when crying, playing with the baby, communicating, responding to needs, and coping with minor illnesses (Vance et al., 2021). Attachment is a state that the infant or young child develops internally, through repeated experiences of sensitive and responsive interactions with the caregiver, as a "safe base" from which to explore the environment and be assured that comfort and protection will be available when needed (Kohlhoff et al., 2022). Parents are the first examples in the formation of attachment behaviors. The fact that individuals often refer to their parents' behaviors for the relationships they will establish in their future lives is an indication that attachment is transmitted between generations. Studies show that attachment developed in infancy continues in later periods and children of securely attached parents also show secure attachment (Tabachnick et al., 2022). While children generally prefer their mothers for their care needs, they prefer their fathers for activities such as play (Vance et al., 2021; Kohlhoff et al., 2022). It is stated that fathers are as important as mothers for healthy attachment. It has been observed that infants who can establish a healthy relationship with their fathers in early infancy develop secure attachment. The father spending quality time with his child, playing games with him and participating in his care strengthens the relationship between them positively (Önem & Özcan, 2023). Contrary to the high number of studies on mother-infant attachment in the literature, there are very few studies examining attachment in fathers with preterm infants and its relationship with parental confidence (Stefana & Lavelli, 2017; Filippa et al., 2021). It is known that communication between father and child contributes to the child's cognitive and psychological development, especially by reinforcing their exploratory behaviors (Rollè et al., 2019). For this reason, knowing the factors that affect the formation of secure attachment and nurses evaluating family health by taking these factors into consideration will be very important for child development. In line with this information, the aim of this study is to examine the relationship between parenting confidence and attachment in fathers of premature infants.

MATERIALS AND METHODS

Study design

This study was conducted in a cross-sectional design.

Population and sample of the study

The data was collected between June and October 2024 from fathers who applied to the pediatric outpatient clinics of a hospital in Kahramanmaraş province, which straddles the Mediterranean and Eastern Anatolia Regions of Turkey. The study population consisted of all fathers who applied to the pediatric outpatient clinic of the relevant hospital between the data collection dates (N=190). Using the 'sample selection formula for a known population group' [$(n = Nt^2pq/[d^2(N-1)+t^2pq)$, (N=190, p=0.5, q=0.5, d=0.05, t=1.96)], the minimum required sample size was calculated to be 128 with a 95% confidence interval. The inclusion criteria for the study were fathers whose premature babies were between 6-12 months old, and who did not have communication difficulties or a diagnosed mental illness.

Survey instruments

In the study, data were collected with Sociodemographic Questionnaire Form, the Paternal-Infant Attachment Scale and the Karitane Parenting Confidence Scale.

Sociodemographic Questionnaire Form

The researchers developed a descriptive information form for fathers by reviewing relevant literature (Yılmaz, & Oskay, 2021; Arslanlı, & Çelebioğlu, 2022; Gül, & Bulut, 2022; Bulut et al., 2023). In this form, there are 22 questions to obtain data such as the father's age, level of education, employment status, support for the baby's care and feeding, etc.

Paternal-Infant Attachment Scale (PIAS)

The scale was developed by Condon et al. (2008) to determine the level of father-infant attachment in 6-12 month-old babies. The validity and reliability study of the Turkish form was conducted by Güleç and Kavlak (2013). The 19-item scale is a five-point Likert type and consists of three subdimensions (patience and tolerance, pleasure in interaction, and affection and pride). 12 items in the scale are reverse-order items. Each item of PIAS takes a value between 1 and 5 and the minimum score that can be obtained from the scale is 19 and the maximum score is 95. The higher the score obtained from the scale, the better the attachment. Güleç and Kavlak (2013) determined that the scale's Cronbach Alpha reliability coefficient was 0.76. In this study, the scale's Cronbach alpha value was 0.71.

Karitane Parenting Confidence Scale (KPCS)

The original scale developed by Crncec et al. (2008) consists of 15 items. The scale was designed by health

professionals to measure parents' competence and self-efficacy related to parenting in early parenting. It is suitable for use with parents with infants between 0-12 months. Although the sample group was mothers during the development of the scale, it was reported that it could also be used to assess the confidence of fathers in parenting. The scale, the validity and reliability of which was conducted by Yılmaz and Oskay (2021), consists of 14 items. The scale includes two sub-dimensions (infant care and parenting role) and only item 11 is reverse scored. Each item in the scale is scored between 0-3. The score range is 0-42 and higher scores indicate higher parental confidence. The Cronbach's α value of the scale was found to be 0.93. Cronbach's alpha value of the scale was 0.89 in this study.

Statistical analysis

In the study, the data were analyzed using the IBM SPSS Statistics 23 program on the computer. The descriptive characteristics of the participants were analyzed using frequency n (%) for categorical variables and mean and standard deviation for continuous variables. Normal distribution of the data depends on the skewness and kurtosis values being between ±3. The independent samples t-test, and the one-way analysis of variance (ANOVA) were employed for categorical variables with normal distribution. Mann Whitney U Test was used in paired groups and Kruskal Wallis-H test was used in more than two groups in data without normal distribution. For continuous variables, the associations were evaluated using Pearson's correlation. The significance level was set at $p < 0.05$.

Ethical considerations

Before the study, ethics committee approval was acquired from the Ethics Committee of XXX University, Faculty of Medicine (Approval Number: 2023/03, Date: 14/03/2023), and required permissions were acquired from the management of the relevant hospital. All participants provided written informed consent before the questionnaires were administered, and could withdraw from the study at any time. The fathers who provided written consent were included to the sample after the participants had been informed about the objective of the study, the location and method of data use, and the confidentiality of the responses.

RESULTS

The average age of the fathers participating in the study was found to be 25.75±4.64 years. The results of the descriptive characteristics of 149 fathers are presented in Table 1. It was determined that 48.3% of the fathers included in the study were primary/secondary school graduates, 51.7% perceived their economic level as insufficient, 89.9% were employed, 61.7% had babies born between 24-29 weeks, and 79.2% were born by cesarean section.

While there was no significant difference between the mean PIAS scores of the fathers participating in the study and family type, employment status, gender of the baby and number of living children, there was a statistically significant difference between the mean PIAS scores and age, education level, perceived economic level, mode of delivery and gestation week ($p<0.05$). Accordingly, compared to the other groups, the mean PIAS scores of the fathers whose education level was university and whose income was higher than their expenses were higher, while the mean scores of the fathers who were between the ages of 23-27, whose baby was born by cesarean section, and whose baby's gestational week at birth was 24-29 were found to be lower. There was no significant difference between the mean KPCS scores of the fathers who participated in the study and the level of education, family type, employment status, gender of the baby, mode of delivery and number of living children, whereas there was a statistically significant difference between the mean KPCS scores and age, perceived economic level and gestational week ($p<0.05$). Accordingly, it was found that the mean scores of the fathers who were 38 years of age and older, whose income was higher than their expenses and whose gestational week at birth was 33-37 were higher than the other groups (Table 1).

It was found that 65.8% of the fathers who participated in the study did not have a planned baby, 61.7% did not feel ready to be a father, and 62.4% did not participate in the care needs of their infant (Table 2). When the PIAS and KPCS mean scores of the fathers who participated in the study and the statements about the father's relationship with his infant were examined, it was found that there was no statistically significant difference between the scales and the fact that the baby was planned ($p>0.05$), while the fathers who felt ready to be a father during pregnancy, who held their baby as soon as it was born, and who participated in the care of their children had statistically significantly higher mean scale scores than the other group ($p<0.05$) (Table 2).

The mean PIAS score of the fathers participating in the study was 61.06±6.64 (high level of paternal attachment) and the mean KPCS score was 22.90±4.43 (moderate level of confidence). There was a statistically significant positive correlation between the mean PIAS and KPCS scores of the fathers ($r=0.43$, $p=0.000$). Accordingly, it can be said that as fathers' confidence in parenting increased, their attachment to their children also increased. In addition, a statistically significant positive correlation was found between the mean PIAS score and Infant Care, a sub-dimension of the KPCS, and between the mean KPCS score and Pleasure in Interaction and Affection and Pride, sub-dimensions of the PIAS ($p<0.05$) (Table 3).

Table 1. Examination of the difference between the descriptive characteristics of the participants and the scales (N=149).

Variables		n	%	PIAS Mean±SD	KPCS Mean±SD
Age (Year)	23-27 (1)	14	9.4	56.01±3.87	21.78±2.72
	28-32 (2)	63	42.3	58.65±4.98	20.68±4.08
	33-37 (3)	57	38.3	63.686±6.762	24.31±4.10
	38 and older (4)	15	10.1	65.93±7.36	27.93±1.09
test/p				**F:14.051/ 0.000**^{**,a,b}	**KW:46.972/0.000**^{**,b,e}
Educational status	Primary/ Secondary (1)	72	48.3	61.35±5.71	22.79±4.49
	High school (2)	58	38.9	59.60±6.62	22.79±4.25
	University (3)	19	12.8	64.42±8.71	23.68±4.93
test/p				**F: 4.063/0.019**^{*,c}	KW:1.001/0.606
Perceived economic level	Income less than an expense (1)	77	51.7	61.49±6.60	23.44±4.92
	Income equivalent to an expense (2)	51	34.2	58.88±4.83	21.50±3.22
	Income more than an expense (3)	21	14.1	64.78±8.63	24.33±4.37
test /p				**F: 6.657/0.002**^{**,c,d}	**KW: 12.249/0.002**^{**,c}
Family type	Nuclear family	122	81.9	61.29±6.34	22.77±4.45
	Extended family	27	18.1	60.00±7.91	23.51±4.37
test /p				t:0.916/0.361	Z: -0.623/0.533
Employment	Working	134	89.9	61.25±6.38	22.81±4.41
	Unemployed	15	10.1	59.40±8.69	23.73±4.68
test /p				t: -1.023/0.308	Z: -0.915/0.360
Gender of newborn	Female	62	41.6	60.44±6.40	22.69±4.17
	Male	87	58.4	61.50±6.80	23.05±4.63
test/p				t: -0.954/0.341	Z: -0.629/0.530
Type of delivery	Vaginal	31	20.8	61.50±6.80	24.09±4.81
	Cesarean birth	118	79.2	60.10±6.01	22.59±4.30
test/p				**t: 3.575/p:0.000****	Z: -1.826/0.068
Gestational age (week)	24-29 (1)	92	61.7	58.51±4.49	20.93±3.60
	30-32 (2)	41	27.5	64.86±7.60	25.12±4.04
	33-37 (3)	16	10.7	65.96±7.31	28.56±0.72
test/p				**F: 23.152/0.000**^{**,a,d}	**KW:59.967/0.000**^{**,a,d}
Number of living children	First	49	32.9	60.81±6.07	22.91±4.17
	2 and more	100	67.1	61.18±6.92	22.90±4.58
test/p				t:0.315/0.753	Z: -0.033/0.974

PIAS: Father–Infant Attachment Scale, KPCS: Karitane Parenting Confidence Scale, F: One-way ANOVA test, KW: Kruskal Wallis test, t: Independent sample t test, Z: Mann Whitney U test, Results of the statistically significant pairwise comparisons (Tamhane's T2 post-hoc test for ANOVA test or Dunn's test, post-hoc test for Kruskal Wallis test): a: 1-3, b: 1-4, c: 2-3, d:1-2, e:2-4, *p<0.05, ** p<0.001

Table 2. Examining the difference between scales and statements regarding father-child relationship (N: 149).

Variables		n	%	PIAS Mean±SD	KPCS Mean±SD
Pregnancy planning status	Planned	51	34.2	13.77±2.29	22.33±4.77
	Unplanned	98	65.8	13.42±1.88	23.20±4.24
Test/p				t:0.960/0.338	Z:-0.661/0.509
Feeling ready to become a father	Yes	57	38.3	14.50±2.35	25.95±3.22
	No	92	61.7	12.95±1.55	21.02±4.03
Test/p				**t:4.401/0.000****	**Z:-6.910/0.000****
Touching/holding the baby when the baby is born	Yes	31	20.8	14.19±2.39	24.10±4.81
	No	118	79.2	13.37±1.90	22.59±4.30
Test/p				**t:3.575/0.000****	Z:-1.82/0.068
Taking your infant for regular health check-ups	Yes	113	75.8	13.59±2.17	23.17±4.55
	No	36	24.2	13.38±1.54	22.05±3.98
Test/p				t:1.273/0.205	Z:-1.58/0.114
Participating in their infant's care needs	Yes	56	37.6	14.55±2.33	26.01±3.21
	No	93	62.4	12.93±1.55	21.03±4.00
Test/p				**t:4.709/0.000****	**Z:-7.032/0.000****
Perception of parenting relationship with spouse	Weak	53	35.6	12.63±1.52	21.50±3.74
	Strong	96	64.4	14.05±2.11	23.67±4.61
Test/p				**t:-3.348/0.001****	**Z:-3.166/0.002****

PIAS: Father–Infant Attachment Scale, KPCS: Karitane Parenting Confidence Scale, t: Independent sample t test, Z: Mann Whitney U test, *p<0.05, ** p<0.001

Table 3. The relationship between parenting confidence and attachment level in fathers

Variables[¥]	Mean	SD	1	1.1	1.2	1.3	2	2.1	2.2
1. PIAS	61.06	6.64	1	**0.778****	**0.641****	**0.703****	**0.427****	**0.463****	0.067
1.1. Patience and Tolerance	27.89	4.63		1	0.065	**0.183***	0.145	**0.169***	-0.030
1.2. Pleasure in Interaction	19.61	2.50			1	**0.715****	**0.530****	**0.544****	**0.212****
1.3. Affection and Pride	13.54	2.03				1	**0.411****	**0.455****	0.026
2. KPCS	22.90	4.43					1	**0.981****	**0.588****
2.1. Infant Care	15.16	3.95						1	**0.422****
2.2. Parenting Role	7.74	0.93							1

[¥]: Pearson correlation analysis, PIAS: Father–Infant Attachment Scale, KPCS: Karitane Parenting Confidence Scale, *p<0.05, ** p<0.001

DISCUSSION

This study was conducted to determine the relationship between secure attachment and parenting confidence between fathers and infants in the Turkish population. The mean PIAS scale score of the fathers participating in the study was 61.06±6.64. The highest score that can be obtained from PIAS is 95 and the higher the score, the higher the attachment level. Considering the total mean score of the fathers in this study, it can be said that fathers are attached to their babies above the medium level. In the study by Serçekuş and Başkale (2016) examining father-infant attachment, the mean total score of PIAS was found to be 78.55±0.63 and 75.68±10.01 in Kartal and Erişen's (2020) study. In the study conducted by Düdükçü and Arslan (2020), the attachment level was found to be 70.81±8.22. We can say that the results of this study are similar to the literature.

In the study, while the mean PIAS scores of the fathers whose education level was university and whose income was higher than their expenses were higher than the other groups, the mean scores of the fathers of premature babies who were between the ages of 23-27, whose babies were born by cesarean section and whose babies were born between 24-29 weeks were found to be lower. On the other hand, Dinç and Balci (2021) did not report a significant relationship between attachment score and father's age in his study. Similar to our study, some studies reported that the attachment scores of fathers over the age of 40 were significantly higher. This suggests that these different results in the literature may be specific to the group in which the study was conducted (Kartal & Erişen, 2020; Kılan & Özpınar, 2020).

One of the striking findings of the study was that fathers of babies born between 24-29 weeks of gestation had low paternal attachment scores. This is very significant in terms of showing that the psychological and emotional stress of preterm birth may still continue to have an effect on fathers. This finding suggests that premature births may have an effect on parent-child attachment. Especially in this type of developmental processes, it may be more difficult for fathers to bond with their babies (Akik & İşbir, 2022). It is also possible that fathers may feel inadequate or helpless after preterm birth. Fathers feeling inadequate or being under stress may negatively affect paternal attachment. As another factor, the fact that the mother is at the forefront in contact with the baby in intensive care may cause fathers to remain in the background in this process and this may change attachment scores (Svendsrud et al., 2023; Bakermans-Kranenburg & van IJzendoorn, 2023).

In the study, the attachment scores of fathers with high income level were found to be significantly higher. The new addition to the family may be a factor that increases socio-economic anxiety. Therefore, it was thought that low income level may negatively affect father-infant attachment. Many studies on father-infant attachment conducted in our country support this finding (Kartal & Erişen, 2020; Düdükçü & Arslan, 2020; Dinç & Balci, 2021; Bulut et al., 2023). The fact that fathers are not in economic distress and have a high level of education may support the attachment status.

In the study, factors such as feeling ready to become a father, holding the baby immediately after birth and active participation in childcare significantly increased father attachment scores, indicating that parent-child attachment can be consciously and actively supported. Holding the baby as soon as the baby is born is a powerful step that initiates the attachment process by providing the father's first physical contact with his baby. This contact not only reinforces the father's sense of fatherhood but also contributes positively to the father's sense of trust by creating an emotional closeness with the baby. Research has demonstrated the positive psychological effects of physical contact on both the infant and the parent (Chen et al., 2017). Therefore, this contact at birth is expected to increase attachment scores (Bigelow & Williams, 2020; Bulut et al., 2023).

When the findings of the study are evaluated, it is seen that the attachment scores of fathers who participate in the physical care of their infants are significantly higher. Involvement in childcare allows the father to spend more time with his baby, develop his ability to respond to the baby's needs and get to know the baby in this process. Fathers' involvement in childcare creates a sense of trust and belonging in the parent-child relationship, which strengthens father-infant attachment. In addition, fathers' involvement in childcare makes them feel more competent and successful and develops a positive perception of the fathering role (Chen et al., 2017). The combination of these factors contributes to significantly higher father attachment scores. Although studies on father-infant attachment are very limited in our country, it is reported in the literature that parents who participate in the care of their children have a better level of attachment with their children (Asalıoğlu, 2017; Kartal & Erişen, 2020; Dinç & Balci, 2021). Considering the results of the study, nurses have many opportunities to support fathers in antenatal classes, child health clinics and hospital settings to encourage children's development in this sense. Supporting fathers from the prenatal period by nurses, who have an important educational role in infant care, will be a pioneer for early initiation of postnatal father-infant communication.

Another striking finding of the study is that the attachment scores of fathers with a strong sense of confidence are also positively high. It is also clear that participation in the care of the baby and effective communication with the baby are effective in this situation. Fathers' increased confidence in parenting is an important factor that directly affects their attachment to their children. Confidence in parenting strengthens fathers' belief in their ability to meet their children's needs and their acceptance of this role. Confident fathers are more willing and comfortable spending more time with their children, forming emotional bonds with them and actively participating in their children's development. This contributes to the strengthening of the father-child bond. Similar studies on the subject support the findings of this study (Vance & Brandon, 2017; Mouton et al., 2018; Jeong et al., 2020). In addition, as fathers' confidence increases, they feel closer to their children and become more sensitive to their children's needs. This confidence increases fathers' patience with their children's behaviors and their capacity to understand their emotional needs. Confident fathers show a calmer and more consistent stance in their interactions with their children, which makes their children feel safe and supports mutual trust in their

relationships (Jeong et al., 2020; Sarkowi et al., 2023). Nurses play an important role in creating opportunities for fathers to bond with their babies and support the adoption of the fatherhood role starting in the intensive care environment. They are also effective in supporting fathers to overcome the emotional difficulties they experience during the hospital process. In one study, it seems that for fathers with babies in the intensive care unit, the attitude and communication style of nurses outweighed the delivery style of their babies. Inconsistent messages and incorrect guidance from nurses can affect fathers' confidence and experience in caring for their premature babies (Stefana et al., 2024). This will also negatively affect the bonding process. Therefore, nurses' observation of fathers' attachment behaviors, identification of risky situations and early intervention, and gaining fathers' trust through a supportive approach to parenting roles will contribute to the healthy attachment processes of premature babies.

Study limitations and strengths

One of the study limitations involved the cross-sectional design. While this design can establish association, it cannot determine causation. Another limitation of the study was the small sample size. Additionally, the data were evaluated in line with the personal answers given to the questions included in the measurement tool.

CONCLUSION

It can be said that as fathers' confidence in parenting increased, their attachment to their children also increased. In line with the information obtained from this study that the father's sense of parenting confidence is an important parameter in the father-infant attachment process. Nurses can contribute to this process by encouraging fathers' participation in infant care processes and providing trainings and supportive guidance to increase their confidence in the role of fatherhood. Such practices that increase fathers' confidence in premature infant care create positive results in terms of both the development of the infant and the strengthening of emotional bonds within the family by strengthening father-infant attachment. Thus, the child can have a healthier physical, social and psychological environment throughout his/her life with early father-infant attachment.

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Conflict of Interest

The author declare no potential conflicts of interest with respect to the research, authorship and/or publication of this article.

Author Contributions

Plan, design: ST, SYÇ; **Material, methods and data collection:** ST; **Data analysis and comments:** ST, SYÇ; **Writing and corrections:** ST, SYÇ.

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Investigation of the Relationship Between Social Media Addiction and Social Loafing Behavior Among Healthcare Workers

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ABSTRACT
Objective: The aim of this study is to investigate the relationship between social media addiction and social loafing behavior among healthcare workers. This is a descriptive study on social media use and social shirking behavior of healthcare workers. **Material and Method:** The study was conducted with the participation of 450 healthcare professionals (doctors, nurses, secretaries, and technicians) working in a university hospital. Social media addiction scale and social loafing scale were used to collect the data. AMOS (Analysis of Moment Structures statistical software) package program was used for the impact analysis. Before the analysis, KMO (Kaiser-Meyer-Olkin) and Barttlet's Sphericity test were performed and goodness of fit values were tested. **Results:** As a result of the reliability analysis, Cronbach's alpha values were found as α=0.914, α=0.824, α=0.854, α=0.902 for social loafing (SL), perceived social loafing (PSL), virtual tolerance (VT) and virtual communication (VC), respectively. It was found that social media addiction had a statistically significant and positive (β=0.389, p<0.01) effect on social loafing behavior. **Conclusion:** As a result of this study, it is thought that informing healthcare professionals about the harms of social media use and addictive behaviors will provide benefits both for the individual and organization.
Keywords: Social Media, Addiction, Social Media Addiction, Social Lifting.

Sağlık Çalışanlarında Sosyal Medya Bağımlılığı ile Sosyal Kaytarma Davranışı Arasındaki İlişkinin İncelenmesi

ÖZ
Amaç: Bu çalışmanın amacı sağlık çalışanlarında sosyal medya bağımlılığı ile sosyal kaytarma davranışı arasındaki ilişkinin incelenmesidir. Bu çalışma sağlık çalışanlarının sosyal medya kullanımı ve sosyal kaytarma davranışını ele alan ilişkisel araştırma yöntemi kullanılarak yürütülen bir çalışmadır. **Gereç ve Yöntem:** Bir üniversite hastanesinde görev yapmakta olan 450 sağlık çalışanının (doktor, hemşire, sekreter, teknisyen ve tekniker) katılımı ile gerçekleştirilmiştir. Verilerin toplanmasında sosyal medya bağımlılığı ölçeği ile sosyal kaytarma ölçeği kullanılmıştır. Etki analizinin yapılması için AMOS paket programı kullanılmıştır. Analizler yapılmadan önce KMO ve Barttlet Küresellik testi yapılmış ve uyum iyiliği değerleri test edilmiştir. **Bulgular:** Güvenirlik analizi sonucunda, kişisel sosyal kaçınma (KSK) algılanan sosyal kaçınma (ASK), sanal tolerans (ST) ve sanal iletişim (Sİ) için Cronbach alfa değerleri sırasıyla α=0.914, α=0.824, α=0.854, α=0.902 bulunmuştur. Sosyal medya bağımlılığının sosyal kaytarma davranışı üzerinde istatistiksel olarak anlamlı ve pozitif yönlü (β=0.389, p<0.01) bir etkisi olduğu tespit edilmiştir. **Sonuç:** Bu çalışma sonucunda sağlık çalışanlarının sosyal medya kullanımının zararları ve bağımlılık davranışları hakkında bilgilendirilmesinin hem bireysel hem de örgütsel olarak faydalı olacağı düşünülmektedir.
Anahtar Kelimeler: Sosyal Medya, Bağımlılık, Sosyal Medya Bağımlılığı, Sosyal Kaytarma.

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INTRODUCTION

Social media is a modern communication tool that has gained increasing importance and usage in contemporary society. It facilitates various aspects of human life, including entertainment, interaction, access to information, identity formation, and personal presentation. However, excessive and unnecessary use can lead to numerous problems, such as addiction, disconnection from reality, incitement of consumption, and violations of privacy. (Balcı et al., 2020).

Social media used individually can occupy the minds of users and create a basis for perceiving it as a need which is manifested as a symptom of addiction. Excessive use of social media that is called media addiction will negatively affect the health and work performance of individuals (Alan, 2019).

Although social media addiction has not been defined precisely as a disease entity the habit of overusing social media has been the subject of many researches and discussions. Especially after the COVID-19 pandemic, it has become common to attend trainings with remote access and to stay in front of the screen (computer, phone, tablet, etc.) for long hours to do business with remote access (Uslu, 2021). The widespread use of information technologies and social media also contributes negatively to the development of loafing behaviour (Alan, 2019).

Social loafing behavior is an important issue that requires investigation, preventive measures, and attention, particularly in organizations that involve group work. In contemporary organizations, the influence of globalization has made it almost imperative to work in groups to accomplish various tasks. Known as the Ringelmann effect, social loafing fundamentally posits that the contributions individuals make to a task are affected by the number of people in the group. Social loafing is an undesirable phenomenon for organizations, as it can harm organizational performance and lead to a decrease in employee productivity (Türe Orhan, 2022).

For this reason, in this study, the relationship between social media addiction and social loafing behaviour of healthcare workers working in a university hospital will be investigated.

Social media addiction

Social media is a medium where online sharing, and dialogues of not only individuals but also groups and institutions can be found. Today, the most practical and fastest way of information flow, communication and access to information is achieved through social internet networks and social media. The virtual network environment created by internet networks enables billions of people to connect and interact with each other. In this way, updates made for the needs of users help the system to grow gradually. Internet networks and social media, which are used by almost everyone in the society, are used for many purposes from product promotion to obtaining information, from shopping to chatting (Daşlı & Baloğlu, 2020).

Apparently, individuals use various platforms, especially facebook, and share their emotions (sadness, joy, etc.) and thoughts (political opinions, etc.) on social media platform, which has rapidly become a part of social life. Moreover, social media is actively utilized in various fields today, including journalism, advertising, non-governmental organization activities, shopping, political campaigning, marketing, and public relations (Çömlekçi & Başol, 2016). Excessive and prevalent use of social media, has resulted in the development of social media addiction (Tutgun Ünal & Bozkurt, 2020).

Individuals spend time on social media for reasons such as feeling lonely, wanting to follow current events and the lives of others, and seeking approval from society or a certain group. However, spending more time on social media platforms than it should be results in media addiction. Behaviours such as distancing from the real world due to social media addiction, the need for approval, emotional instability and sleep problems, as well as the desire to constantly follow the developments in social media and spend time in front of the screen for a long time constitute the symptoms of social media addiction.

The fact that individuals are happy as a result of the shares they made on social media platforms causes the emergence of behaviour patterns that cause the individual to share more, and more and increase the duration of social media use. Individuals who cannot balance the use of social media effectively are being constantly ‘online’ and ‘online communication’ using tablets or phones (Utma, 2019). Social media addiction refers to the situation of thinking that life consists of social media and spending more time than necessary (Arıbaş & Özşahin, 2022).

Apparently, individuals with social media addiction continue to spend time in applications and create content until they get the expected result. This preoccupation, which encompasses both private and business life of individuals, will cause some communication problems. Social media, which functions as ‘medicine’ for some people by relieving the loneliness of individuals on one hand, functions as ‘poison’ by causing addiction on the other hand. Especially with the introduction of smartphones and tablets into human life, social media addiction has become an increasingly serious problem (Utma, 2019). Social media addiction causes individuals to make compromises in their eating habits, sleep patterns and social lives and to postpone or not to do the work that needs to be done. For this reason, the fear of missing developments in working life and social media addiction negatively affect the work performance of employees (Çetinceli & Acar, 2023).

Social media addiction can cause loss of time in working hours (spending most of the time on social media platforms), decrease in work efficiency

(inability to fully focus on work), social isolation (distancing oneself from real life), low self-esteem (feeling inadequate) and personal skill deficiencies (distraction, concentration disorder, communication skills, etc.) (Dinçer, 2023).

Social loafing

Social loafing behaviour (also called social shirking behaviour) is defined as the tendency of individuals working as a member of a group to show a decrease in their performance during teamwork compared to their individual work performance in doing the same job (Kafes & Kaya, 2017). Similarly, it is defined also as the tendency of employees to show lower effort than their expected level of individual performance in group work, although they perfectly perform their individual work (İnce, 2022). Apart from these definitions, it is defined as the employees' disregard for the teamwork and providing minimum support for the execution of the teamwork by assuming that other members of the teamwork also has the same opinion (Öneren et al., 2018).

The fact that the activities carried out in organisations are systematic and interconnected shows that employees must fully fulfil their duties and responsibilities. For this reason, the quality of human resources of organisations, their adaptation to the working environment and willingness to work are among the determining criteria on the effectiveness and efficiency of the business (Öneren et al., 2019).

Factors affecting social loafing behaviour are examined in terms of individuals, groups and organisations. Individual factors are personality, gender, culture, seniority/title, organisational commitment level, burnout level; regarding group factors which are group cohesion, group size, lack of interpersonal coordination, role ambiguity, lack of unity of purpose, underestimation of individual's effort in the group, interpersonal trust, social loafing behaviour of other group members, and with respect to organisational factors including organisational culture, working conditions, lack of reward system, organisational injustice in rewarding, intra and inter-group competition level (Öneren et al., 2019).

Before individuals exhibit social loafing behavior, there are numerous factors that influence this phenomenon. These factors are related to both internal and external elements. Therefore, it would be inaccurate to attribute the factors or conditions that may lead to loafing behavior solely to the individual's personal characteristics or exclusively to group dynamics. The factors influencing individuals' social loafing behavior can be categorized under four main headings. These are personal characteristics, situational characteristics, group characteristics, cultural and social norms. (Kafes and Kaya, 2017).

When the studies are examined, it is seen that the literature mostly focuses on the relationship between social media addiction and cyberloafing behavior (Alan, 2019; Turan et al, 2020; Chan et al., 2024). However, there is no research on determining the relationship between social media addiction and social loafing behavior. In this context, some hypotheses have been established:

- Hypothesis 1. Virtual tolerance has an effect on one's own social loafing behaviour.
- Hypothesis 2. Virtual tolerance has an effect on perceived social loafing.
- Hypothesis 3. Virtual communication has an effect on one's own social loafing behaviour
- Hypothesis 4. Virtual communication has an effect on perceived social loafing

MATERIALS AND METHODS

Study type

This study was conducted in a university hospital in the Mediterranean region between February 2024 and July 2024 using the relational research method to examine the relationship between social media addiction and social loaf,ng behaviour in healthcare workers.

Study population and sample

This study was conducted in a hospital that uses modern medical technologies and provides tertiary health care services. The population of the study consisted of 2511 employees working in a university hospital as doctors, nurses, medical secretaries, technicians and health officers.

The sample analysis was carried out by considering the quantitative methods cited in the literature (İslamoğlu, 2009). According to the analysis used in this study, at least 333 healthcare workers should participate in the study. Total of 450 healthcare workers participated in the study., other hospital personnel were not included in the study. In the study, a simple random sampling method was employed. Due to the presence of shift work conditions in healthcare institutions, the survey was conducted face-to-face with personnel who are on duty both during and outside of regular working hours. To ensure the anonymity of the data, the data collection process was conducted on a unit-by-unit basis. Once one unit was completed, the process proceeded to the next unit. No identifying information, such as name, surname, identification number, or personnel registration number, was collected from the voluntary personnel who agreed to participate in the study. The survey included only statements regarding demographic characteristics.

$$n = \frac{Z^2 \mathrm{PQ}}{E^2 + \frac{Z^2 PQ}{N}} = \frac{1.96^2 * 0.5 * 0.5}{0.05^2 + \frac{1.96^2 * 0.5 * 0.5}{2511}} = 333$$

Z: 1.96 (Standard normal variable = 95% confidence level)

N: Sampling size

P: Proportion of the main population = (50%); margin of deviation: 0.5 (taken as maximum error),

Q: 1-P = 0.5

E: Default error (5%) = 0.05

Data analysis

In this study, the social loafing scale and the social media addiction scale were employed. In binary variable expressions, the T-test has been conducted, while in expressions with three or more variables, the ANOVA test has been performed. Based on the data obtained from voluntary participants, frequency analysis, impact analysis, and correlation analysis were conducted with consideration of the hypotheses. SPSS 29 and AMOS statistical software were utilized for the analyses.

Ethical considerations

Data collection and analyses were conducted in accordance with the World Medical Association *Declaration of Helsinki*. Ethical principles for medical research involving human subjects (Halonen et al., 2020). Two different scales were used to obtain the data. Therefore, ethics committee approval was obtained. Before application of the scale, the personnel who participated voluntarily in the study were given the necessary information about the scale and an informed consent forms were obtained from the participants.

Variables and scales

The survey data were collected with face-to-face interviews without using the online survey method. The scale in question consists of two main parts: items related to demographic characteristics and scale items. Social Loafing Scale (SLS) and Social Media Addiction Scale (SMAS) were used in the study.

Social Loafing Scale (SLS)

The SLS was developed by Mulvey and Klein (1998) and adapted into Turkish by Şeşen and Kahraman (2014). It is a 5-point Likert scale consisting a total of 9 items and two dimensions, namely social loafing for self (SLS) (5) and perceived social loafing (PSL). Social loafing is defined as the reduction of effort by an individual during group work. The concept of perceived social loafing refers to the belief that individuals within a workgroup exhibit performance levels that are lower than what is expected by their group peers. This notion is distinct from social loafing itself, as it specifically pertains to the evaluation of team members' performance by their colleagues (Köksal, 2020; Olcay et al., 2018).

Social Media Addiction Scale (SMAS)

The validity and reliability study of the SMAS was conducted by Şahin and Yağcı (2017). The scale is a 5-point Likert scale consisting a total of 20 items and two dimensions namely virtual tolerance (VT) (11) and virtual communication (VC) (9). Virtual tolerance refers to the level of tolerance exhibited by individuals towards various situations and negative behaviors encountered in virtual environments. Virtual communication is the process of exchanging information using the internet or computers (Layng, 2016).

RESULTS

In this study, the AMOS structural equation model was applied. In order to apply the AMOS structural equation model, the data should be normally distributed (Byrne, 2001). Skewness and kurtosis values are indicators of whether the data set is normally distributed or not. If the skewness and kurtosis values of the data sets are between ±3, it means that the data set is normally distributed (Shao, 2022, p.28). The skewness kurtosis values in this study are within the specified range (Table 1).

Table 1. Results of normality test.

Scales	Skewness	Kurtosis	State
SLSS	-1.000	0.479	Normal
PSLS	0.219	-0.426	Normal
VT	-0.120	0.115	Normal
VC	-0.594	0.040	Normal

Abbreviations: SLSS: Social Loafing Scale for Self; **PSLS:** Perceived Social Loafing Scale; **VT:** Virtual Tolerance; **VC:** Virtual Communication

Confirmatory Factor Analysis (CFA) is critical for assessing construct compatibility. Items with factor loadings above 0.5 give more suitable results for analysis. If the values in AMOS structural equation modeling are low, a modification process can be applied to obtain acceptable goodness of fit indices (Gürbüz, 2019, pp.32-62). Some goodness-of-fit indices are as follows: CFI<5, RMSEA<0.08, SRMR<0.08, SRMR<0.08, NFI>0.90, IFI>0.90, AGFI>0.85, GFI>0.90 and NNFI>0.90. In this study, the goodness of fit indices of the SL and SLS scales were within the specified range (Table 2).

Descriptive characteristics of health personnel

Study population consisted of 270(60%) female participants, 197(43.8%) nurses, 332(73.8%) day workers, 238(52.9%) married individuals, and 201(44.7%) healthcare professionals with a bachelor's degree. Some of the study participants (n=228; 50.7%) worked in outpatient clinics Study participants were either in their first year in the profession (n=141; 31.3%) or in their first year in this hospital 184(40.9%). (Table 3).

Data related to hypotheses

In the study, priorly, the presence (if any) a statistically significant difference between gender, marital status and type of employment, and PSLS, PLS, VT and VC was analysed by t-test (Table 4).

Table 2. DFA goodness-of-fit indices.

Goodness-of-fit indices	Perfect Correlation	Acceptable Correlation	SLSS	ASLS	VT	Vİ
χ2/df	<3	<5	2.981	1.065	3.406	3.580
CFI	>0.95	>0.90	0.995	1.00	0.955	0.970
RMSEA	<0.05	<0.08	0.066	0.01	0.073	0.076
SRMR	<0.05	<0.08	0.019	0.019	0.042	0.052
NFI	>0.95	>0.90	0.993	0.993	0.937	0.960
IFI	>0.95	>0.90	0.995	1.000	0.955	0.971
AGFI	>0.90	>0.85	0.960	0.988	0.928	0.925
GFI	>0.95	>0.90	0.989	0.998	0.960	0.962
NNFI (TLI)	>0.95	>0.90	0.988	0.999	0.935	0.954
Cronbach α			**0.914**	**0.824**	**0.854**	**0.902**

Abbreviations: SLSS: Social Loafing Scale for Self; **PSLS:** Perceived Social Loafing Scale: **VT:** Virtual Tolerance; **VC:** Virtual Communication

χ2: Chi-square Test**; df:** Degree of Freedom; **CFI:** Comparative Fit Index; **RMSEA:** The Root Mean Square Error of Approximation; **SRMR:** Standardized Root Mean Square; **NFI:** Normal Fit Index; **IFI:** Incremental Fit Index; **AGFI:** Adjusted Goodness of Fit Index; **GFI:** Goodness of Fit Index; **NNFI:** Non-normal Fit Index; **TLI:** Tucker-Lewis Index

Table 3. Socio-demographic characteristics of the participants.

Variables		n	%	PSLS	PSLS	VT	VC
Gender	Female	270	60.0	3.94±0.97	2.96±0.89	3.62±3.49	3.86±0.81
	Male	180	40.0	3.70±1.08	3.03±0.91	3.49±0.78	3.58±0.88
Marital status	Single	211	46.9	3.65±1.05	2.97±0.94	3.42±0.73	3.63±0.81
	Married	239	53.1	4.01±0.97	3.01±0.85	3.71±0.77	3.85±0.86
Age (years)	20-29	154	34.2	3.49±1.03	2.97±0.87	3.23±0.70	3.53±0.81
	30-39	146	32.4	3.93±1.01	2.98±0.86	3.62±0.75	3.77±0.83
	40-49	108	24.0	4.11±0.90	3.00±0.96	3.88±0.73	3.96±0.91
	≥50	42	9.3	4.17±0.99	3.05±0.95	3.85±0.65	3.96±0.73
Education level	High school	68	15.1	3.71±1.09	3.04±0.98	3.77±0.68	3.86±0.98
	Associate degree	90	20.0	3.90±1.05	2.91±0.78	3.66±0.83	3.79±0.95
	Undergraduate	201	44.7	3.78±1.03	3.03±0.90	3.46±0.75	3.66±0.81
	Master's degree	64	14.2	3.91±0.90	2.87±0.88	3.50±0.80	3.77±0.73
	Doctorate,PhD	27	6.0	4.30±0.80	3.12±1.00	3.76±0.67	3.94±0.64
Employment status	Day worker	332	73.8	3.87±1.01	2.98±0.89	3.59±0.77	3.76±0.87
	Shift worker	118	26.2	3.76±1.06	3.02±0.90	3.50±0.76	3.71±0.77
Length of service in the profession (years)	1-4	141	31.3	3.79±1.01	3.00±0.92	3.61±0.72	3.86±0.77
	5-9	85	18.9	4.02±0.84	3.07±0.99	3.43±0.71	3.65±0.79
	10-14	71	15.8	3.76±1.19	2.88±0.92	3.56±0.80	3.78±0.87
	15-20	60	13.3	3.90±1.05	2.92±0.80	3.72±0.77	3.81±0.85
	≥20	93	20.7	3.81±1.03	3.05±0.80	3.55±0.84	3.60±0.96
Term of office in this organisation (years)	1-4	184	40.9	3.82±1.00	2.97±0.92	3.61±0.74	3.85±0.78
	5-9	89	19.8	4.05±0.84	3.06±0.97	3.44±0.72	3.73±0.79
	10-14	75	16.7	3.77±1.16	2.93±0.86	3.59±0.82	3.71±0.93
	15-20	47	10.4	3.78±1.04	2.89±0.76	3.66±0.80	3.71±0.81
	≥20	55	12.2	3.84±1.02	2.99±0.89	3.57±0.77	3.75±0.85

Abbreviations: SLSS: Social Loafing Scale for Self; **PSLS:** Perceived Social Loafing Scale: **VT:** Virtual Tolerance; **VC:** Virtual Communication

As a result of the analyses, a statistically significant difference between gender and the total score of social media addiction was detected (t=2.787, p=0.006). A statistically significant difference between SLSS (p=0.017) and VC (p=0.001) at 95% confidence level. There was a statistically significant difference (p<0.05) between marital status and SLSS scores (p=0.00), also between VT (p=0.000) and VC (p=0.005). No statistically significant difference was found between the type of employment and any variable analysed (Table 4).

Table 4. Findings related to the differences between demographic characteristics and variables.

Variables			n	x̄	SS	df	t	p
Gender	SLSS	Female Male	270 180	3.94 3.70	097 1.08	356.072	2.404	**0.017***
	PSLS	Female Male	270 180	2.96 3.03	0.89 0.91	378.306	-0.787	0.432
	VT	Female Male	270 180	3.62 3.49	0.75 0.78	374.273	1.707	0.089
	VC	Female Male	270 180	3.86 3.58	0.81 0.88	360.962	3.395	**0.001***
Marital status	SLSS	Single Married	211 239	3.65 4.01	1.05 0.97	430.415	-3.804	**0.000***
	PSLS	Single Married	211 239	2.97 3.01	0.94 0.85	427.837	-0.425	0.671
	VT	Single Married	211 239	3.42 3.71	0.73 0.77	445.357	-4.008	**0.000***
	VC	Single Married	211 239	3.63 3.85	0.81 0.86	446.146	-2.826	**0.005***
Employment status	SLSS	Day worker Shift worker	332 118	3.87 3.76	1.01 1.06	196.465	0.988	0.324
	PSLS	Day worker Shift worker	332 118	2.98 3.02	0.89 0.90	203.574	-0.404	0.686
	VT	Day worker Shift worker	332 118	3.59 3.50	0.77 0.76	207.763	1.109	0.268
	VC	Day worker Shift worker	332 118	3.76 3.71	0.87 0.77	230.145	0.531	0.595

Abbreviations: SLSS: Social Loafing Scale for Self; **PSLS:** Perceived Social Loafing Scale: **VT:** Virtual Tolerance; **VC:** Virtual Communication

In addition to the analyses, the difference between age and educational status and the research variables was examined. Gabriel test was applied to analyse the groups in the age factor data set. According to the analysis, a statistically significant difference between the age factor score and SLSS scores (F=11.083, p=0.000), VT (F=19.579, p=0.000) and VC (F=6.670, p=0.000). A statistically significant difference was also observed between 20-29 years old healthcare workers and all other age groups (p<0.05). In the age group of 50 years and over, social loafing behaviour was more frequently observed. A significant difference was found between the age group 40-49 and all other age groups (p<0.05). Social tolerance was at a comparatively higher level in the 40-49 age group. A significant difference was found between the VT scores of 20-29 years and all other age groups (p<0.05). In the age group of 50 years and over, social communication was entertained more frequently.

Hochberg's GT2 test was performed because of the greater difference between the sample numbers of the groups in the education level data set. According to the analysis, there was no statistically significant difference between the level of education and PSLS (p=0.100), PLS (p=0.586) and VC (p=0.307) scores. However a statistically significant difference was detected between VC (p=0.015) and the level of education (p<0.05). We also determined that social tolerance scores were higher in high school graduates when compared with the undergraduate participants.

We also determined that social media addiction had a statistically significant and positive (β=0.389, p<0.01) effect on social loafing behaviour. The path analysis showing the effect of VT, one of the subdimensions of social media addiction, on PLSS and PSL scores is given in the figure below (Figure 1). According to the analysis, it was found that VT had a statistically significant positive effect on PSLS (β=0.344, p<0.01) and PSL (β=0.194, p<0.01).

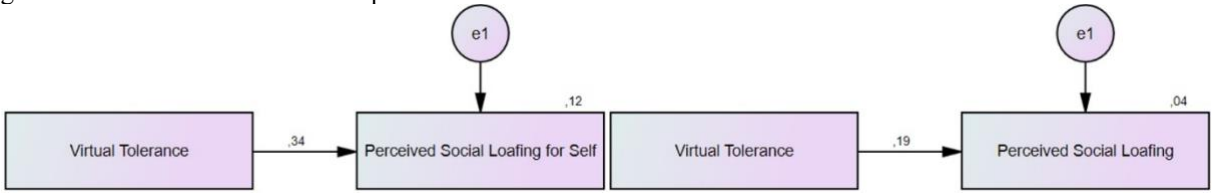

Figure 1. Path Analysis of the Effect of VT on PSLS and PSL

The findings related to the effect of VT on PSLS and PSL are given in Table 5. As shown in Table 5, VT has a statistically significant and weakly positive effect on the PSLS and PSL (p<0.01). According to the findings, Hypothesis 1 and Hypothesis 2 are confirmed.

Table 5. Findings related to the effect of ST on PSLS and PSL.

Virtual Tolerance				
Direction of effects	**Estimates**	**Standard Error**	**t**	**p**
VT→PSLS	0.344	0.044	10.093	***
VT→PSL	0.194	0.039	4.192	***

*** p<0.01

Abbreviations: VT: Virtual Tolerance; **PSLS:** Perceived Social Loafing for Self; **PSL:** Perceived Social Loafing

The path analysis showing the effect of VC on PSLS and PSL is given in the figure below (Figure 2). According to the analysis, it is seen that VC has a statistically significant and positive effect on PSLS (β=0.352, p<0.01) and PSL (β=0.162, p<0.01). The findings related to the effect of VC on PSLS and PSL are given in Table 6.

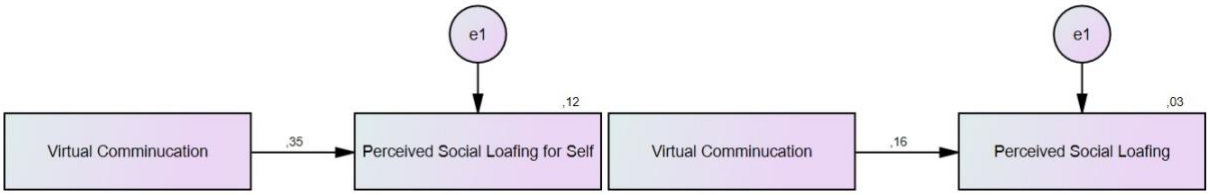

Figure 2. Path Analysis of the Effect of VC on PSLS and PSL

In Table 6, it is determined that VC has a statistically significant but weakly positive effect on the PSLS and PSL (p<0.01). According to the findings, Hypothesis 3 and Hypothesis 4 were confirmed.

Pearson correlation analysis was applied to determine the relationship between the subdimensions of the scales used as data collection tools in the study. The results of correlation analyses are given in Table 7.

Table 6. Findings related to the effect of SI on CSC and ASC.

Virtual Communication				
Direction of effects	**Estimates**	**Standard Error**	**t**	**p**
VC→PSLS	0.352	0.053	7.980	***
VC→PSL	0.162	0.036	3.475	***

*** p<0.01

Abbreviations: VC: Virtual Communication; **PSLS:** Perceived Social Loafing for Self; **PSL:** Perceived Social Loafing

Table 7. Correlation analysis between variables.

	1	1a	1b	2	2a	2b
1-Social media addiction	1	0.927**	0.921**	0.304**	0.379**	-0.046
1a-VT		1	0.723**	0.266**	0.344**	-0.056
1b-VC			1	0.282**	0.352**	-0.042
2-Social loafing				1	0.795**	0.499**
2a-PSLS					1	-0.129**
2b-PSL						1

** p<0.01

Abbreviations: VT: Virtual Tolerance; **VC:** Virtual Communication**; PSLS:** Perceived Social Loafing for Self; **PSL:** Perceived Social Loafing

According to the results of correlation analysis, a statistically significant and positive correlations were found between social media addiction and VT (r=0.927, p<0.01), VC (r=0.921, p<0.01), social loafing (r=0.304, p<0.01) and PSLS (r=0.379, p<0.01) (Table 7).

A statistically significant and positive correlation was also detected between VT and VC (r=0.723, p<0.01), social loafing (r=0.266, p<0.01), and PSLS (r=0.344, p<0.01) (Table 7).

A statistically significant and positive correlation was revealed between VC and social loafing (r=0.282,

p<0.01), and PSLS (r=0.795, p<0.01). In addition, a statistically significant and positive correlation was detected between the social loafing scale and its subdimensions of PSLS (r=0.795, p<0.01) and PLS (r=0.499, p<0.01) (Table 7).

DISCUSSION

This study was conducted to examine the relationship between social media addiction and social loafing behaviour among healthcare workers. Based on the results of the study a statistically significant difference was detected between gender and PSLS, VC; and also between marital status PSLS, VT and VC (p<0.05). In addition, a statistically significant difference was revealed between the age factor score and VC (F=11.083, p=0.000), VT (F=19.579, p=0.000) and VC (F=6.670, p=0.000).

In this research study, as is seen,social media addiction has exerted a statistically significant and positive effect on social loafing behaviour (β=0.389, p<0.01). In addition, VT exerted a statistically significant and positive effect on PSLS (β=0.344, p<0.01) and PSL (β=0.194, p<0. 01), and VC had a statistically significant and positive effect on PSLS (β=0.352, p<0.01) and PSL (β=0.162, p<0.01). As shown in Table 7, a significant relationship existed between social media addiction and social loafing behaviour at p<0.01 level. In a study conducted on healthcare professionals, a statistically significant difference was observed between gender and social media addiction (Balcı et al., 2020). However, in some studies, any statistically significant difference could not be demonstrated between gender and social media addiction (Kırık et al., 2015; Baz, 2018; Balcı & Baloğlu, 2018; Arıbaş & Özşahin, 2022). In this study, although there is no statistically significant difference between VT, which is the subdimension of social media addiction, and gender, a statistically significant difference between VT and VC was noted (p<0.05). However, a statistically significant difference was present between gender and the total score of social media addiction scale (p<0.05).

Çizmeci and Deniz (2016) stated in their study that health professionals mostly use the internet outside of their working hours to relax and get away from the stressful and intense working environment. In a study conducted by Saraç and Çiftçioğlu (2011) involving 130 enterprises, the researchers concluded that non-work-related internet use during working hours makes employees happy and more productive. A study conducted on university students, revealed there was a statistically significant and negative relationship between social network use and significant cyberloafing behaviour (Alan, 2019). Similarly, in a study conducted by Black et al. (2013) on healthcare professionals, it was concluded that the time spent on social media negatively affects job performance.

According to Mahmoud's (2023) research, social media addiction negatively impacts the psychological well-being of healthcare workers. It has been indicated that social media addiction can lead to psychological issues and feelings of loneliness. Individuals experiencing psychological problems may exhibit reluctance to actively participate in team activities, which could result in an increase in tendencies toward social loafing.

Limitations and strengths

This study was conducted using a cross-sectional design. Therefore, it cannot provide clear information on determining its causality. The main strength of this study is that it used scales with previously established validity and reliability to measure the study results.

CONCLUSION

According to the analyses conducted, it has been determined that social media addiction has a statistically significant and positive effect on social loafing (also called social shirking) behavior. When the results are evaluated comparatively with other studies in the field, it is thought that informing healthcare workers about the harms of social media use and addiction behaviors would be beneficial both individually and organizationally. In this context, in-house training is strongly recommended.

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Conflict of interest

The author declares no potential conflicts of interest with respect to the research, authorship and/or publication of this article.

Author contributions

Plan, design: OH; **Material, methods and data collection:** OH; **Data analysis and comments:** OH; **Writing and corrections:** OH.

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Ethical approval

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The Effect of Play Dough Activities Before the Venipuncture Procedure on Pain and Anxiety Level in Children: A Randomized Controlled Study

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ABSTRACT
Objective: The aim of this study was to determine the effect of play dough activities applied before the venipuncture procedure on pain and anxiety levels in children. **Materials and Methods:** The study was a randomized controlled trial. The sample of the study is consisted of 68 children (experimental group=34; control group=34) who agreed to participate in the study and met the sample selection criteria, according to the result of the power analysis. Before the venipuncture process, the children in the experimental group played with play dough, while the children in the control group were only given routine venipuncture. Personal Information Form, Wong-Baker Facial Pain Rating Scale and Child Anxiety Scale-State were used to collect the data. **Results:** When the results of the research were evaluated, it was found that the Wong-Baker Facial Pain Rating Scale and Child Anxiety Scale-State scores of the children in the experimental group were found to be significantly lower than the ones of the children in the control group ($p<0.05$). **Conclusion:** Play dough activities are effective in reducing pain and anxiety before the venipuncture in children. In line with these results, it is recommended to use play dough activities to reduce the pain and anxiety level of children during venipuncture procedure. Play dough activities are simple, effective, feasible, rapid, easy-to-access, non-risk and cost-effective methods that nurses can safely implement.
Keywords: Anxiety, Child, Pain, Play Dough, Venipuncture.

Çocuklara Kan Alma İşlemi Öncesi Uygulanan Oyun Hamuru Aktivitelerinin Ağrı ve Anksiyete Düzeyine Etkisi: Randomize Kontrollü Çalışma

ÖZ
Amaç: Araştırma çocuklarda kan alma işlemi öncesi uygulanan oyun hamuru aktivitelerinin ağrı ve anksiyete üzerindeki etkisini belirlemek amacı ile yapılmıştır. **Gereç ve Yöntem:** Araştırma randomize kontrollü deneysel çalışmadır. Araştırmanın örneklemini yapılan güç analizi sonucuna göre, çalışmaya katılmayı kabul eden ve örneklem seçim kriterlerini karşılayan 68 çocuk (deney grubu=34; kontrol grubu=34) oluşturmuştur. Deney grubundaki çocuklara kan alma işlemi öncesi oyun hamuru oynatılmış, kontrol grubundaki çocuklara ise sadece rutin kan alma işlemi gerçekleştirilmiştir. Verilerin toplanmasında Kişisel Bilgi Formu, Wong-Baker Yüz İfadelerini Derecelendirme Ölçeği ve Çocuk Anksiyete Skalası-Durumluluk kullanılmıştır. **Bulgular:** Araştırma sonuçları değerlendirildiğinde, deney grubundaki çocukların Wong-Baker Yüz İfadelerini Derecelendirme Ölçeği ve Çocuk Anksiyete Skalası-Durumluluk puanlarının kontrol grubundaki çocukların puanlarından anlamlı düzeyde düşük olduğu belirlenmiştir ($p<0.05$). **Sonuç:** Çocuklara kan alma işlemi öncesi uygulanan oyun hamuru aktiviteleri ağrı ve anksiyeteyi azaltmada etkilidir. Bu sonuçlar doğrultusunda kan alma işlemi uygulanan çocukların ağrı ve anksiyete düzeyini azaltmak için oyun hamuru etkinliklerinin kullanılması önerilmektedir. Oyun hamuru aktiviteleri, hemşirelerin güvenle uygulayabileceği basit, etkili, uygulanabilir, hızlı, erişimi kolay, risksiz ve uygun maliyetli yöntemlerdir.
Anahtar Kelimeler: Anksiyete, Çocuk, Ağrı, Oyun Hamuru, Kan Alma.

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INTRODUCTION

Pain is defined as "an unpleasant sensory and emotional experience associated with, or resembling that associated with, actual or potential tissue damage" (IASP, 2020). Pain is a multidimensional phenomenon with sensory, physiological, cognitive, affective and behavioural components (Andersson et al., 2022). Pain is a traumatic experience that children also frequently suffer from and that can affect their physiological, psychological and cognitive functions (Martin, 2018; Rivi et al., 2023).

Children suffer from pain due to accidents, injuries, diseases, surgery, and interventional procedures such as suturing, injection and venipuncture (Andersson et al., 2022; Çetin & Çevik, 2019; Martin, 2018). Invasive procedures are one of the interventions in which children have the highest levels of pain, fear and anxiety. The fear and anxiety that arise after these interventions also negatively affect the future hospital experiences of the child and parents (Birnie et al., 2018; Özdemir & Kürtüncü, 2017). In a study conducted with adults in Canada, 25% of individuals were found to have a fear of injections that emerged during childhood (Taddio et al., 2010). In addition, pain negatively affects children's mood, behavior, relationships, nutrition, growth and development, family and other social interactions (Kudubeş et al., 2021; Rivi et al., 2023). For these reasons, it is important to diagnose and interpret children's pain and to implement the necessary interventions (Taddio et al., 2010).

Many pharmacological and nonpharmacological methods are used in pain management in children. It is also reported that the combination of both methods is more effective (Büyükgönenç & Törüner, 2018; Kudubeş et al., 2021). Nonpharmacological methods can help reduce pain and anxiety when used alone or in combination with medications. In these methods, which can be applied independently by nurses, effective pain control is provided by establishing a safe relationship with the child and their parents (İnal & Canbulat, 2015; Kudubeş et al., 2021; Kurban & Konuk Şener, 2024). The most important reasons for preferring non-pharmacologic methods are having no side effects, ease of implementation, low cost, increase in the effects of analgesics and nurse-friendliness (Büyükgönenç & Törüner, 2018; Kudubeş et al., 2021; Shen et al., 2022).

One of the non-pharmacological methods used in pain management in children is distraction (Kudubeş et al., 2021; Shen et al., 2022; Yazıcı et al., 2022). The aim of the distraction method is to increase children's sense of control over pain by getting them to pay attention to the things they like (Kudubeş et al., 2021; Yazıcı et al., 2022). Distraction methods used in children include activities such as inflating balloons, dreaming, rhythmic breathing, playing music, using virtual reality glasses and playing play dough (Karakaş et al., 2023; Kudubeş et al., 2021; Kurban & Konuk Şener, 2024; Yazıcı et al., 2022).

Pediatric nurses can benefit from play activities in reducing pain, stress, and anxiety that occur during the blood collection process in children and in allowing children to express their emotions (İnci & Günay, 2019; Karakaş et al., 2023; Sezici et al., 2017). Play dough activity is a visual, tactile and active sensory distraction for children (Karakaş et al., 2023). Play dough activities improve children's fine motor skills, increase their creativity and support their cognitive and emotional development (Karakaş et al., 2023; Sezici et al., 2017). When the literature is examined, it is seen that many different distraction methods such as distraction cards, virtual reality glasses, kaleidoscope, lighted toy, cartoon watching, bubble-blowing and buzzy are used to reduce the pain and anxiety during the blood collection procedure (Erdogan & Ozdemir, 2021; Karakaya, & Gözen, 2016; Özkan, & Polat, 2020; Turgut & Türkmen, 2023; Ugucu et al., 2022). However, there are a limited number of studies in the literature reporting the effectiveness of using the play dough technique in blood collection procedures (Maghsoudi et al., 2016). In line with the results of this study, it is thought that play dough activities applied before blood sampling will contribute to the reduction of pain and anxiety levels of children and improve the quality of care by improving children's ability to cope with pain. The aim of this study was to determine the effect of play dough activities, which is applied before the venipuncture procedure, on the pain and anxiety level of children aged between 4-7 years old.

MATERIALS AND METHODS

Study type

The study was conducted as a randomized controlled trial with a parallel design.

Study group

The population of the study consisted of children aged 4-7 years who were admitted to the Blood Collection Unit of Düzce Atatürk State Hospital. The sample was calculated with Gpower 3.1 package programme. The minimum number of patients to be included per group was determined to be 30 patients in each, with an effect size of 0.8 and a power of 0.90. Considering possible drop-outs during the study, it was decided to include 34 children in each group. The sample of the study consisted of a total of 68 children who met the inclusion criteria. The inclusion criteria for the children were determined as being aged between 4 and 7 years, having no acute pain complaints, being conscious and having no perception problem; having no visual, hearing, or neurologic impairment; undergoing venipuncture only once; and having no history of sedative, analgesic, or narcotic substance use within the 24 hours before admission.

Randomization

The children who participated in the study were divided into two groups by randomization method. Randomization was done by simple lottery method. While forming the groups, a lottery was drawn blindfolded by a nurse other than the research nurse

and the children was assigned to one of the study groups. Thus, a total of 68 children, including 34 in the play dough group, 34 in the control group were included in the study. A CONSORT 2010 flow diagram of the study is shown in Figure 1 (Schulz, Altman, Moher, & CONSORT Group, 2010).

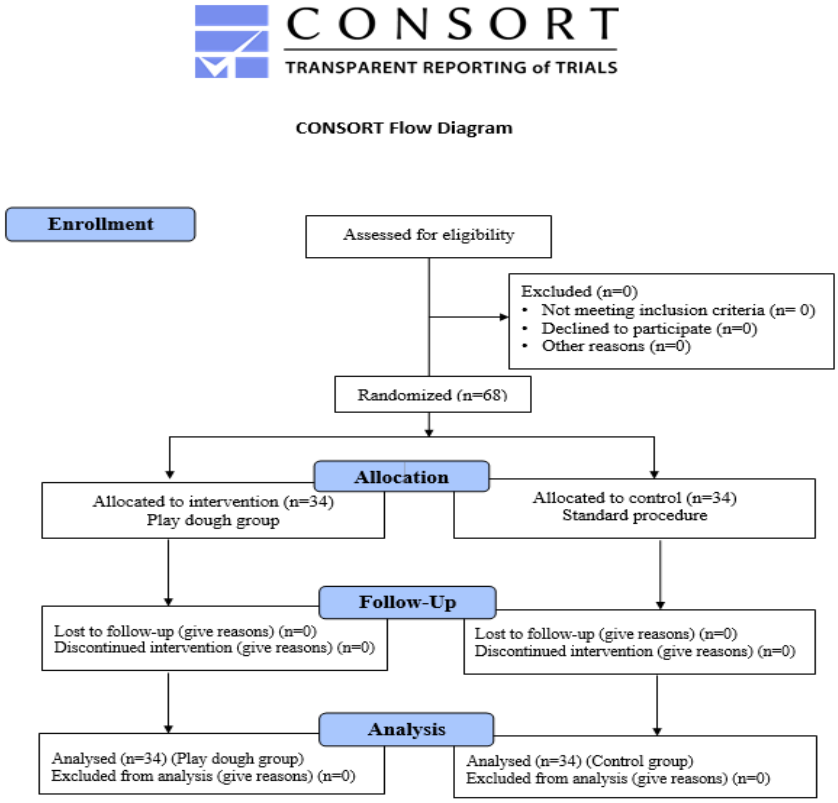

Figure 1. Consort flow diagram

Dependent and independent variables

The dependent variables of the study were children's pain and anxiety levels, and the independent variables were play dough activities.

Data collection instruments

Introductory Information Form

The introductory information form was developed by the researchers after a literature review (Karaca & Guner, 2022; Karakaya, & Gözen, 2016). The form consisted of a total of 13 questions about the child's age, gender, body measurements, chronic disease status, time of the last venipuncture, use of analgesic, and parent's age, educational level and number of children.

Wong-Baker FACES Pain Rating Scale (WB-FPRS)

Wong and Baker developed the scale in 1981 and revised it in 1983. This scale is used to assess the severity of pain in children aged 3–18 years. There are a total of six facial expressions in the scale and a smiling face (zero points) means no pain and a crying face (ten points) means unbearable pain. As the score on the scale increases, the level of pain increases (Wong & Baker, 1988).

Child Anxiety Scale-State (CAS-S)

The Child Anxiety Scale-Situation (CAS-S) was developed by Ersig et al in 2013. Turkish validity and reliability was conducted by Özalp Gerçeker et al in 2018. The scale was developed to measure anxiety levels of children aged 4-10 years. The scale is shaped like a thermometer with a light bulb at the bottom and horizontal lines at intervals going upwards. The bottom bulb chamber is '0' points. The top line is '10' points. While applying the scale, the children are asked to tick what they feel 'right now'. The CAS-S score can vary between 0 and 10 points. As the score on the scale increases, the level of anxiety increases. (Ersig et al., 2013; Özalp Gerçeker et al., 2018).

Implementation stages

Before the study, the parents of the children were interviewed and given the necessary information and asked to sign the informed consent forms. Since all the children came to the blood collection unit with their parents, interviews were conducted with the mothers and fathers. The introductory information form of the parents and children was filled in during this interview. The researchers measured the weight and height of the children before the procedure.

Pain and anxiety levels of the children were evaluated two times. The first evaluation was performed before the venipuncture procedure, and the second evaluation was performed after the completion of procedure.

After the first evaluation, play dough was given to the children in the experimental group and they played for

five minutes. Blood collection was started after the children played with play dough. After the procedure, pain and anxiety levels were evaluated for the last time. The control group was subjected to routine blood collection procedure without any practice. The children's parents were present at all stages of the procedure.

Statistical analysis

The analyses of this study were conducted using the IBM SPSS Statistics 26 package program. Descriptive statistics of the continuous variables included in the study are expressed in mean, standard deviation, minimum, and maximum values, and descriptive statistics of categorical variables are expressed in frequency and percentage. The normal distribution of the variables was analysed by Shapiro Wilk's test. When examining the differences between the groups, Chi-Square test was used when examining the relationships between two independent categorical variables. Independent Samples T-test was used when examining the differences between two independent groups. Dependent Samples T-test was used when examining the differences between two dependent numerical variables. The significance level was set at 0.05 (p-value) in statistical analyses.

Ethical considerations

Written approval was obtained from the Non-Interventional Health Research Ethics Committee of a University to conduct the study. Prior to the study, permission was obtained from the Governorship and Health Directorate in the provincial center. The permission to use the CAS-S was obtained from Dr. Özalp Gerçeker who conducted the validity and reliability study. Since the answers should have been voluntarily given in all research for which data were gathered, the researcher attached importance to the voluntary participation of the children and their parents included in the study. Furthermore, after the children and their parents were informed about the purpose of the study and the purposes for which the collected data would be used, they gave their consent (informed consent principle) verbally and in writing. The researcher followed the "principle of confidentiality" by explaining to the participants that their personal data would not be disclosed to others.

RESULTS

When the descriptive characteristics of the children were compared in terms of the groups in Table 1, no statistically significant difference was found between the groups in terms of the variables of age, gender, height, weight, chronic disease status, time of the last venipuncture and use of analgesic ($p>0.05$), and they had homogeneous characteristics.

When the descriptive characteristics of the parents were compared in terms of the groups in Table 2, no statistically significant difference was found between the groups in terms of the variables of age, educational level, number of children ($p>0.05$), and they had homogeneous characteristic.

Table 1. Comparison of descriptive characteristics of the children in terms of the groups.

	Experimental Group (n=34)		Control Group (n=34)		Total (n=68)		t	p
	Mean	SD	Mean	SD	Mean	SD		
Age	5.50	0.99	5.41	0.89	5.46	0.94	0.38	0.70
Height (cm)	112.03	7.94	111.35	6.66	111.69	7.28	0.38	0.70
Weight (kg)	20.67	4.22	20.40	3.73	20.54	3.95	0.28	0.77
Chronic disease								
Yes	0	0.0	0	0.0	0	0.0	-	-
No	34	100.0	34	100.0	68	100.0		
Use of analgesic								
Yes	0	0.0	0	0.0	0	0.0	-	-
No	34	100.0	34	100.0	68	100.0		
Time of the last venipuncture								
0-1 months	7	21.85	6	18.15	13	20.01	0.68	0.95
1-3 months	6	18.78	6	18.21	12	18.46		
3-6 months	7	21.86	10	30.26	17	26.17		
6-12 months	6	18.75	6	18.16	12	18.45	-	-
12 months and ↑	6	18.76	5	15.22	11	16.91		
	n	%	n	%	n	%	$\chi 2$	p
Gender								
Female	7	20.55	6	17.60	13	19.15	0.09	0.75
Male	27	79.45	28	82.40	55	80.85		

SD: Standard deviation t: Independent Samples T-test

Table 2. Comparison of descriptive characteristics of the parents in terms of the group.

	Experimental Group (n=34)		Control Group (n=34)		Total (n=68)		t	p
	Mean	SD	Mean	SD	Mean	SD		
Age	35.00	4.64	33.94	5.79	34.47	5.24	0.83	0.41
	n	**%**	**n**	**%**	**n**	**%**	**χ2**	**p**
Parent								
Mother	26	76.50	29	85.30	55	80.90	0.85	0.35
Father	8	23.50	5	14.70	13	19.10		
Educational level								
Illiterate	0	0.00	1	2.89	1	1.52		
Primary School	13	38.19	11	32.41	24	35.28		
Secondary School	2	5.94	4	11.82	6	8.79	4.02	0.54
High School	13	38.24	13	38.18	26	38.21		
University	6	17.63	4	11.81	10	14.74		
Master's degree	0	0.00	1	2.89	1	1.46		
Number of Children								
1 Child	1	2.92	3	8.79	4	5.92		
2 Child	24	70.56	24	70.64	48	70.56	1.46	0.69
3 Child	7	20.63	6	17.63	13	19.11		
4 Child	2	5.89	1	2.94	3	4.41		

SD: Standard deviation t: Independent Samples T-test

When the mean scores of the WB-FPRS used to assess the pain levels that the children were analyzed in Table 3, it was determined that there was no statistically significant difference between the experimental and control groups in terms of WB-FPRS scores before the procedure ($p>0.05$), while there was a statistically significant difference in terms of WB-FPRS scores after the procedure ($p<0.001$, Table 3). It was found that the WBFPRS mean scores of the children in the experimental group after the procedure (1.09±0.45) were significantly lower than the scores of the children in the control group (2.09±1.14).

Table 3. Comparison of WB-FPRS scores according to groups and processing time.

		Experimental Group (n=34)		Control Group (n=34)		t^a	p
		Mean	SD	Mean	SD		
WB-FPRS	Before procedure	0.03	0.17	0.06	0.34	-0.44	0.65
	After procedure	1.09	0.45	2.09	1.14	-4.76	**0.000****
	t^b; p	-12,633; **0,000****		-10,370; **0,000****			

SD: Standard deviation **:p<0.001
t^a: Independent Samples T-test (differences between groups)
t^b: Dependent Samples T-test (pretest-posttest differences within groups)

When the mean scores of the CAS-S used to assess the anxiety levels that the children were analyzed in Table 4, it was determined that there was no statistically significant difference between the experimental and control groups in terms of CAS-S scores before the procedure ($p>0.05$), while there was a statistically significant difference in terms of CAS-S scores after the procedure ($p<0.001$, Table 4). It was found that the CAS-S mean scores of the children in the experimental group after the procedure (2.97±1.49) were significantly lower than the scores of the children in the control group (6.44±1.74). In addition, while the after procedure CAS-S scores of the children in the experimental group decreased significantly compared to the before procedure ($p<0.001$), there was no statistically significant difference between the before procedure and after procedure CAS-S scores of the children in the control group ($p>0.05$).

Table 4. Comparison of CAS-S scores according to groups and processing time.

		Experimental Group (n=34)		Control Group (n=34)		t^a	p
		Mean	SD	Mean	SD		
CAS-S	Before procedure	6.68	2.34	6.94	2.33	-0.46	0.64
	After procedure	2.97	1.49	6.44	1.74	-8.82	**0.000****
	t^b; p	11.100; **0.000****		1.513; 0.140			

SD: Standard deviation **:p<0.001
t^a: Independent Samples T-test (differences between groups)
t^b: Dependent Samples T-test (pretest-posttest differences within groups)

DISCUSSION

In this study, it was aimed to determine the effect of play dough activities before the venipuncture procedure on pain and anxiety level in children. Children are exposed to many painful procedures throughout their developmental process (Erdogan & Ozdemir, 2021). The perception of pain varies in children, and the reactions to pain may differ from one child to another. Factors such as age, gender, BMI, developmental level, previous pain experiences, emotional state, level of understanding, learning ability, genetic differences, type and duration of pain, parental feelings and expectations, social and cultural characteristics may affect children's perception of pain (Büyükgönenç & Törüner, 2018; Çalı, 2020; Güngör & Öztürk Şahin, 2021). When the descriptive characteristics of the children and their parents in the experimental and control groups were analyzed, no statistically significant difference was found between the groups (p>0.05) (Table 1, Table 2). This shows that the children and parents in the experimental and control groups had similar descriptive characteristics, which increased the reliability of the research by reducing bias. In this study, homogeneity was ensured between the groups and the results of the research were not affected. When the literature is reviewed, it is seen that experimental studies conducted to evaluate pain in children are homogeneous between groups in terms of the same characteristics (Erdogan & Ozdemir, 2021; Karakaş et al., 2023; Karakaya, & Gözen, 2016; Kurban & Konuk Şener, 2024; Özkan, & Polat, 2020; Turgut & Türkmen, 2023; Ugucu et al., 2022).

When the pain level of children's before the procedure was examined in the study, there was no statistically significant difference between the groups in terms of WB-FPRS scores and the groups were homogeneous (p>0.05, Table 3). Similarity of characteristics between groups increases the reliability of the study and reduces bias. In the study, when the pain levels of children's were compared after the venipuncture procedure; it was determined that the pain level of children in the play dough group was lower than the control group, and the difference between them was found to be statistically significant (p<0.001, Table 3). These findings show that the play dough activities applied to the intervention group was effective in drawing children's attention in different directions and reduced the level of pain. It is thought that the use of cheap, simple and easy-to-access techniques such as play dough before blood sampling in children will reduce the level of pain.

Maghsoudi et al. (2016) reported similar results in their study. In their study, they examined the effects of play-dough, and bubble making methods on pain during venipuncture and found that the pain levels of children in the play-dough group were significantly lower than the other groups (Maghsoudi et al. (2016). When the literature is examined, no other study was found that examined the effect of using the play dough method on pain during the blood collection procedure. However, it was observed that there were studies reporting that the use of different distraction methods such as distraction cards, virtual reality glasses, kaleidoscope, lighted toy, cartoon watching, bubble-blowing and buzzy during blood collection procedure reduces the level of pain (Erdogan & Ozdemir, 2021; Karakaya, & Gözen, 2016; Özkan, & Polat, 2020; Turgut & Türkmen, 2023; Ugucu et al., 2022).

When the anxiety level of children's before the procedure was examined in the study, there was no statistically significant difference between the groups in terms of CAS-S scores and the groups were homogeneous (p>0.05, Table 4). In the study, when the anxiety levels of children's were compared after the procedure; it was determined that the anxiety level of children in the play dough group was lower than the control group, and the difference between them was found to be statistically significant (p<0.001, Table 4). In addition, the anxiety levels of children in the play dough group that were high before the procedure were significantly reduced after the procedure (p<0.001), while there was no statistically significant difference between the before procedure and after procedure anxiety levels of the children in the control group (p>0.05). This suggests that play dough activities provide relaxation and decrease in anxiety levels in children.

When the literature is examined, no study was found that examined the effect of using the play dough method on anxiety during the venipuncture procedure. However, it was observed that there were studies reporting that the use of play dough method decreased the anxiety level in invasive procedures such as dental examination and premedication

anxiety in children (Aydın et al., 2017; Karakaş et al., 2023). In the study of Karakaş et al. (2023) with children aged 3-6 years who came to dental examination for the first time, the children in the experimental group played with play dough before dental examination, while the control group was subjected to routine dental examination without any practice. It was determined that the anxiety levels of children in the play-dough group were significantly lower than the control group (Karakaş et al., 2023). A study by Aydın et al., (2017) found that playing with play dough reduces premedication anxiety in young children. In addition, it is seen that many different distraction methods such as distraction cards, virtual reality glasses, kaleidoscope, cartoon watching, bubble-blowing and buzzy are used to reduce the anxiety during the blood collection procedure (Erdogan & Ozdemir, 2021; Özkan, & Polat, 2020; Ugucu et al., 2022).

In this study, it is thought that it will make an important contribution to the literature because it is proved that the play dough activities has a positive effect on the pain and anxiety level of children and there are few studies on this subject. In addition, it is thought that the play dough activities would contribute to the nurses performing the procedure more safely by comforting the children during venipuncture procedures in order to alleviate the pain and anxiety of the children, and the use of these study results in interventions to be performed with children would also be beneficial for staff and patient safety.

Study limitations and strengths

The advantages of this study are the use of a randomized controlled trial design and that it is the first study to use play dough activities during venipuncture procedure in children. However, this study has some limitations. Since the study was conducted with children aged 4–7 years, it cannot be generalized to children in other stages of development.

CONCLUSION

The results of the present study showed that play dough activities applied to children during venipuncture procedures reduced pain and anxiety levels. In line with these results, it is recommended to include play dough activities into nursing practices and care in order to lower the level of pain and anxiety that develop during venipuncture procedures. For an effective pain and anxiety management in children, healthcare professionals should be trained, and the training should be repeated at certain times. Necessary materials should be provided for the widespread use of distraction methods in clinics. Furthermore, it is recommended that evidence-based studies on different age groups and different painful procedures support the effectiveness of play dough activities.

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Conflict of Interest

The author declare no potential conflicts of interest with respect to the research, authorship and/or publication of this article.

Author Contributions

Plan, design: AA, DKŞ; **Material, methods and data collection:** AA, DKŞ; **Data analysis and comments:** AA, DKŞ; **Writing and corrections:** AA, DKŞ.

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Ethical Approval

Institution: Düzce University Non-Interventional Health Research Ethics Committee
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Turkish Validity and Reliability of the Salutogenesis Health Indicator Scale in Adolescents

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The article was produced from the master's thesis study titled Turkish validity and reliability of the salutogenesis health indicator scale in adolescents (2019), presented as an oral presentation at the 3rd National Public Health Nursing Congress on January 7-9, 2021.

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ABSTRACT
Objective: The aim of this study is to determine the validity and relability of the Salutogenesis Health Indicator Scale in adolescents in Türkiye. **Materials and Methods:** The study was conducted using a methodological design. The sample included 705 students in grades 7, 8, and 9. The Adolescent Salutogenesis Health Indicator Scale was used in the study. Number, percentage, confirmatory and explanatory factor analysis, cronbach alpha and test-retest reliability coefficients were used to evaluate the data. **Results:** The Kaiser-Meyer-Olkin value was 0.945. This value indicates that the sample size is sufficient for the analysis. Bartlett's test of sphericity value indicated that the data set was suitable for factor analysis (BS=3351.25, p<0.001), the model shows an acceptable fit. A unidimensional model was obtained by factor analysis. Since the model fit indices $\chi 2/df<3$, the model shows an acceptable fit. Cronbach's alpha value was 0.90 and the test-retest coefficient was 0.98(p<0.001). **Conclusion:** It has been determined that the Salutogenesis Health Indicator Scale in Adolescents is a valid and reliable measurement tool for the adolescents in Türkiye. The scale is short, understandable and easy to use.
Keywords: Adolescent, Reliability and Validity, Salutogenesis.

Adölesanlarda Salutogenez Sağlık Göstergesi Ölçeği'nin Türkçe Geçerlilik ve Güvenilirliği

ÖZ
Amaç: Bu çalışmanın amacı Adölesanlarda Salutogenez Sağlık Göstergesi Ölçeği'nin Türkçe geçerlik ve güvenirliğinin yapılmasıdır. **Gereç ve Yöntem:** Araştırma metodolojik tasarımdır. Örneklemi 7, 8 ve 9. sınıfa giden 705 öğrenci oluşturmuştur. Araştırmada Adölesanlarda Salutogenez Sağlık Göstergesi ölçeği kullanılmıştır. Verilerin değerlendirilmesinde sayı, yüzde, açıklayıcı ve doğrulayıcı faktör analizi, cronbach ve test- tekrar test güvenirlik katsayıları kullanılmıştır. **Bulgular:** Kaiser-Meier Olkin değeri 0.945 bulunmuştur. Bartlett Küresellik testi değeri, veri setinin faktör analizi için uygun olduğunu göstermiştir (BS=3351.25, p<0.001). Faktör analizi ile tek boyutlu model elde edilmiştir. Model uyum indeksleri $\chi 2/sd<3$ olduğu için model kabul edilebilir bir uyumu göstermektedir. Cronbach alfa değeri 0.90, test retest katsayısı 0.98'dir (p<0.001). **Sonuç:** Adölesanlar'da Salutogenez Sağlık Göstergesi ölçeğinin Türk adölesanları için geçerli ve güvenilir bir ölçüm aracı olduğu belirlenmiştir. Ölçek kısa, anlaşılır ve kullanımı kolaydır.
Anahtar Kelimeler: Adölesan, Güvenilirlilik ve Geçerlilik, Salutogenez.

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INTRODUCTION

Salutogenesis was proposed by Antonovsky in the 90's as a theory to guide health promotion (Antonovsky, 1996) and is derived from the words "saluto" (health) and genesis (source), meaning the source of health (Antonovsky, 1979). It has shifted the focus from medicine (care and treatment) to public health (prevention, protection and promotion and improving the health of the population (Eriksson & Lindström, 2008). The Salutogenesis health model aims to create positive health rather than focus on disease (Antonovsky, 1979). One tool used to measure positive health based on the Salutogenesis model is the Salutogenic Health Indicator Scale (SHIS).

SHIS, developed by Bringsén et al. (2009) addresses the physical, mental and social dimensions of well being holistically, but does not rule out disease, as it may prevent people from achieving their goals. SHIS was first used on hospital personnel. In the first study, a two-factor structure of the scale consisting of 12 items was revealed, but in the subsequent studies it was determined that the scale was unidimensional (Bringsén et al., 2009).

Lindström et al. (2018) also showed in their study with hospital staff that SHIS has a high validity in promoting health in the workplace. The study confirmed the psychometric properties of the SHIS in an adolescents and revealed the unidimensional structure of the scale (Garmy et al., 2017). In 2014, Warne et al. adapted the Positive Health Scale, a shorter version of the SHIS, to measure adolescents' health. The Salutogenesis model provides a positive paradigm approach to promoting well-being amongst adolescents. It fits into the 'glass half full' approach that is becoming increasingly evident in policy and practice. It is positive by definition because it questions what constitutes health rather than focusing solely on finding solutions to prevent or alleviate disease (Antonovsky, 1987). SHIS has the capacity to determine the salutogenic approach underlying health-improving resources. The short 12-item structure of the scale allows it to be used in community-based research on holistic health (Hult & Valimaki, 2023).

Although there is theoretical knowledge about the use of the Salutogenesis model in our country and the Family Sense of Coherence Scale, which was developed by Antonovsky and Soruani (1998) to measure the sense of coherence that forms the basis of the Salutogenesis model and whose Turkish validity and reliability was done by Çeçen (2007), there is no available measurement tool for adolescents. In this context, there is a need for a scale that uses the Salutogenesis model in adolescents.

This study aimed to test the reliability and validity of SHIS in Turkish adolescents. The research question was: "Is the SHIS the reliable and valid measurement instrument for Turkish adolescents?".

MATERIALS AND METHODS

Study type

The research conducted was of methodological type.

Study group

The population of the research consisted of 10.364 adolescents who were 7th, 8th and 9th grade students studying in a province in Türkiye during the 2017-2018 academic year. The sample size consisted of 705 students. Factor analysis is one of the analyses requiring a large sample. For sample size; 300 participants are considered as 'good', 500 participants as 'very good' and 1.000 participants as 'excellent' (Comrey & Lee, 2016). The sample size of this study can be considered as 'very good'. Amongst the schools located in the city centre, 8 junior schools and 4 high schools were selected by random selection method. By randomly selecting students, data collection tools were applied to 169 students for the second time three weeks later for test-retest. The average age of participants in the research was 14.23±0.84, 54.6% were male and 36.5% had mothers with primary school education, 29.8% had fathers with junior school education and 84.7% had a medium family income.

Dependent and independent variables

The independent variables of this research are gender, mothers and fathers' education and family income. The dependent variable is SHIS.

Procedures

The sociodemographic characteristics form and the SHIS were used to collect data. SHIS-Adolescent was developed by Bringsén et al. (2009) to determine health status. The scale consists of 12 items and also has 2 sub-scales. Adolescents are asked to take into consideration the last 4 weeks of their lives when answering the scale items. Scale items are scored as a 6-point Likert. Positively scored items are placed to the left of the health continuum line, and the negative items are placed to the right side. The SHIS was developed from a sample of 790 healthcare professionals to define positive health and measure individuals' health from a salutogenic perspective. Cronbach alpha values of 0.84 and 0.90 were obtained. It's validity and reliablity were conducted by Garmy et al. (2017) in amongst Swedish adolescents aged 13-15. The scale is one-dimensional. Higher scores indicate better salutogenic health. Cronbach's alpha value was found to be 0.9315 (Garmy et al., 2017).

Validity

Scope (content) validity

Language and content validity were performed using the translation-back-translation method. The scale was translated into Turkish by three experts who are fluent in Turkish and English. The scale was then back-translated into English by three different experts. The opinions of 10 experts at doctoral level working in different specialities in nursing were taken. Kendall's Coefficient of Agreement (Wa) was found to be compatible. For the semantic integrity and

language simplicity of the scale items, a preliminary application was made to 10 adolescent junior school students. The scale was given it's final version in line with the suggestions (Alpar 2020; Landis & Koch, 1977).

Construction(factor) validity

Exploratory Factor Analysis/Principal Components Analysis (EFA) and Confirmatory Factor Analysis (CFA) were used for construction validity. The suitability of the data was examined with the Kaiser-Meyer-Olkin (KMO) value and the Bartlett Sphericity Test (BS). The KMO value determines whether the sample size is sufficient for factor analysis. BS also shows whether the data has a multivariate normal distribution (Alpar, 2020, 2021; Çokluk et al., 2012; Tavşancıl, 2018).

Scale reliability

Internal consistency

As the value of the Cronbach Alpha Coefficient increases, it is assumed that the scale items are consistent with each other and consist of items examining the elements of the same feature (Alpar, 2020).

Test-retest

This is seen in cases where the same test is repeated. The test-retest coefficient is expected to be above 0.80 (Alpar, 2020).

Application of data collection tools

In order to determine the clarity of the questions and the application time before research, a preliminary application was done with 10 students from a school included in the sample. No changes were made to the form. Pre-application data was not included in the research. The response time of the scale varied between 3 and 5 minutes. Test-retest application was carried out with 169 students with an interval of 15 days.

Statistical analysis

Data were analyzed using SPSS v.22 and LISREL 8.54 programmes. Appropriate descriptive statistics of the data included in the study were calculated. CFA was performed with multivariate Mardia Kurtosis Normality Test, Variance Inflation Factor (VIF), KMO test, BS test, MINRES Factor analysis and Maximum Likelihood Estimation technique. The following programmes were used to evaluate suitability of the model; Chi-square(χ^2), p value, degree of freedom(Sd), Chi-square/degree of freedom(χ2/d>), Root Mean Square Error of Approximation(RMSA), Comparative Fit Index(CFI),Goodness of Fit Index(GFI), Adjusted Goodness of Fit Adjusted Goodness of Fit Index(AGFI), Standardised Root Mean Residual(SRMR) and Normed Fit Index(NFI). Cronbach's alpha α and test retest coefficients were calculated. $p<0.05$ was taken for statistical significance (Alpar, 2021; Cangur & Ercan, 2015; Çokluk et al., 2012; Landis & Koch, 1977; Tabachnick & Fidell, 2013; Tavşancıl, 2018;).

Ethical considerations

The Ethic committee approval from Non-Interventional Health Research Ethical Committee of a State University
(Approval No. 2017/151). Institutional permission were obtained from Provincial Directorate of National Education and Governorship (E.20486347). Since the students were under the age of 18, written consent was obtained from their parents. Permission was received via e-mail to adapt ASGÖ to Turkish. The study was conducted in accordance with the principles of the Declaration of Helsinki.

RESULTS

Validity

Scope validity

The results of the experts' evaluations were analysed using the Kendall W test (Wa =0.083, p =0.437).

Structure validity

A one-dimensional model was obtained with MINRES Factor analysis and the variance explanation rate of this factor was found to be 47.75%. KMO test statistic was calculated as 0.945 and BS test statistic was calculated as Chi-square=3351.25 $p<0.001$.

When the fit index values of the model were examined the following was found; χ2 is 118.30, p value <0.001, df value is 49, χ2/df value is 2.41, RMSEA value is 0.045, SRMR value is 0.027, CFI value is 0.99, NFI value is 0.99, GFI value is 0.97 value is 0.97 and AGFI value is 0.96 (Table 1). The path diagram of the model is presented in Figure 1.

Tablo 1. SHIS model conformity index (n=705).

χ2	P	Df	χ2/df	RMSEA
118.30	0.001	49	2.41	0.045
SRMR	**CFI**	**NFI**	**GFI**	**AGFI**
0.027	0.99	0.99	0.97	0.96

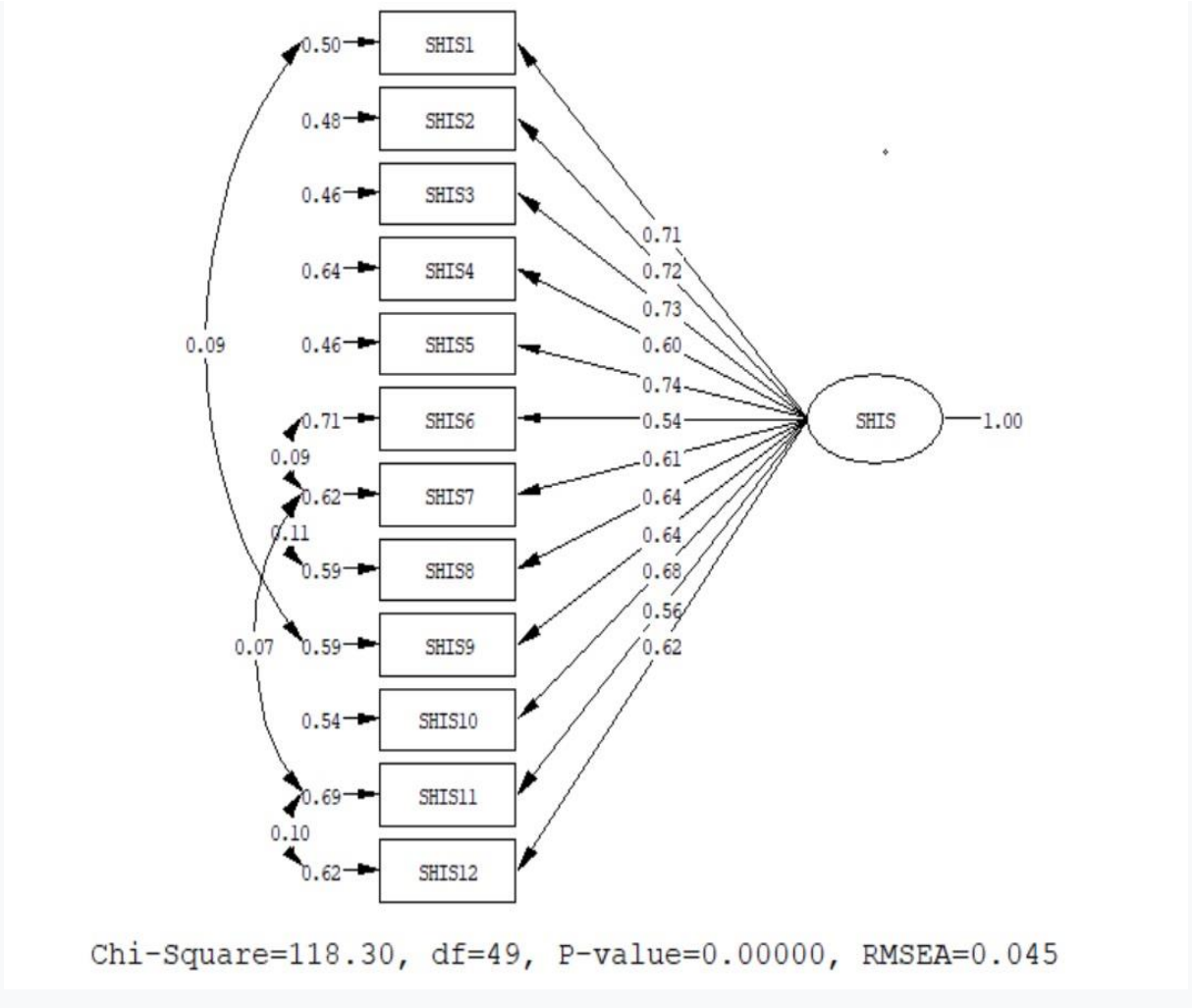

Figure 1. Standardised solution of the path diagram of the conceptual model.

In Figure 2, the t-values of the path coefficients as a result of the hypothesis test are given on the diagram. All items have a positive significant effect on the scale. Indicators that have a significant effect on the scale can be listed as SHIS5, SHIS3, SHIS2, SHIS1, SHIS10, SHIS8, SHIS9, SHIS12, SHIS7, SHIS4, SHIS11 and SHIS6 according to their effect levels. As each indicator score increases, the SHIS total scale score also increases. The most important and largest effect on the scale belongs to SHIS5 (b5=0.74 t=21.94>1.96). It can be said that as the level of concentrating easily (SHIS5) increases, the SHIS scale score also increases. When the entire model is evaluated, the first 3 items that contribute the most are SHIS5 (b5=0.74 t=21.94>1.96), SHIS3 (b3=0.73 t=21.77>1.96) and SHIS2 (b2=0.72 t=21.32>1.96). The least contributing items are found to be SHIS6 (b6=0.54 t=14.61>1.96), SHIS11 (b11=0.56 t=15.35>1.96) and SHIS4 (b4=0.60 t=16.68>1.96). In this model there are significant relationships between SHIS7 and SHIS6, SHIS8, SHIS11, SHIS1 and SHIS9, and also SHIS11 and SHIS12.

Reliability

Internal consistency analysis

Cronbach's α was found to be 0.90.

Test-retest analysis

The test-retest coefficient of SHIS was found to be 0.98($p<0.001$).

DISCUSSION

Validity

Scope validity

When the evaluation catagories of the scale are not symmetrical and there are more than two raters, the Kendall W Good Agreement Coefficient is used. Kendall W value was used to evaluate the opinions of 10 experts in this study. When the Kendall W value is in the range of 0.81-1.00, it is assumed that there is a very good level of fit (Alpar, 2021). In this study, the experts who evaluated the SHIS reached a consensus on the scale items (Kendall W= 0.083 p= 0.437).

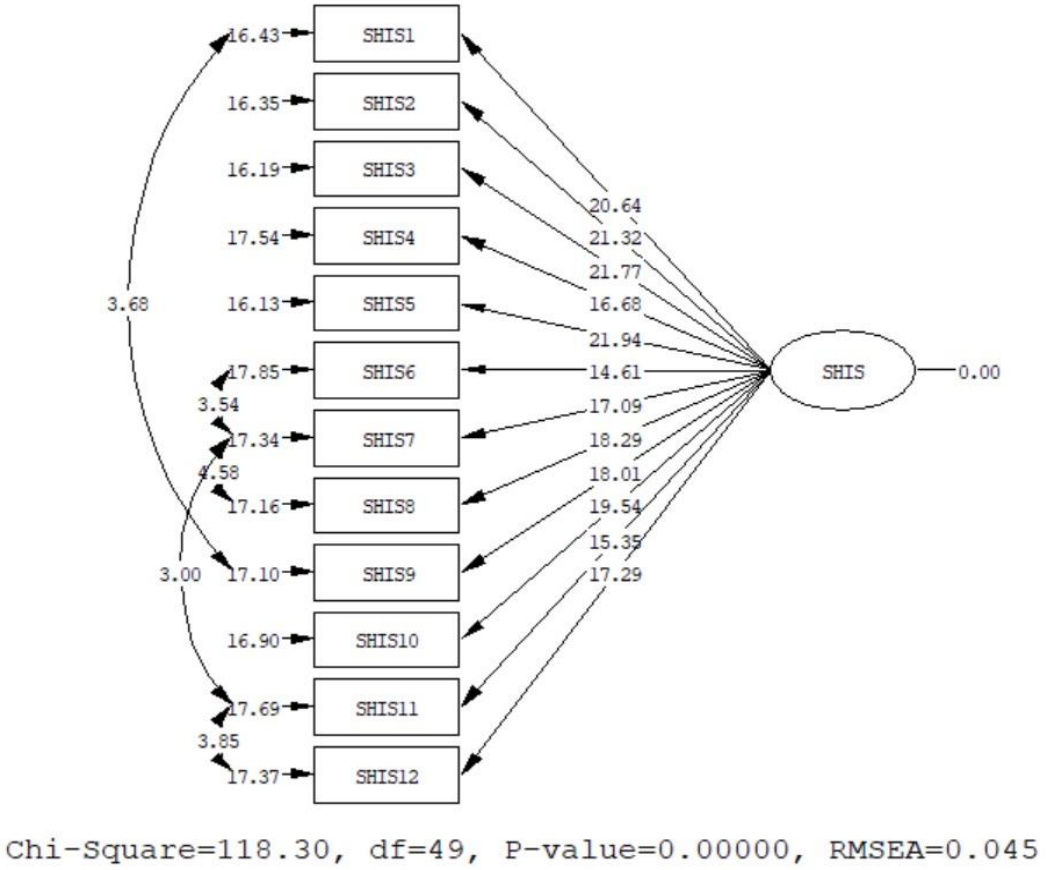

Figure 2. t values of the path diagram of the conceptual model.

Structure validity

Structure validity is the degree to which a test measures a characteristic that cannot be measured directly. One of the methods used to evaluate structure validity is factor analysis (Alpar, 2020 Alpar, 2021). KMO is used to determine suitability for factor analysis and KMO value varies between 0-1. The KMO value is expected to be greater than 0.80, and a value of 0.90-1.00 is considered very good for a sample adequacy (Alpar, 2021). In this research, the sample was considered sufficient for analysis as the KMO value was found to be high at 0.945. Garmy et.al. conducted a validity and reliability study of SHIS in adolescents and found the KMO value to be 0.95 (Garmy et.al., 2017). The sample size was found to be sufficient for both studies.

The BS test value is required to be below 0.50 (Çokluk et al., 2012; Tavşancıl, 2018). In this study it is assumed that the data is suitable for factor analysis if the BS test value is less than 0.05. Garmy et.al found the BS test value to be $p<0.001$ (Garmy et.al., 2017). The results of these two studies support each other.

In this study, MINRES Factor analysis revealed that the scale is one-dimensional and the variance explanation rate of this factor was 47.75%. In one-dimensional scales, the factor required to explain at least 40% of the total variance (Alpar, 2020). Therefore, the explained variance is sufficient. Garmy et.al (2007) conducted a validity and reliability study of the SHIS in an adolescent sample (13-15 years old) and found that SHIS was unidimensional and the explained variance was 66.9%. In an adult sample, as a result of principal component analysis, SHIS was found to be two-dimensional (Bringsén et al., 2009). The interpretation of this difference in scale size could be that it represents the differences between adults and adolescents. Additionally, methodological differences in adaptations in adult and adolescent samples may also explain this result. Bringsén et al. (2009) used principal component analysis with varimix rotation based on the Pearson correlation matrix and used the eigenvalue>1 rule to determine the number of dimensions. This study, as with Garmy et al. (2017) used factor analysis in the validity and reliability study conducted on an adolescent sample. While factor analysis is preferred when a theoretical solution that is original and uncontaminated by error variable is desired, and when an evaluation based on the underlying structures that expect to produce scores on the observed variables of the study is desired, principal component analysis is used when it is simply desired to present an empirical summary of the data set (Tabachnick & Fidell, 2013).

In confirmatory factor analysis, whether the model structure is compatible with the data is determined with the help of fit indice (Çokluk et al., 2012). Although the model obtained from this study was not found to be significant (Chi-square=118.30 df=49 p<0.001), when other model fit indices were examined, the model showed an acceptable fit as $\chi 2$ /df <3 (Cangur & Ercan, 2015). Since RMSEA<0.05 and SRMR<0.05 and CFI; NFI; GFI; AGFI indices are close to 1, it can be said that the model has a good fit (Table 1).

According to the results of this study, all items of the scale were found to have a positive significant effect on the scale. The items that affects the scale most is ASQ5(I could concentrate easily) and the item that affects the least is ASQ6 (I had many ideas, I was creative) (Figure 1-2).

Reliability

Internal consistency analysis

The higher the Cronbach's alpha value, the more consistent the scale items are with each other. The generally accepted value is expected to be 0.60 and above (Alpar, 2020, 2021). This study produced Cronbach's alpha 0.90 and therefore it can be said that SHIS has high reliability. Similarly, while the Cronbach alpha value was 0.93 in the adaptation of SHIS for adolescents, the alpha value was found to be between 0.84 and 0.92 in the adaptation for the adult sample (Bringsén et al.. 2009; Garmy et al., 2017). Acccording to this result, the scale adapted to different samples was found to have high reliability and in this context, it is clear that SHIS shows similar characteristics in both groups.

Test- retest reliability

The test-retest reliability coefficient of this study was 0.98 and therefore it can be said that the adaptation of SHIS into Turkish is reliable. In the study that adapted the SHIS to adolescents, the item-level test-retest reliability Kappa value was found to be between 0.53 and 0.79, while in the adaptation to the adult sample, the reliability coefficents were found to be between 0.44 and 0.67 (Bringsén et al., 2009; Garmy et al., 2017). As a result of both studies, it can be said that the scales are compatible at a moderate level.

Validity and reliability results of SHIS show that the Turkish form of the short and one-dimensional scale can be used to determine the Salutogenic health of adolescents in Türkiye. The acceptability of SHIS as an assessment tool in adolescents was supported in the literature by a similar methodological study by Garmy et al. (2017).

Study Limitations and Strengths

The findings of the research can be generalised to the students with whom the study was conducted. It was assumed that students answered the scale questions sincerely. SHIS is a valid and reliable measurement tool for Turkish adolescents studying in the 7th, 8th and 9th grade of junior and high schools.

CONCLUSION

It was concluded that SHIS is a valid and reliable measurement tool that can be used with Turkish adolescents. It is thought that this scale will contribute to improving the health of adolescents by being used to evaluate their health status.

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Conflict of Interest

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Autonomic Pupillary Light Response in Central Serous Chorioretinopathy

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ABSTRACT
Objective: The aim of the study is to evaluate the autonomic nervous system (ANS) activity by assessing static and dynamic pupillary light responses in central serous chorioretinopathy (CSCR). **Materials and Methods:** A case-control study. Thirty eyes of 30 patients with CSCR who were previously diagnosed in our clinic were included in the study group, and 31 right eyes of 31 healthy participants were included in the control group. All participants underwent a complete ophthalmologic examination. Static and dynamic pupillometry values were measured with the Scheimpflug/Placido photo-based topography system, Sirius topographer (CSO, Firenze, Italy) and pupillary dilation velocities were calculated and compared between the groups. **Results:** The mean scotopic, mesopic, photopic pupil diameters as well as scotopic/photopic ratios were not statistically different in the study and control groups, with values of 4.98±0.87 mm vs. 5.05±0.98 mm, 3.86±0.82 mm vs. 3.86±0.83 mm, 2.94±0.60 mm vs. 2.87±0.57 mm and 1.72±0.20 vs. 1.77±0.22, respectively (p1=0.759, p2=0.997, p3=0.676, p4=0.304). Dynamic pupillometric values were also similar between the groups (p>0.05). Pupillary dilatation velocity was slower in the study group during the 2-4 second interval (p=0.013). **Conclusion:** Pupillary responses mediated by the ANS in CSCR patients are similar to those of healthy participants. This suggests that systemic hormonal factors and local choroidal responses, rather than sympathetic activation, should be prioritized in understanding the pathophysiology of CSCR.
Keywords: Autonomic Nervous System, Central Serous Chorioretinopathy, Pupillary Reflex.

Santral Seröz Koryoretinopati'de Otonom Pupil Işık Yanıtı

ÖZ
Amaç: Çalışmanın amacı santral seröz korioretinopatide (SSKR) statik ve dinamik pupil ışık yanıtlarını değerlendirerek otonom sinir sistemi (OSS) aktivitesini değerlendirmektir**. Gereç ve Yöntem:** Bir vaka-kontrol çalışması. Kliniğimizde daha önce tanı almış 30 SSKR hastasının 30 gözü çalışma grubuna, 31 sağlıklı katılımcının 31 sağ gözü ise kontrol grubuna dahil edildi. Tüm katılımcılara tam bir oftalmolojik muayene yapıldı. Statik ve dinamik pupillometre değerleri Scheimpflug/Placido foto-tabanlı topografi sistemi, Sirius topografı (CSO, Floransa, İtalya) ile ölçüldü ve pupil dilatasyon hızları hesaplandı ve gruplar arasında karşılaştırıldı. **Bulgular:** Çalışma ve kontrol gruplarında ortalama skotopik, mezopik, fotopik pupil çapları ve skotopik/fotopik oranlar istatistiksel olarak farklı değildi; sırasıyla 4,98±0,87 mm ile 5,05±0,98 mm, 3,86±0,82 mm ile 3,86±0,83 mm, 2,94±0,60 mm ile 2,87±0,57 mm ve 1,72±0,20 ile 1,77±0,22 idi (p1=0,759, p2=0,997, p3=0,676, p4=0,304). Dinamik pupillometrik değerler de gruplar arasında benzerdi (p>0,05). Çalışma grubunda pupil dilatasyon hızı 2-4 saniyelik aralıkta daha yavaştı (p=0,013). **Sonuç:** SSKR hastalarında OSS tarafından yönetilen pupilla yanıtları sağlıklı katılımcıların yanıtlarına benzerdir. Bu, SSKR'nin patofizyolojisini anlamada sempatik aktivasyondan ziyade sistemik hormonal faktörler ve lokal koroidal yanıtların önceliklendirilmesi gerektiğini düşündürmektedir.
Anahtar Kelimeler: Otonom Sinir Sistemi, Santral Seröz Koryoretinopati, Pupiller Reflex.

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INTRODUCTION

Central serous chorioretinopathy (CSCR) is defined as serous detachment of the macula and commonly affects males of working age who present to retina clinics with complaints of metamorphopsia and visual impairment (Koizumi et al., 2024). Initially, disruption of the retinal pigment epithelium (RPE) was believed to be the primary cause of the disease (Maumenee, 1965). However, current research with advanced techniques for retinal imaging, like optical coherence tomography (OCT), have supported the hypothesis that choroidal imbalances—such as increased choroidal thickness, vascular dilation in the Haller layer, choriocapillaris dysfunction, and elevated hydrostatic pressure on the RPE—contribute to subretinal fluid leakage (Zhang et al., 2023). Despite these insights, the etiopathogenesis of the disease doesn't remain completely understood. While spontaneous recovery typically occurs within 4–6 months of symptom onset, the condition can sometimes become chronic, leading to RPE and/or photoreceptor atrophy or macular neovascularization, which may result in permanent vision loss (Feenstra et al., 2024).

Unlike retinal vascularity, choroidal vessels are directly influenced by the autonomic nervous system (ANS) (McDougal & Gamlin, 2015). It has been previously suggested that both sympathetic and parasympathetic pathways may be impaired in patients with CSCR (Tewari et al., 2006). Stress is also considered as a significant risk factor for CSCR, it upregulates the sympathetic pathway which leads to choroidal vasodilation and increases hydrostatic pressure (Scarinci et al., 2019; O'Connor et al., 2021). Pupillary light response serves as a reflection of ANS function and is a noninvasive, reproducible, and easily measurable alternative to more challenging tests like heart rate variability (HRV) (Venkata et al., 2020). In this study, we aimed to evaluate ANS activity in CSCR patients by analyzing pupillary response, one of the indicators of its function.

MATERIALS AND METHODS

Study type

This case-control study was conducted at the Ophthalmology Department of Balikesir University in accordance with the ethical standards of the Declaration of Helsinki. The study protocol was approved by ethical committee of the Balikesir University. Informed consent was taken from all participants prior to examinations.

Study group

Patients who have previously been diagnosed with CSCR in our clinic within the last 6 months and healthy controls of similar age and gender were included in the study. CSCR was diagnosed by OCT and fundus fluorescein angiography (FFA) images of the patients. The presence of subretinal fluid in the macula on OCT and typical CSCR leakage pattern on FFA were considered diagnostic. Patients with ocular diseases and conditions such as glaucoma, age-related macular degeneration, uveitis, optic neuropathy, pupillary anomalies, previously cataract surgery, grade 3-4 cataracts, history of any ocular trauma, as well as those with systemic diseases including diabetes, hypertension, heart diseases, thyroidal disorders, or any medication usage that could affect the ANS (e.g. antidepressants, hormones or vitamine supplements), or treatment with steroids in the last 6 months were excluded from the study.

Procedures

All participants went through a comprehensive ophthalmological examination, as well as, the static and dynamic pupillographic values were measured. Best corrected visual acuity (BCVA) was evaluated with the Snellen chart, followed by pupillography assessment by the Scheimpflug/Placido photo-based topography system, Sirius topographer (CSO, Firenze, Italy), using Phonix v2.6 software. After a 5-minute of dark adaptation, pupillary measurements were taken under 0.4 lux illumination for scotopic response, 4 lux for mesopic response, and 40 lux for photopic response (Cankurtaran et al., 2019; Prakash et al., 2016). To minimize accommodative effects, participants were instructed to look straight ahead without focusing on the light source. For dynamic measurements, 500 lux illumination was applied, followed by a gradual dimming of the light to measure the pupillary redilation speed per second (Cankurtaran et al., 2019). Participants were asked to refrain from consuming tea, coffee, cigarettes, or stimulant medications for at least 4 hours before the evaluation. All measurements were performed by the same clinician (YG), between 8:30 and 10:30 am to minimize circadian variabilities. In the study group, measurements were taken from the CSCR-affected eye, or in biateral cases, the more severely affected eye (based on subretinal fluid or chronicity). In the control group, the right eyes of all participants were evaluated. Additionally, a biomicroscopic anterior segment examination, intraocular pressure (IOP) measurement using non-contact tonometry, and fundus examination with non-contact lenses were performed.

Statistical analysis

For statistical analyses, SPSS version 22.0 was used. The Shapiro-Wilk test was applied to assess the normality of the data distribution. Differences in descriptive data between the groups were analyzed using the Chi-square test. The Independent t-test and Mann-Whitney U test were used to compare group results. A p-value of <0.05 was considered statistically significant for all tests.

RESULTS

This study included 30 patients in the study group and 31 healthy participants in the control one. 70.0% (21) in the study group and 54.8% (17) in the control group were male ($p=0.222$). There were no statistically significant differences between the two groups in

terms of age, smoking status, spherical equivalent of refraction, or IOP values (p_1=0.400, p_2=0.906, p_3=0.075, p_4=0.074). Table 1 presents the demographic and clinical characteristics of both groups. In the study group, 14 patients had right, 10 had left, and 6 had bilateral eye involvement and in 25 patients (83.3%), the disease had persisted for more than 6 months.

The mean scotopic, mesopic, and photopic pupil diameters, scotopic/photopic pupil diameter ratios, and the average dynamic pupillometry values measured over 10 seconds are presented in Table 2. No significant differences were found between the groups in terms of static pupil diameters or the scotopic/photopic diameter ratios. Additionally, the velocity of increase in pupil diameter was calculated at 2-second intervals throughout the 10-second period (Table 2). The study group had significantly slower pupil dilation velocity (median 0.13 mm/sec) compared to the control group (median 0.22 mm/sec) specifically during the 2–4 second interval (p = 0.013) (Figure1).

Table 1: Demographic and clinical characteristics of participants and eyes in study and control groups.

	Study group (n=30)	Control group (n=31)	P value
Age (mean±)	49.80±11.19	47.32±11.61	0.400
Gender (M/F)	21/9	17/14	0.222
Smoking (n, %)	14 (46.7%)	14 (45.2%)	0.906
Spheric equivalant (SE, mean±)	0.40±1.04	-0.08±0.65	0.075
Intraocular pressure (IOP, mmHg, mean±)	15.43±3.49	14.03±2.39	0.074
Best corrected visual acuity (BCVA, mean±)	0.76±0.27	0.99±0.02	0.000
Central macular thickness (CMT, µm mean±)	284.03±90.36	234.77±29.82	0.009

Table 2: Static and dynamic pupillometric values and mean pupillary dilatation velocities measured between study and control groups

	Study group (n=30)	Control group (n=31)	P value
Static pupillometry (mm±SD)			
Scotopic	4.98±0.87	5.05±0.98	0.759
Mesopic	3.86±0.82	3.86±0.83	0.997
Photopic	2.94±0.60	2.87±0.57	0.676
Scotopik/photopic ratio	1.72±0.20	1.77±0.22	0.304
Dynamic pupillometry (mm±SD)			
0th second	2.99±0.58	2.95±0.49	0.757
2nd second	4.17±0.75	4.05±0.77	0.547
4th second	4.46±0.86	4.47±0.79	0.937
6th second	4.67±0.87	4.67±0.89	0.985
8th second	4.83±0.90	4.77±0.93	0.804
10th second	4.89±0.90	4.89±0.88	0.984
Pupillary dilatation velocity (mm/sec, median, minimum-maximum)			
0-2 second	0.60 (0.40-0.88)	0.52 (0.26-0.94)	0.147
2-4 second	0.13 (-0.06-0.50)	0.22 (-0.07-0.35)	0.013
4-6 second	0.11 (-0.07-0.23)	0.07 (-0.06-0.29)	0.591
6-8 second	0.07 (-0.08- 0.33)	0.06 (-0.09-0.31)	0.430
8-10 second	0.4 (-0.08-0.11)	0.03 (-0.09-0.51)	0.954

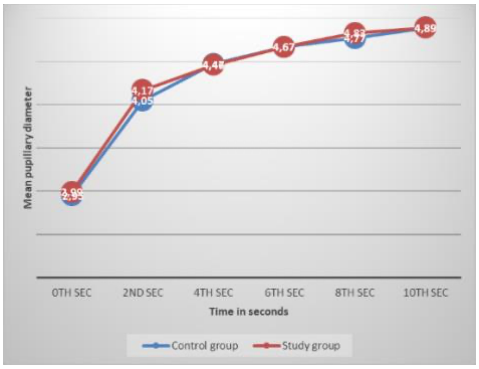

Figure 1: Mean pupil diameters measured in dynamic pupillometry in study and control groups.

DISCUSSION

Unlike retinal vessels, choroidal vessels are under the control of the ANS (McDougal & Gamlin, 2015). The ANS influences the sphincter pupillae muscle via parasympathetic innervation through the ciliary ganglion, resulting in miosis, and the dilator pupillae muscle via postsynaptic sympathetic innervation from the superior cervical ganglion, causing mydriasis. It is known that choroidal vascularity is impaired in CSCR patients (Min et al., 2018). Limited studies assessing HRV have suggested an imbalance in sympathetic and parasympathetic pathways in these patients, with increased sympathetic activity and decreased parasympathetic activity (Tewari et al., 2006; Hwang et al., 2024). Additionally, Zhou et al. examined pupillary light response, task-evoked pupillary responses, and HRV in CSCR patients, detecting sympathetic activation and reduced parasympathetic function in this population (Zhou et al., 2022). In the present study, pupillary light responses in eyes with CSCR were evaluated both statically-under scotopic, mesopic, and photopic conditions-, and dynamically, and were compared with the healthy eyes. No statistically significant differences were observed. However, the absence of sympathetic activation in pupillary light response is insufficient to conclude that the ANS is ineffective in CSCR. The ANS operates through extensive central and peripheral pathways (Gibbons, 2019). While cardiac autonomic functions assessed via HRV have been reported to correlate with pupillary light response (Venkata et al., 2020), the choroidal vascular effects may involve distinct pathways. Moreover, attributing CSCR etiopathogenesis solely to ANS dysfunction is inadequate. Leclercq et al. reported that all choroidal vessels are under neuronal control and that mineralocorticoid receptor overexpression may lead to changes in neuronal intracellular organelles and myelin, causing choroidal neuropathy and pachychoroid appearance (Leclercq et al., 2023). These findings suggest that systemic hormonal and local neuronal disruptions may play a more dominant role in CSCR pathophysiology.

Dynamic pupillometry allows the observation of pupillary responses during the transition from photopic to scotopic conditions, providing valuable insights, particularly into sympathetic pathways in terms of timing and velocity. In this study, pupillary diameters were measured at 2-second intervals over a total duration of 10 seconds. No significant differences were observed in pupillary diameters or dilation velocities between the groups, except for a slower dilation velocity in the 2–4 second interval in the study group. In our opinion, this difference in dilation velocity during the 2–4 second interval may be incidental when evaluated alongside other markers. Pupillary responses have previously been used to assess autonomic activity in diabetic patients and those with erectile dysfunction (Cankurtaran et al., 2019; Jain et al., 2018). However, the pupillary response represents only a single component of the ANS. In CSCR, the ANS may also exert its effects through vascular pathways, or local autoregulatory and non-neuronal mechanisms may play a role.

Study Limitations and Strengths

The primary limitation of our study is the small sample size. Additionally, commonly used tests for evaluating the ANS, such as HRV, were not performed. Most of the patients in the study group had chronic CSCR. Autonomic sympathetic activity may be a risk factor in the initial development of the disease, the condition might become chronic over time due to RPE and choroidal damage, even after sympathetic activity normalizes.

CONCLUSION

In conclusion, no significant differences were found in autonomic pupillary responses between CSCR patients and healthy participants. This suggests that systemic hormonal factors and local choroidal responses may play a more critical act in the pathophysiology of CSCR than sympathetic activation. Further studies with larger patient groups and evaluations of other components of the ANS are needed.

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Conflict of Interest

The author declare no potential conflicts of interest with respect to the research, authorship and/or publication of this article.

Author Contributions

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The Effect of Kisspeptin-10 on Cisplatin-Induced Testicular Oxidative Stress

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ABSTRACT
Objective: Cisplatin, one of the anticarcinogenic drugs, causes damage to spermatogenic cells, sertoli cells and leydig cells. This study aimed to investigate the kisspeptin-10 effect against oxidative stress caused by cisplatin in male reproductive organs and its negative effects on spermatological parameters. **Materials and Methods:** In the experiment, 34 male Sprague Dawley rats were used. Rats were divided into 4 groups as control, cisplatin, kisspeptin-10 and cisplatin+kisspeptin-10. Cisplatin 5 mg/kg/single dose and kisspeptin-10 50 nmol/kg dose were administered intraperitoneally for 7 days. **Results:** In the cisplatin group, testicular malondialdehyde level increased ($p<0.001$), catalase enzyme activity ($p<0.001$) and glutathione level ($p<0.01$) decreased, sperm motility ($p<0.05$) and testicular ($p<0.01$) and seminal vesicle ($p<0.001$) weights decreased. In the cisplatin group administered kisspeptin-10, it was determined that testicular malondialdehyde level decreased ($p<0.001$), glutathione level increased ($p<0.01$), sperm motility increased ($p<0.05$), and testicular ($p<0.01$) and seminal vesicle ($p<0.001$) weights increased compared to the cisplatin group. **Conclusion:** As a result, it was revealed that Kisspeptin-10 showed improving effects on spermatological parameters by reducing oxidative stress that is effective in cisplatin-induced testicular damage.
Keywords: Cisplatin, Testes, Kisspeptin-10, Oxidative Stress.

Sisplatinin Neden Olduğu Testikular Oksidatif Stres Üzerine Kisspeptin-10'un Etkisi

ÖZ
Amaç: Antikanserojen ilaçlardan biri olan sisplatin, spermatogenik hücrelerde, sertoli hücrelerinde, leydig hücrelerinde hasara yol açmaktadır. Bu çalışmada, sisplatinin erkek üreme organlarında neden olduğu oksidatif stres ve akabinde gelişen spermatolojik parametreler üzerindeki olumsuz etkilere karşı kisspeptin-10'un etkisinin araştırılması amaçlandı. **Gereç ve Yöntem:** Deneyde 34 adet erkek Sprague Dawley ırkı sıçan kullanıldı. Ratlar kontrol, sisplatin, kisspeptin-10 ve sisplatin+kisspeptin-10 olarak 4 gruba ayrıldı. Sisplatin 5 mg/kg/tek doz, kisspeptin-10 ise 50 nmol/kg dozda 7 gün boyunca intraperitoneal uygulandı. **Bulgular:** Sisplatin grubunda testikular malondialdehit düzeyinin arttığı ($p<0.001$), katalaz enzim aktivitesinin ($p<0.001$) ve glutatyon düzeyinin ($p<0.01$) azaldığı, sperm motilitesinin ($p<0.05$) ve testis ($p<0.01$) ile vezikula seminalis ($p<0.001$) ağırlıklarının azaldığı belirlendi. Sisplatin grubu ile kıyaslandığında Kiss-10 uygulanan sisplatin grubunda testikular malondialdehit düzeyinin azaldığı ($p<0.001$), glutatyon düzeyinin arttığı ($p<0.01$), sperm motilitesinin ($p<0.05$) ve testis ($p<0.01$) ile vezikula seminalis ($p<0.001$) ağırlıklarının arttığı belirlendi. **Sonuç:** Kisspeptin-10'un sisplatin kaynaklı testikular hasarda etkili olan oksidatif stresi azaltarak, spermatolojik parametreler üzerinde iyileştirici etkiler gösterdiği kanısına varılmıştır.
Anahtar Kelimeler: Sisplatin, Testis, Kisspeptin-10, Oksidatif Stres.

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INTRODUCTION

One of the main causes of testicular toxicity leading to permanent or temporary infertility is chemotherapeutic agents used in cancer treatment. One of the important chemotherapeutic agents used in the treatment of various cancers is cisplatin (CP) (Kostova, 2006). However, CP has side effects such as ototoxicity, nephrotoxicity, cardiotoxicity, gastrointestinal, hepatotoxicity and reproductive dysfunction (Atessahin et al., 2006; Ilbey, Ozbek, Cekmen, et al., 2009) It was reported that testicular toxicity due to CP administration is an important problem in men due to the high mitotic activity of spermatogenic cells. It has been shown that cisplatin exposure can cause azoospermia, abnormal sperm, impaired spermatogenesis and a decreased testosterone levels in rats (Ilbey et al., 2009), as well as oxidative stress characterized by histological changes in testicular tissue, increased lipid peroxidation and decreased antioxidant system (Ilbey et al., 2009). It has been suggested that testicular redox balance is disrupted by CP exposure (Antunes et al., 2001; Ilbey et al., 2009).

Kisspeptin neuropeptides are transcribed by the Kiss-1 gene (1q32) (Lee et al., 1996). Since the products of the Kiss-1 gene suppress metastasis of breast cancer and melanoma, the 54 amino acid product of the Kiss-1 gene has been named "metastin" (Gottsch et al., 2006). In later studies, shorter fragments of kisspeptin-54 were also identified and all of these were called "kisspeptins". All of these products are activated by binding to the GPR54 receptor (Shahed & Young, 2009). Known derivatives of kisspeptin are kisspeptin-10, 13, 14, 52 and 54. Kisspeptin-10 (KISS-10) is secreted from cultured human trophoblast cells and contains the C-terminal decapeptide-10. Kisspeptins are known to play an important role in puberty and fertility (Mikkelsen et al., 2009). Kisspeptin administration has been reported to stimulate the hypothalamic-pituitary-gonadal axis (HPG) (Dhillo et al., 2005). Signals generated by the binding of kisspeptins to GPR54 receptors on gonadotropin-releasing hormone (GnRH) neurons in the hypothalamus enable the release of GnRH into the portal pituitary circulation. Studies have reported that peripheral kisspeptin-10 administration is effective on LH and FSH concentrations (Shahab et al., 2005; Thompson et al., 2004)

Reactive oxygen species (ROS) play important roles in normal physiology. However, their excessive production causes oxidative stress. Various mechanisms, including antioxidant enzyme systems such as catalase and glutathione peroxidase, protect cells from damage caused by ROS. The relationship between gonadotropins and oxidative stress has been shown in many studies. (Hurtado de Catalfo et al., 2007; Muthuvel et al., 2006). Studies show that kisspeptin provides protection against oxidative damage (Akkaya et al., 2017; Güvenç & Aksakal, 2018). The purpose of this study was to examine the effect of kisspeptin-10 against oxidative stress caused by CP in male reproductive organs and the resulting negative effects on spermatological parameters.

MATERIALS AND METHODS

Experimental animals

The study was conducted in accordance with applicable rules regarding animal experimentation and animal welfare. Sprague Dawley male rats were obtained from Fırat University Experimental Research and Application Center. A total number of 34 male rats with an average weight of 200-250 g and 10-12 weeks old were used.

Experimental design

Experimental procedures were carried out in accordance with the conditions for the care and use of laboratory animals (12 hours of light: 12 hours of darkness and 24±3°C). Standard commercial rat pellet feed and tap water were provided ad libitum to the rats during the experimental procedure. After a one-week adaptation period, the rats were divided into 4 groups as fallows. Control group (n=7): A single dose of saline was administered intraperitoneally for 7 days. Kisspeptin-10 Group (KISS-10: n=7): Kisspeptin 50 (Novopro 316777) nmol/kg/single dose (Güvenç & Aksakal, 2018) was dissolved in saline and administered intraperitoneally for 7 days. Cisplatin Group (CP: n=10): Cisplatin (Koçak Farma) 5 mg/kg/single dose (Mercantepe et al., 2018) was administered intraperitoneally at the beginning of the study. Cisplatin+ Kisspeptin-10 Group (CP+KISS-10: n=10) At the beginning of the study, cisplatin 5 mg/kg/single dose was administered intraperitoneally and then Kisspeptin 50 nmol/kg/single dose was dissolved in saline and administered intraperitoneally for 7 days.

Oxidative stress analyses

Testicular tissues were weighed and transferred to glass tubes while maintaining their cold temperatures. 1/10 lysis buffer was added to the tissues. The tissues were kept cold and homogenized in a homogenizer. This homogenate was centrifuged at 4000 rpm for 60 minutes in at +4 °C cooled centrifuge to obtain the supernatant (Arkali et al., 2021). Malondialdehyde (MDA), catalase (CAT), glutathione (GSH) and glutathione peroxidase (GSH-Px) levels were determined from the supernatants. Lipid peroxide (MDA) was determined according to the spectrophotometric method described by Placer et al (Placer ZA, . 1966). MDA levels were reported in nmol g^{-1} of tissue. Catalase activity in the testicle was measured using the spectrophotometric method described by Goth (Goth, 1991) Catalase enzyme activity was expressed as kU g^{-1} protein. The GSH level in the tissue was measured using the spectrophotometric method described by Sedlak and Lindsay (Sedlak & Lindsay, 1968). GSH levels were reported in nmol g^{-1} of tissue. GSH-Px enzyme activity in in the testicle was determined according to the spectrophotometric method described by

Lawrence et al (Lawrence & Burk, 1976). GSH-Px enzyme activity was expressed as IU g^{-1} protein. The Lowry method was used to measure the total protein content in the testis (OH, 1951).

Spermatological analyses

Sperm motility was assessed using the method outlined described by Sönmez et al. and Türk et al. after reconstitution of spermatozoa obtained by obtaining sections from the left cauda epididymis with Tris buffer solution [Tris (hydroxymethyl) aminomethane 3.63 g, glucose 0.50 g, citric acid 1.99 g and distilled water 100 ml] (Sönmez et al., 2005; Türk et al., 2007). The same method was used to determine sperm density in the cauda epididymis tissue (Sönmez et al., 2005; Türk et al., 2007). Abnormal spermatozoon ratio was determined by examining a total of 200 spermatozoa in frotis and expressing head, tail and total abnormal spermatozoon ratio as percentage according to the method described by Sönmez et al. and Türk et al. (Sönmez et al., 2005; Türk et al., 2007)

Statistical analyses

Shapiro-Wilk normality analysis was used to determine whether the values obtained as a result of the study were normally distributed. Shapiro-Wilk normality analysis was performed. Accordingly, group means of normally distributed data were tested with one-way ANOVA. Differences between groups were determined with Duncan test. Significance level $p<0.05$ was accepted. IBM SPSS Statistics 22 package program was used for statistical analyses. Data were given as Mean ± Standard Deviation (X±SD).

Ethics committee approval: This study was carried out at Fırat University Experimental Research Center with the "permission dated 16.04.2022 and numbered 2022/06" of the Fırat University Animal Experiments Local Ethics Committee

Study limitations and strengths

Because of the budget constraint, we were not able evaluate the pathology of testes and Johnsenscore**.**

RESULTS

Body Weight Results

Compared to the control group, final body weight decreased in the CP and CP+KISS-10 groups ($p<0.001$). There was no significant difference in CP+KISS-10 group compared to CP group ($p>0.05$) (Figure 1).

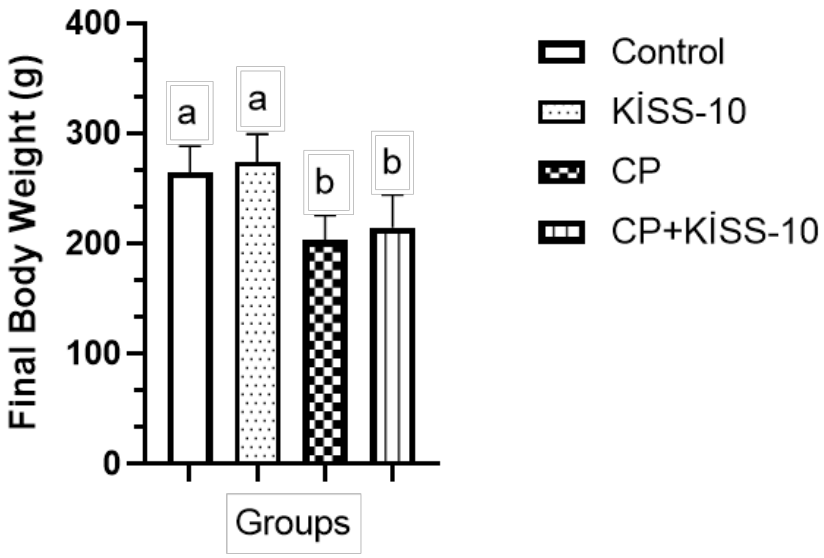

Figure 1. Final body weight (g) values at the end of the study. Data are given as mean and standard deviation. [a,b]: The difference between the groups with different letters is statistically significant.

Oxidative Stress Results

Compared to the control group, MDA level increased ($p<0.001$), GSH level and CAT enzyme activity decreased ($p<0.001$) in the CP group. Compared to the CP group, MDA level decreased ($p<0.001$), GSH level increased ($p<0.001$) and CAT enzyme activity did not differ statistically in the CP+KISS-10 group ($p>0.05$). Compared to the control group, MDA level decreased in KISS-10 group ($p<0.001$). It was determined that there was no statistically significant in GSH-Px activity between the groups ($p>0.05$) (Table 1).

Spermatologic Parameter Results

When compared with the control group, motility decreased in the CP group ($p<0.05$). Compared to the CP group, motility increased in CP+CISS-10 group ($p<0.05$). There was no difference between the groups in sperm concentration, head-tail and total abnormal spermatozoon ratios ($p>0.05$) (Table 2). When the absolute reproductive organ weights were analyzed, testis ($p<0.01$) and vesicula seminalis ($p<0.001$) weights decreased in the CP group compared to the control group. Compared to the CP group, testis increased in the CP+KISS-10 group. Compared to the

control group, there was an increase in the ventral prostate weight in the KISS-10 group (p<0.01). There was no difference between the groups in epididymis and right cauda epididymis weights (p>0.05) (Table 3).

Table 1. Testicular tissue malondialdehyde (MDA) and glutathione (GSH) levels and glutathione peroxidase (GSH-Px) and catalase (CAT) enzyme activity levels.

	MDA (nmol g^{-1} tissue)	GSH (nmol g^{-1} tissue)	GSH-Px (IU g^{-1} prot)	Katalaz (kU g^{-1} prot)
Control	35.19±3.06 [b]	1.97±0.19[a]	17.68±1.47	2.92±0.54[a]
KİSS-10	25.64±5.36[c]	2.16±0.29[a]	19.59±1.47	3.51±1.15[a]
CP	40.68±2.90[a]	1.67±0.07[b]	18.44±1.74	2.05±0.34[b]
CP+KİSS-10	35.79±2.27[b]	1.95±0.13[a]	17.73±1.83	1.93±0.30[b]
Significant	**p<0.001**	**p<0.01**	**p>0.05**	**P<0.001**

Data are presented as mean ± standard deviation. [a,b,c]: The difference between groups with different letters in the same column is statistically significant means.

Table 2. Spermatologic parameters.

Groups	Motility (%)	Sperm Concentration (million/right cauda epididymis)	Abnormal Spermatozoon Rate (%)		
			Head	Tail	Total
Control	70.95±18.12[a]	91.14±14.91	8.20±3.38	6.40±2.04	14.60±1.87
KİSS-10	69.99±16.77[a]	106.66±24.04	6.33±2.28	7.20±1.21	14.36±3.27
CP	45.55±18.18[b]	78.44±24.04	9.72±3.75	8.14±2.59	17.86±4.73
CP+KİSS-10	65.55±13.84[a]	89.33±31.98	7.77±3.45	7.66±3.75	15.44±4.17
Significant	**p<0.05**	**p>0.05**	**p>0.05**	**p>0.05**	**p>0.05**

Data are presented as mean ± standard deviation. [a,b]: The difference between groups with different letters in the same column is statistically significant means.

Table 3. Absolute reproductive organ weights (g).

Groups	Testes (Right +Left)/2	Epididymis (Right +Left)/2	Right Cauda Epididymis	Vesicula Seminalis	Ventral Prostate
Control	1.31±0.10[a]	0.45±0.05	0.18±0.03	1.08±0.10[a]	0.15±0.05[b]
KİSS-10	1.37±0.13[a]	0.48±0.06	0.19±0.05	1.19±0.12[a]	0.24±0.07[a]
CP	1.10±0.09[b]	0.40±0.03	0,17±0.01	0.52±0.16[c]	0.12±0.03[b]
CP+KİSS-10	1.26±0.18[a]	0.42±0.06	0,18±0.03	0.72±0.15[b]	0.14±0.04[b]
Significant	**p<0.01**	**p>0.05**	**p>0.05**	**p<0.001**	**p<0.01**

Data are given as mean ± standard deviation. [a,b,c]: The difference between groups with different letters in the same column is statistically significant.

DISCUSSION

The use of chemotherapy drugs causes harmful side effects and organ toxicity in the body. One of the tissues damaged by chemotherapeutic drug use is the testicular tissue (Azarbarz et al., 2020). Cisplatin causes severe dysfunction in male reproductive function, limiting the clinical use of CP. Cisplatin toxicity triggers oxidative stress and activates inflammation cascade in testicular tissue (Türk et al., 2008). The purpose of this study was to examine the effect of Kisspeptin-10 administration, which has been increasingly studied due to its antioxidant properties, against gonadotoxic side effects that may occur with cisplatin administration in male rats.

In clinical trials, azoospermia, impaired fertility and decreased male reproductive activity have been observed in men receiving cisplatin-based chemotherapy (Brenner et al., 1985; Hansen et al., 1990). Previous animal studies have also shown that cisplatin has harmful effects on spermatogenesis, especially on spermatocytes and spermatozoa (Kinkead et al., 1992; Oshio et al., 1990). In rats, a dose-dependent decrease in spermatogenesis, sperm count, sperm motility and fertility was found after cisplatin treatment (Kinkead et al., 1992). In experimental studies, low doses of cisplatin such as 1.1-2.5 mg/kg were reported to be selectively toxic to spermatogonia, while higher doses such as 10-20 mg/kg were reported to have toxic effects on spermatocytes and spermatids (Cherry et al., 2004; Mercantepe et al., 2018). Therefore, in order to reduce the side effects of these high doses, a single intraperitoneal dose of cisplatin at 5 mg/kg was used in this study. In this study, only the decrease in motility was statistically significant in the CP group compared to the control group (Table 2). The decrease in sperm concentration and increase in abnormal spermatozoon rates were not statistically significant (Table 2). Türk et al. reported that a single dose of 7 mg/kg i.p. cisplatin decreased epididymal sperm concentration and motility and increased sperm morphology abnormalities (Türk et al., 2008). Çiftci et al. reported a decrease in sperm concentration and sperm motility, no difference in head and tail abnormal spermatozoon, but an increase in total abnormal spermatozoon ratio after a single dose of 5 mg/kg cisplatin (Ciftci et al., 2011). These different results in sperm parameters after cisplatin administration are thought to be related to the dose of cisplatin used and the time elapsed after administration.

Reproductive organ weights play an important role in determining CP-induced male reproductive toxicity (Soni et al., 2016). In this study, testicular and vesicular seminalis weights in the CP group were found to be significantly lower than in the control group (Table 3) and these data are consistent with the data of many studies (Abdel-Wahab et al., 2021; Azarbarz et al., 2020). The decrease in testicular weights at the end of the study is thought to be due to severe testicular parenchymal atrophy and spermatogenic injuries after CP administration. The significant decrease in testicular weight of CP-treated rats compared to the control group suggests that CP has a detrimental effect on the function and structure of the testes (Wang et al., 2021). In some additional studies, researchers reported that CP administration caused a significant increase in the testicular weight of rats. This is contrary to the results of the present study. It is thought that this may vary depending on the extent to which the histological structure of the testis is affected and the dose and duration of cisplatin (Yucel et al., 2019).

Although there are many factors in CP-induced gonadal toxicity, oxidative stress has been reported to be one of the main causes. CP-induced oxidative stress causes male infertility by reducing sperm function (Ateşşahin et al., 2006). It has been reported that cisplatin treatment induced excessive amounts of ROS in rat testes, which decreased antioxidant activities and increased lipid peroxidation (Casares et al., 2012; Kohsaka et al., 2020). In this study, in accordance with previous studies (Casares et al., 2012; Kohsaka et al., 2020), there was a deterioration in the oxidative status in the CP-treated group due to a decrease in GSH and catalase enzyme levels parallel to an increase in testicular malondialdehyde levels (Table 1), and this is thought to be related to decreased sperm quality in this group.

Studies on the effects of kisspeptin on the HPG axis and the reproductive system are increasing day by day (Dhillo et al., 2007; George et al., 2011). In recent years, studies have been conducted on whether this peptide has antioxidant effects (Akkaya et al., 2014; Aslan et al., 2017). In a study, it was suggested that kisspeptin may reduce testicular lipid peroxidation and may have an antioxidant effect (Akkaya et al., 2017). In another study, it was reported that kisspeptin-10 administration showed antioxidant properties in methotrexate-induced testicular damage (Güvenç & Aksakal, 2018). In this study, Kisspeptin-10 administration was shown to have antioxidant effect by decreasing the CP-induced increase in MDA level and increasing GSH level in testicular tissue (Table 1). In this respect, the study is in parallel with the previous studies (Akkaya et al., 2017; Güvenç & Aksakal, 2018). The HPG axis is stimulated by Kisspeptin-10 or kisspeptin-54 (Dhillo et al., 2005; George et al., 2011). In a study, Kisspeptin and its receptor were reported to be localized in epididymal sperm (Mumtaz et al., 2017). A positive correlation between overall kisspeptin levels and sperm concentration, sperm count and motility was first demonstrated in a study by Zou et al. (Zou et al., 2019). As a result of the studies, Kisspeptin has been reported to have a positive effect on testicular function, but some studies also indicate that Kisspeptin administration has an inhibitory effect (Mumtaz et al., 2017; Pinilla et al., 2012). Administration of Kisspeptin for more than 30 days

has been reported to cause testicular degeneration (Abbara et al., 2015). This is thought to be due to desensitization of the hypothalamic pituitary axis due to desensitization of the GPR54 receptor (KISS1R) by chronic use of Kisspeptin. Studies investigating the effects of exogenous administration of Kisspeptin-10 on the male reproductive system are increasing (Aytürk et al., 2017; Feng et al., 2019). In this study, increased sperm motility was observed in the CP+Kiss-10 group compared to the CP group (Table 2).

In conclusion, when Kisspeptin-10 hormone was administered exogenously, it was found to reduce CP-induced testicular damage through its anti-antioxidant activity. This peptide may be effective in male fertility by reducing oxidative stress. However, further examination of the antioxidant effect of different forms and analogs of kisspeptin on the male reproductive system will provide more specific data and thus allow for more data to be obtained.

Conflict of Interest

The author declare no potential conflicts of interest with respect to the research, authorship and/or publication of this article.

Author Contributions

Plan, design: GA, **Material, methods and data collection:** GA, TCA, MA, AY, MÇ; **Data analysis and comments:** GA, EGE, MS, TCA, FBK **Writing and corrections:** GA, MÇ, MA, FBK.

Ethical Approval

Institution: Fırat University Experimental Research Center
Date: 16.04.2022
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The Reflections of Nursing Students, the Future COVID-19 Pandemic Warriors: A Qualitative Evaluation on Fear Appeal

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ABSTRACT
Aim: The aim of this study is to determine what nursing students, the future health professionals, think about the concept of "COVID-19 Pandemic". **Material and Methods:** This qualitative study employed the Word Association Test (WAT) as a data collection tool to obtain the reflections regarding COVID-19 Pandemic among the first and the second-year students, and the concept of "COVID-19 Pandemic" was defined through face-to-face interviews carried out with the volunteering students (n=97). **Results:** Analysis of data collected from 97 nursing students regarding COVID-19 Pandemic yielded five main categories: Perceived threat assessment [frequency, f=144], coping response [f=134], mask/distance/cleaning [f=189], special connotations for COVID-19 disease [f=57], and restrictions/bans [f=45]), based on the reflections that the term "COVID-19 Pandemic" evoked among the students. **Conclusion:** The qualitative assessment conducted in this study with nursing students may provide a different perspective on the handling of fear and threat perception through motivation.
Keywords: COVID-19 Pandemic, Nursing Student, Theory.

Geleceğin COVID-19 Pandemi Savaşçıları Hemşirelik Öğrencilerinin Düşünceleri: Korku Çekiciliği Üzerinden Nitel Bir Değerlendirme

ÖZ
Amaç: Bu çalışmanın amacı geleceğin sağlık profesyonelleri olan hemşirelik öğrencilerinin "COVID-19 Pandemisi" kavramı hakkında ne düşündüklerini belirlemektir. **Gereç ve Yöntemler:** Bu nitel araştırmada, 1. ve 2. sınıf öğrencilerinin COVID-19 Pandemisine ilişkin yansımalarını elde etmek amacıyla veri toplama aracı olarak Kelime İlişkilendirme Testi (WAT) kullanılmış ve "COVID-19 Pandemisi" kavramı yüz ifadeleri aracılığıyla tanımlanmıştır. Gönüllü öğrencilerle (n=97) yüz yüze görüşmeler yapıldı. **Bulgular:** 97 hemşirelik öğrencisinden COVID-19 Pandemisine ilişkin toplanan verilerin analizi sonucunda beş ana kategori ortaya çıktı: Algılanan tehdit değerlendirmesi [frekans, f=144], başa çıkma tepkisi [f=134], maske/mesafe/temizlik [f=189], "COVID-19 Pandemisi" teriminin öğrencilerde uyandırdığı yansımalardan hareketle, COVID-19 hastalığına ilişkin özel çağrışımlar [f=57] ve kısıtlama/yasaklamalar [f=45] yapılmıştır. **Sonuç:** Bu çalışmada hemşirelik öğrencileriyle yapılan niteliksel değerlendirme, korku ve tehdit algısının motivasyon yoluyla ele alınması konusunda farklı bir bakış açısı sağlayabilir.
Anahtar Kelimeler: COVID-19 Pandemisi, Hemşirelik Öğrencisi, Teori.

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INTRODUCTION

The coronavirus disease 2019 (COVID-19) has caused great concern in the healthcare sector worldwide due to the high number of confirmed cases, while highlighting the crucial importance of the nursing profession for the healthcare system and humanity. Even on social media, nurses were portrayed as superheroes selflessly combating the COVID-19 pandemic (Williams, 2020). "In a study conducted on the experiences of nurses working in COVID-19 services, nurses stated: 'It was difficult, but our struggle to touch a life gave us great strength', which emerged as a personal statement." One particular study highlighted that nurses experienced professional satisfaction and motivation when they are on the front line of battle (Deliktas Demirci et al., 2021). It is said that nurses, with their unique knowledge and skills, can contribute to a more peaceful and equal future for everyone beyond healthcare, whether it's big issues like global warming or virus-borne diseases like the coronavirus (Catton, 2022).

So, what do nursing students who will be the ones to fight in case of another pandemic think? What are their experiences of the COVID-19 pandemic and observations on the battle fought against the disease so far?

Overview of Protection Motivation Theory-(PMT)

For community-focused care, particularly in public health studies, theories and models are employed during the course of program planning to better understand and explain health behavior and to guide processes while identifying, developing, and implementing the related interventions. It has been stated that theories and models about individual, institutional and social changes will prove useful (Rootman et al., 2011). Therefore, using theories/models in research can contribute positively to the concept of health by asking questions with a broader perspective on factors affecting health and creating new options for prevention (Hovell et al., 2002). The Conservation Motivation Theory is a version and extension of the Health Belief Model, which incorporates various evaluation processes determined by research on coping with stress. Proposed to explain the effects of fear on attitudes and health behavior, the theory was developed by Ronald Rogers in 1975 to better understand how and why individuals respond to potential threats to their health and safety (Clubb & Hinkle, 2015). Rogers stated that while the use of threatening messages in advertisements and social marketing is widespread, research has not been able to fully reveal how this works, leading him to come up with his theory to understand the concept of fear appeal.

According to the theory, people initially examine the badness of an event publicised in the advertisements together with the probability of it happening to them, and then they measure to what extent they can fight against the event and ultimately decide whether to change their corresponding behavior. In other words, when people receive a message containing a fear appeal, they do not change their attitude if the harm/fearsomeness of the events described is unbelievable or if the event seems far from being possible or if the suggested course of action is thought to be insufficient to cope with the threat. Rogers describes his theory as a motivational theory of fear appeal and attitude change towards protection. According to the model, individuals primarily cognitively evaluate the available information about the severity of a danger, they then evaluate the possibility of the emergence of the danger and then evaluate whether the fight with the behavior will eliminate the danger and if so, whether they will have the capacity to fight (Cakar, 2009).

Objective

In this context, the aim of this study is to determine what nursing students who will become future health professionals soon think of the concept of "COVID-19 Pandemic."

MATERIALS AND METHODS

Setting and design

This study is a conceptual evaluation using the Word Association Test (WAT) to explore the attitudes of nursing students, who are likely to play a role in future pandemic response measures, towards the concept of the 'COVID-19 pandemic' that has been part of their lives for about two years. The Word Association Test (WAT) is a way typically utilized in psychology to discover an individual's internal world. The association test serves as an instrument for determining the relational meaning of a stimulus word or the connection between stimulus words. These institutions screen participants` verbal memories, notion patterns, emotional states, and persona traits (Deese, 1962). A qualitative research model was employed to examine nursing students' reflections on the concept of the 'COVID-19 Pandemic' in a practical and comprehensive manner. Qualitative studies, which allow in knowledge evaluations and perceptions, make use of diverse statistics series methods, along with observation, interviews, and record evaluation (Rees et al., 2002).

Selection of participants

In our faculty, all nursing students at the time of research took classes (at least 2 hours) about the COVID-19 Pandemic and had the opportunity to observe COVID-19 patients in practice. To minimize bias in the study, only volunteers were included. The study was concluded upon reaching data saturation, which occurred when the participating students began to provide repetitive data (after 81 students). Written consent was directly obtained from all participants.

Study sample (n=97)

Of the nursing students (n=97) participating in the study, 76 were female, 20 were male, and one of them did not wish to specify any gender. The student

population was between the ages of 18-22, 10 of whom were 18 years old, 30 were 19 years old, 31 were 20 years old, 18 were 21 years old, and 8 were 22 years old at the time of study. On the other hand, while most of them (n=60) lived with their parents-siblings/nuclear family, 20 lived at home with their friends, 10 lived alone, 7 lived with a single parent. 16 students expressed their income less than their expenses, while again 16 students expressed an income more than their expenses, and 65 expressed an income equal to their expenses. Among the nursing students, 8 stated that they had a chronic disease, 34 of them personally had COVID-19, while 54 had a family history of COVID-19, and 92 had COVID-19 disease in their circles.

Data collection tool and technique

The study used a single instrument and a single method for data collection. Specifically, WAT was used as a data collection technique and the concept of the 'COVID-19 Pandemic' was explored through face-to-face interviews with volunteer students. Participants were given an A4 sheet of paper and asked to write down the first three words that came to mind when they hear the term 'COVID-19 Pandemic", along with several sentences (e.g. experiences, descriptions, etc.) for each word.

To prevent the random assignment of terms, the students were instructed to write the term 'COVID-19 Pandemic' three times on their paper (Figure. 1). This approach aimed to ensure focus on the key concept, as the absence of repetition might lead participants to write unrelated words instead of staying aligned with the primary theme.

Code name of the participant (*optional*): **Participant no:**

Age: **Main concept:** Covid- 19 Pandemic

Gender:

Family type:

Perception of her family about her income:

History of illness (chronic illness, Covid-19):

1. Covid- 19 Pandemic:
   - One word .....
   - Sentence .....
2. Covid- 19 Pandemic:
   - One word .....
   - Sentence .....
3. Covid- 19 Pandemic:
   - One word .....
   - Sentence .....

Figure 1. Sample of the page format for the data collection tool.

WAT was disclosed to study participants prior to administration. They were asked to write down the terms that came to mind about the key concept within 30 seconds, which was determined as the most appropriate time period in previous academic studies (Elbi et al., 2019; Bahar et al., 1999).

Unlike other studies employing WAT, participants in this research were asked to write a few descriptive sentences for each word they listed. This approach aimed to capture more complex responses, and a deeper level of understanding compared to single-word answers.

These sentences were evaluated to determine whether they demonstrated understanding or revealed misunderstandings. Participants were given extra time to complete this part of the test, with the average data collection time being 3–4 minutes. The WAT was administered in Turkish, and the word-association norms of the participants' written responses were initially analyzed in this language. After completing the analysis in Turkish, the results were translated into English. To ensure the reliability of the translated data, a native English speaker was consulted.

Data analysis: creation of categories

The phrases and sentences supplied through individuals finishing the WAT had been sequentially numbered from 1 to 97 (as player notes) for analysis. The phrases associated with the idea of “COVID-19 Pandemic” had been alphabetically arranged, and their frequencies had been calculated. Two coders independently checked the answers, and a single code list was created based on the consistency of their coding. The coded responses were analyzed together with the words and sentences written by individuals were analyzed to identify five themes. The relationships among the 3 principal phrases and the sentences describing them had been additionally examined"The data obtained from the WAT was organized into word tables, and frequencies were calculated to show how often certain words were repeated in relation to the concept of the 'COVID-19 Pandemic.

The themes created in the analysis were obtained through inductive analysis. It was determined that the categories derived overlap with the concepts of Conservation Motivation Theory and were discussed from a theoretical perspective.

During the frequency calculations, the frequency numbers were higher in the data analysis because some participants repeated the same word multiple times (with some words being used three to seven times). Frequencies were determined by counting how often a word appeared in the sentences written by participants. In our analysis, not only the three primary words but also the additional words used to describe these main words within the sentences were included in the evaluation. The frequency numbers were denoted by the abbreviation "f".

Ethical considerations

Approval for the study was obtained from the Izmir Tınaztepe University Scientific Research and Publication Ethics Committee prior to its commencement (Date: 02/12/2021, Approval No: 30), as well as from the faculty where the research was

conducted. The study included only voluntary participants. Before the interviews, students were informed about the study's content and the intended use of the collected data. Written and verbal consents were obtained from all participants.

To ensure confidentiality, the real names of students who shared their views and any identifying information were kept private in adherence to ethical principles of privacy protection. Each participant was assigned a unique code for data recording and citation purposes. The term "participant" was abbreviated as "P," followed by the assigned code number. For instance, P9 represented Participant 9 in the study.

Trustworthiness

The quality criteria for qualitative research were based on credibility, confidence and confirmability in this study during the course of the data collection and data analysis process. Data analysis was done by means of hand coding method. While reporting qualitative research, the COREQ (Consolidated criteria for reporting qualitative research) checklist recommended in the literature was employed (Tong et al., 2007).

There are two (OÇ and AC) academicians in the field of public health nursing in the research team. OÇ works in the emergency room during the COVID-19 process and also lectures at the Faculty of Nursing. One of the researchers, AÇ, has a qualitative data analysis certificate. OÇ carried out the data collection process by interviewing the participants.

RESULTS

Analysis of the data collected on the COVID-19 Pandemic process obtained from 97 nursing students participating in the study yielded five main categories: The perceived threat assessment [f=144] is based on student reflections regarding the term "COVID-19 Pandemic" in terms of the coping response [f=134],, mask/distance/cleaning [f=189], specific connotations for COVID-19 disease19 [f=57], and restrictions/bans [f=45]. It was determined that all female students (n=76) who participated in the study used more negative expressions (Figure. 2).

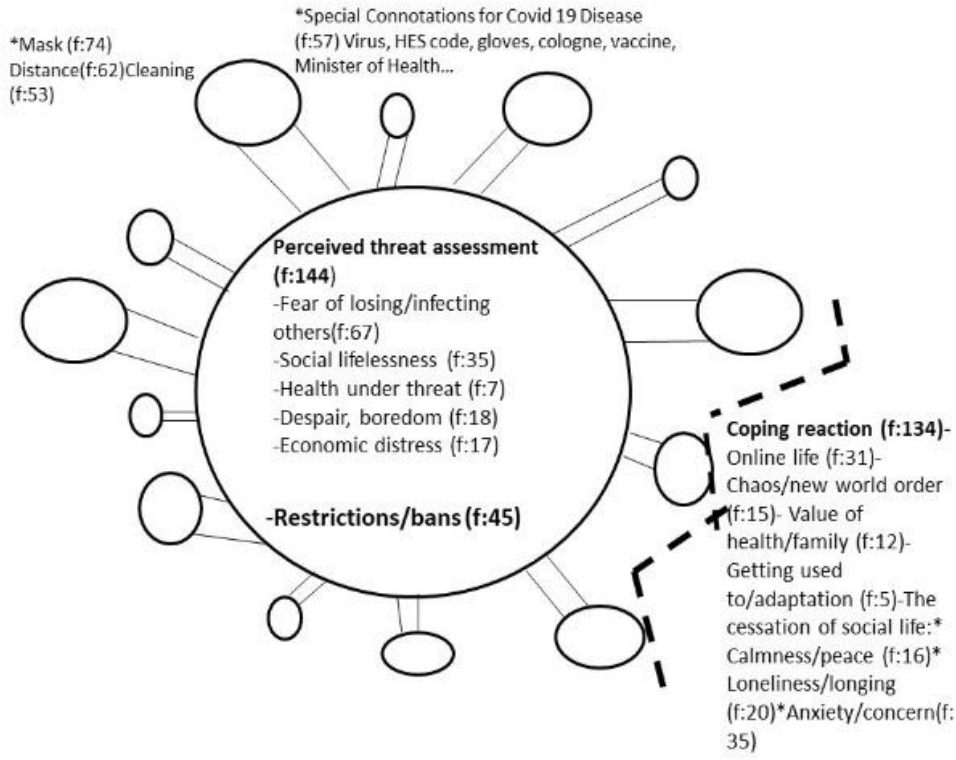

Figure 2. Nursing students' perceptions of covid-19 through fear appeal: a qualitative evaluation based on Rogers' protection motivation theory

Category 1. Perceived threat assessment (f=144)

Such words as "fear", "threat", "anxiety" and "panic" were used among the expressions that included the perceived threat assessment. This theme, cited 144 times by 97 participants, contained frequent emotional expressions. Under this category, the students expressed such specified sub-categories as being afraid of losing/infecting a loved one (f=67), social lifelessness (f=35), health under threat (f=7), helplessness, boredom (f=18) and economic distress (f=17). Threat assessment, which is the basic concept in the Protection Motivation Theory, can be summarized as the fear of illness or injury which become predisposed to be triggered. Nursing students also expressed their perceptions of threat in different dimensions and forms. Some quotes are:

"COVID-19 Pandemic means health is in danger" (P 20, Female)
"Fear of coming into contact with people" (P 2, Female)
"I am worried about getting infected" (P 25, Male)
"State of panic at the slightest cough" (P 36, Female)
"I'm out of money" (P 12, Female)
"Unemployment, economic problems" (P 15, Male)
"Concerns for the future" (P 14, Female)

Category 2. Coping reaction (f=134)

The perceived probability of success, that is, the perception that one's response will be effective in reducing the threat, is defined as the individual's ability to take preventive measures in addition to the self-efficacy perception in the Protection Motivation Theory. This theme, cited 134 times by 97 participants, contained positive and negative emotional expressions. Subcategories under this category can be listed as Subcategories under this category include online life (f=31), chaos/the new world order (f=15), the value of health/family (f=12), habituation/adaptation (f=5) and cessation of social life (f=8). While the phrase 'cessation of social life' is sometimes included in the positive coding of tranquilly/peace (f=16), it is also negatively coded as loneliness/desire (f=20) and anxiety/fear (f=35). "It was good for me to focus on myself" (P 22, Female)
"I spent more time with myself" (P 16, Male)
"I saw the majority withdraw to their own borders" (P 44, Female)
"I found peace in my inner world" (P 63, Female)
"A huge void, like it will never end" (P 14, Female)
"As we do not know what will happen when, being focused on the moment rather than the plan"
"Doing everything online" (P 57, Male)
"Every day is the same, I don't have the slightest expectation of a new day" (P 87, Female). **Category 3. Restrictions/bans(f=45)**

This theme was cited 45 times by 97 participants. However, the striking point in the category is that the feeling of restrictions/bans can be effective in both threat assessment and coping response. "There was a time when I was restricted in terms of education, social life and goals" (P 89, Female)
"Simple things are luxurious" (P 37, Female). **Category 4. Mask/distance/cleaning (f=189)**

The term "COVID-19 Pandemic" elicited reactions reflecting the concept of pandemic. Responses from the participants highlighted the growing concepts associated with the pandemic in Category 4 and Category 5. As expected, the most frequently mentioned codes for the COVID-19 fight were: Mask (f=74) Distance/Distance (f=62) Cleaning (f=53)

Category 5. Special Connotations for COVID-19 Disease (f=57)

The statements with COVID-19 diseases expressions included "virus", "case", "isolation/ quarantine", "Minister of Health/Ministry of Health", "Life Fits into Home (Hayat Eve Sığar) (HES) code", "glove", "cologne" and "vaccine".

DISCUSSION

In the qualitative study conducted to determine what nursing students, the future health professionals, think about the concept of "COVID-19 Pandemic", the focus of data analysis was seen to be centeredupon perception of fear and threat. In Rogers' Protection Motivation Theory, protection motivation is determined by two assessment processes as threat assessment and coping assessment. Threat assessment is based on the assessment of perceptions of perceived vulnerability and perceived severity of a health threat, much like the Health Belief Model. In contrast, coping assessment focuses on the evaluation of behavioral strategies aimed at mitigating the threat, particularly by considering the role of cognitive processing time. Fear is the mediating variable between perceived susceptibility and perceived severity and threat assessment and is the incentive that causes protection motivation and health behaviors. Basically, these two assessment processes together result in either adaptive or maladaptive responses (Conner, 2010; Bashirian et al., 2019). Nursing students' thoughts and perceptions about COVID-19 also overlap with the fear appeal. When the studies on the subject in the literature are examined, it is possible to see similar results. In a study conducted with 7143 university students in order to determine the psychological effects of the COVID-19 pandemic on university students in China, it was stated that 24.9% of the students experienced anxiety due to reasons such as economic stress, the effects of quarantine on daily life, future employment uncertainty and prolongation of academic periods, similar to this study (Naser et al., 2020).

Again, according to another study, approximately 24.9% of nursing students experienced anxiety due to the COVID-19 pandemic, concerns about the possible effects of COVID-19 and quarantine process, higher levels of health anxiety and they also expressed that they were negatively affected by staying at home due to the pandemic, and as a result of this, they felt nervous and overwhelmed due to fear of infection and death (Huang et al., 2020; Okuyan et al., 2020). In the literature, it has been stated that proactive treatment of health anxiety with digital interventions may be required because such situations as excessive and unnecessary health care use may increase in the event that health anxiety prevails in society (Hedman et al., 2016). While nursing students experienced problems such as inability to cope with stress, financial inadequacy and anxiety due to financial inadequacy, increased workload at home and family problems affecting academic success, they also stated that restrictions and bans had some positive effects on developing a positive perspective on life, such as the self-development and strengthening of family relations, allocating enough time for oneself, increasing awareness, increasing hygiene, increasing struggle and motivation and spirituality (Yanik &Yesilcinar, 2021). The literature

review examples support the conceptual structure of Rogers' Conservation Motivation Theory as in this study.

Study limitations and strengths

In the study, which was designed with a data collection instrument in the form of WAT with open-ended questions, data collection process was continued until data saturation was reached. However, not using a pattern from qualitative research approaches can be considered as the most important limitation in the study. However, new generation data collection tools, aside from interviews and surveys, attract more attention for students. In this context, qualitative analysis was carried out within the framework of an inductive approach in the data analysis process.

CONCLUSION

As a result of the study, it was described that student nurses were affected adversely, physically and psychologically during the COVID-19 process, in addition to experiencing various personal and social problems, and they used a large amount of effective methods to cope with all these negativities. The focus of nursing students' perceptions of the concept of "COVID-19 Pandemic" is the perception of fear and threat. In order to improve and maintain the physical and mental health of students, it is recommended to closely monitor their support needs and to establish support systems. Thus, increasing the quality of life of nursing students can positively affect the management of the pandemic in the long run. It is recommended that effective coping methods be included in the nursing curricula and support from psychological counseling units of schools is also recommended.

Next question to arise is "What can facilitate the transformation of COVID-19 fears into health behavior in the form of protection motivation for nursing students who will fight/struggle when such threats occur in the future? and How can this be achieved?". New studies are needed to build the process in future pandemics.

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Conflict of Interest

The author declare no potential conflicts of interest with respect to the research, authorship and/or publication of this article.

Author Contributions

Plan, design: OÇ, AÇ; **Material, methods and data collection:** OÇ, AÇ; **Data analysis and comments:** OÇ, AÇ; **Writing and corrections:** OÇ, AÇ.

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Pediatric Hardware Removal Complications; Are They Really Easy Surgeries?

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ABSTRACT
Objective: The aim of this study was to investigate the complications and challenges encountered in pediatric implant removal cases. **Materials and Methods:** This retrospective study was conducted in Sancaktepe Şehit Prof. Dr. İlhan Varank Research and Training Hospital and data was collected from patients' charts, operating room registrations, and operation notes, who underwent hardware removal surgery between January 2024 and October 2024. The normality of the data was assessed with the Q-Q plot test. The Student's t-test was used to compare two independent groups with normal distribution, whereas the Kruskal-Wallis test was used for non-normally distributed data. **Results:** Forty-two cases of pediatric implant removal patients were included in the study and significant correlation was found between the duration of surgery and the type of implant removed (p=0.006). After the removal of implants, the following complications were observed: superficial infection occurred in 3 patients (7%), deep tissue infection in 2 patients (5%), failure to remove the implant in 2 cases (5%), refracture in 1 patient (2%), and extensor tendon injury in 1 patient (2%). **Conclusion:** To minimize the risk of complications during implant removal, it is recommended to choose the correct and high-quality implant, apply appropriate surgical techniques, and plan the removal surgery while performing fracture fixation, adjusting the treatment accordingly.
Keywords: Hardware Removal, Complication, Pediatric Implant.

Pediatrik İmplant Çıkarım Komplikasyonları; Gerçekten Kolay Ameliyatlar mı?

ÖZET
Amaç: Bu çalışmanın amacı, pediatrik implant çıkarma vakalarında karşılaşılan komplikasyonları ve nedenlerini ortaya koymaktır. **Gereç ve Yöntem:** Bu retrospektif çalışma Sancaktepe Şehit Prof. Dr. İlhan Varank Eğitim ve Araştırma Hastanesi'nde gerçekleştirilmiş ve veriler Ocak 2024 ile Ekim 2024 tarihleri arasında pediatrik implant çıkarım ameliyatı geçiren hastaların dosyalarından, ameliyathane kayıtlarından ve ameliyat notlarından elde edilmiştir. Verilerin normalliği Q-Q plot testi ile değerlendirilmiştir. Student's t-testi ile normal dağılıma sahip iki bağımsız grubu karşılaştırırken, normal dağılıma sahip olmayan veriler için Kruskal-Wallis testi kullanılmıştır. **Bulgular:** Kırk iki pediatrik implant çıkarım hastası çalışmaya dahil edilmiş ve ameliyat süresi ile çıkarılan implant tipi arasında anlamlı korelasyon bulunmuştur (p = 0.006). İmplantların çıkarılmasından sonra 3 hastada (%7) yüzeyel enfeksiyon, 2 hastada (%5) derin doku enfeksiyonu, 2 vakada (%5) implantın çıkarılamaması, 1 hastada (%2) refraktür ve 1 hastada (%2) ekstansör tendon yaralanması gibi komplikasyonlar gözlendi. **Sonuç:** İmplant çıkarılması sırasında komplikasyon riskini en aza indirmek için, doğru ve yüksek kaliteli implantın seçilmesi, uygun cerrahi tekniklerin uygulanması ve kırık fiksasyonu yapılırken çıkarma ameliyatının planlanması, tedavinin buna göre ayarlanması önerilir.
Anahtar Kelimeler: Pediatrik İmplant, Komplikasyon, İmplant Çıkarımı.

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INTRODUCTION

Extremity fractures are two times more common in pediatric than in adults (Schalamon et al., 2011; Wells, 2012). Approximately one out of every three children is treated for extremity fracture at least one time before reaching adulthood (Boutis, 2020). Due to the implants used in the treatment of these fractures, implant removal procedures are among the most common operations performed in orthopedic surgery. The most common concern of patients and their relatives after fracture surgeries is whether the existing implant should be removed or not. Advancements in implant technology significantly contribute to a decline in orthopedic implant removal rates for adult fractures. In pediatric cases, it is advisable to remove implants because of ongoing bone growth, which raises concerns about the implant disrupting the natural process of bone remodeling (Kahle, 1994; Schildhauer, 2021; Stanitski, 2005; Wentzensen, 1991). However in recent years, it has been reported that implant removal is not necessary unless specific complications arise, such as persistent pain, limitations in joint movement, or fracture of the implant (Clement, Yousif, Duckworth, Teoh, & Porter, 2012). The decision to remove an implant should not be underestimated, as complication rates during the process can reach as high as 40% (Evers, 2004).

The aim of this study was to investigate the complications and challenges encountered in pediatric implant removal cases through a retrospective single-center analysis.

MATERIALS AND METHODS

Study type

This retrospective study was conducted in Sancaktepe Şehit Prof. Dr. İlhan Varank Research and Training Hospital between January 2024 and October 2024.

Study group

The research universe consisted of patients who underwent hardware removal surgery and younger than 18 years of age.

Dependent and independent variables

The independent variables of this research are implant types, anatomical locations, BMI, and the dependent variable is the complications.

Procedures

In this retrospective analysis, data was collected from patients' charts, operating room registrations, and operation notes for those who underwent hardware removal surgery between January 2024 and October 2024. Patients younger than 18 years at the time of implant removal surgery were included in this study. Outpatient patients and those with inadequate surgical documentation were excluded from the study. The following prognostic factors were identified and recorded: gender, age, body mass index (BMI), history of previous surgeries, type of hardware used, location of implantation, side of the body, duration of hardware implantation until removal, length of surgery, number of fluoroscopies performed during surgery, and any complications that occurred. Complications were classified using the Goslings and Sink grading systems.

Statistical analysis

Datasets were analyzed using SPSS (Statistical Package for Social Sciences) for Windows version 22.0 (SPSS Inc, Chicago, IL). The normality of the data was assessed with the Q-Q plot test. For normally distributed data, mean values and standard deviations were reported, while frequency and percentage were used for categorical variables. The Student's t-test compared two independent groups with normal distribution, whereas the Kruskal-Wallis test was used for non-normally distributed data. A significance level of $p<0.05$ was set for all statistical tests.

Ethical considerations

Before the study was started, written permissions were obtained. Written approval was obtained from the Ethics Committee approval (Ethic Committee of Sancaktepe Şehit Prof. Dr. İlhan Varank Research and Training Hospital 11.12.2024, File No: 372).

RESULTS

Forty-two cases of pediatric implant removal performed at our hospital between January 2024 and October 2024 that met all the established criteria. The patient population consisted of 6 female and 36 male children with a mean age of 12.1 at the time of hardware removal. The mean BMI was 20.49 kg/m^2. The implants were retained for an average of 17.8 months, and the median surgery duration was 55 minutes (Table 1).

Patients who underwent implant removal surgery were categorized by the anatomical location of the implants. The distribution was as follows: 13 patients in the forearm (31%), 9 in the tibia shaft (21%), 8 in the ankle (19%), 8 in the femur shaft and knee (19%), and 4 in the humerus shaft and elbow (9.5%) (Table 1, figure 1).

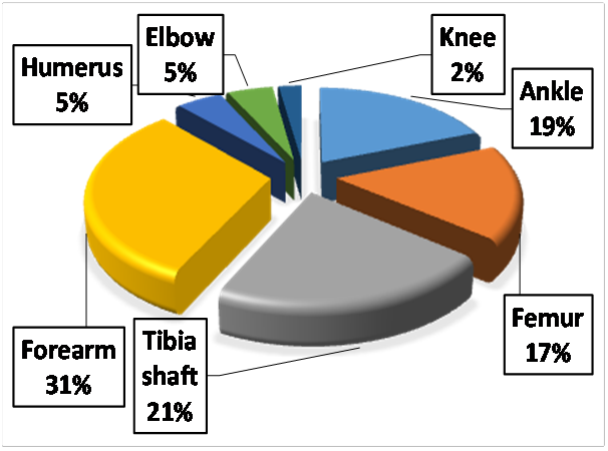

Figure 1. Anatomical localization of the implants.

The types of implants used in fracture fixation included 22 titanium elastic nails (TEN) (52%), 9 free screws (22%), 8 plate screws (19%), and 3 Kirschner wires (7%) (Table 1, Figure 2).

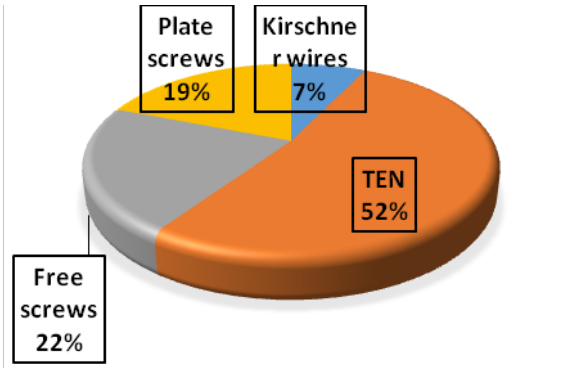

Figure 2. The types of implants.

After the removal of implants, the following complications were observed: superficial infection occurred in 3 patients (7%), deep tissue infection in 2 patients (5%), failure to remove the implant in 2 cases (5%), refracture in 1 patient (2%), and extensor tendon injury in 1 patient (2%) (Table 1, Figure 3).No statistically significant association was found between implant type and specific complications.

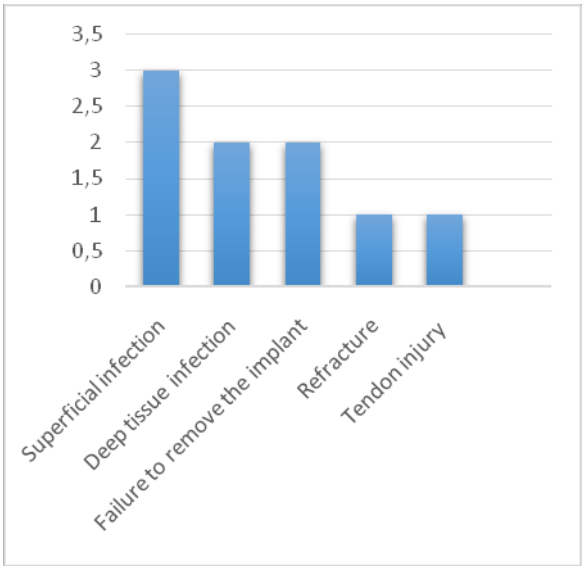

Figure 3. Complications.

A significant correlation was found between the duration of surgery and the type of implant removed (p=0.006). However, surgery durations were similar across different anatomical locations (p=0.225). The number of fluoroscopy images taken did not differ significantly among the various types of surgeries (p=0.177), nor did it vary across different anatomical localizations (p=0.488). Additionally, surgery durations were not statistically correlated. with BMI (p=0.172), and the number of fluoroscopy images also showed no correlation with BMI (p=0.321).

Table 1.Patients characteristics.

	All Patients	
	n=42	(%)
Age (years), Median (min-max)	12.1 (7-17)	
Gender		
Boy	36	(85.7%)
Girl	6	(14.3%)
Body mass index (kg/m^2)		
<25	38	(90.5%)
≥25	4	(9.5%)
Body part		
Ankle	8	(19.0%)
Femur and knee	8	(19.0%)
Tibia shaft	9	(21.4%)
Forearm	13	(31.0%)
Humerus and elbow	4	(9.5%)
Type of surgery		
TEN	22	(52.4%)
Kirschner wire	3	(7.1%)
Free screw	9	(21.4%)
Plate screw	8	(19.0%)
Duration between first and second surgery, (Months) Mean (min-max)	17.8 (4-48)	
Duration of surgery (Minutes) Median (min-max)	55 (8-150)	
Number of fluoroscopy Median (min-max)	5 (1-50)	
Rate of complications	9	(21.4%)
Superficial infection	3	(7.0%)
Deep tissue infection	2	(5.0%)
Failure to remove the implant	2	(5.0%)
Refracture	1	(2.0%)
Extensor tendon injury	1	(2.0%)

DISCUSSION

Although implant removal is generally regarded as one of the simpler procedures in orthopedic surgery, it is imperative that it be conducted with utmost care and attention. The average duration of these operations is 62 minutes, and the reported complication rate may reach up to 21%. This emphasizes the necessity for careful execution in line with the standards of any surgical intervention.

The complication rates of the removal surgeries were 21.4% was in our study. The complication rate of 17.1% in Scheider et al.'s series of 449 cases is comparable to our study (Scheider, Ganger, & Farr, 2020).

We treated superficial infections encountered after implant removal with dressings, local debridement, and antibiotic treatment in an outpatient clinic, while deep tissue infections necessitated reoperation.

In certain medical practices, the tips of titanium elastic nails employed in the management of long bone shaft fractures may be intentionally left exposed outside the skin. This approach, while feasible, carries a heightened risk of infection. Therefore, it is imperative to ensure meticulous care of the pin base, along with rigorous and consistent follow-up assessments. Moreover, one must consider that in the event of any discharge, timely interventions, including the removal of the implant, debridement, and administration of antibiotics, will be necessary to mitigate complications.

In our study, we found that the existing implant could not be removed in 5% of the cases (2 out of 42 patients). In a related investigation, Simanovsky et al. (2006) documented that the implant was unable to be removed in 3 patients within their cohort of 149 individuals. Thus, it is important to explain to the patients and their families that it may not always be possible to remove the existing implants. It should be made clear what procedure will be followed in such cases, and written consent from the parents should be obtained.

In our analysis of cases in which the implant could not be removed, we identified a significant issue related to the stripping of the screw head. The primary contributors to the deterioration of the screw head include the quality of the implant, recurrent strains applied to the screw head during surgical procedures, and the embedding of the screw head in the cortex, which occurs over time following the initial surgery.

The other case in which the implant could not be removed involved a patient with a humeral shaft fracture who was treated with a titanium elastic nail. In our study, the average time between the first operation and implant removal was 17.8 months. In this specific case, however, the implant was removed after 21 months. Although the implant was located in a non-load-bearing area, it was removed later than the average timeframe. There are varying opinions on the optimal timing for implant removal. This timeframe can differ based on factors such as patient age, the location of the fracture, and the type of fracture. Studies indicate that the recommended periods for implant removal are 4 to 32 weeks for forearm fractures, 3 to 12 months for femur fractures, and an average of 6.2 months for tibial fractures (Doğan, 2024; Gölgelioğlu, 2023; Jain et al., 2023; Küçük, 2022).

Upon analyzing the reasons for the non-removal of intramedullary nails (TEN), it was found that one significant factor was the length of the nail left protruding outside the bone. During TEN procedures, it is important to balance leaving the nail tips short enough to avoid irritating the soft tissue while ensuring they are long enough to facilitate easy removal later. This approach helps in planning for implant removal surgery without unnecessary delays after the fracture has healed. Additionally, sociocultural evaluations of implant removal cases indicate that factors such as younger age, Caucasian ethnicity, and higher socioeconomic status are often associated with a preference for these procedures (Dodwell et al., 2016). To mitigate the risk of future complications, it is imperative to conduct closer follow-up for disadvantaged cases and to strategically plan for implant removal surgery at the appropriate time. This approach should be implemented without disrupting the ongoing follow-up of patients who are already scheduled for implant removal.

An analysis of the anatomical sites for implant removal revealed that the most common sites were the forearm, tibia shaft, ankle, and femur shaft, in that order. The data indicates that more distal locations, such as the forearm and metacarpals, were associated with higher complication rates, which aligns with existing literature (Langkamer & Ackroyd, 1990; Sanderson et al., 1992).

Our findings indicated that the plates remained in place the longest, with an average retention time of 20.75 months. The screws followed with an average of 18.3 months, while the TENs lasted for 16.5 months. Kirschner wires had the shortest retention time at approximately 14.6 months. These findings were consistent with expectations, as Langkamer & Ackroyd established an average persistence of 23.7 months for the extracted plates in 1990. Additionally, in the context of supracondylar humerus and distal radius fractures, where Kirschner wires are frequently utilized, the extraction of these wires was not addressed in our study. This omission is due to the fact that the removal procedures were conducted in an outpatient clinic setting. Consequently, the durations for the removal of Kirschner wires appear to be comparable to those associated with other implant types.

Schmalzried et al. (1991) conducted a study to examine the effect of implant type on surgical duration. Their findings indicated that the removal of plates necessitates the longest surgical time, whereas the removal of K-wires requires the least time. In our own research, we also identified a significant correlation between surgery type (the specific implant being removed) and surgical duration ($p=0.006$). These results corroborate the findings of Schmalzried and colleagues in this aspect.

Study Limitations and Strengths

The limitations of this study include its retrospective design and the fact that we only included patients who had hardware removal performed in an inpatient setting under general anesthesia.

CONCLUSION

In summary, implant removal will remain a common procedure in orthopedic practices as long as pediatric trauma persists. To reduce the risk of complications

during implant removal, it is advisable to plan for the removal surgery while performing fracture fixation and to organize treatment accordingly.

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Conflict of Interest
The author declares no potential conflicts of interest with respect to the research, authorship and/or publication of this article.

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Static and Dynamic Core Stability's Relationship with Agility and Speed in Female Basketballers

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ABSTRACT

Objective: This study aims to investigate the relationship between static and dynamic core stabilization with agility and speed among female basketball players. Core stability, encompassing static and dynamic components, is fundamental for maintaining balance and enhancing athletic performance. **Materials and Methods:** Fifteen female athletes from the Bandırma Basketball Team participated, undergoing a series of core stability, agility, and speed assessments. These included the plank and double leg lowering test for static core stability, back extensions for dynamic core stability, the Hexagonal Obstacle Test (HOT) for agility, and a 20-meter sprint test for speed. **Results:** The results revealed a significant positive correlation between static core stability (plank test) and speed performance (r=0.576, p=0.025), suggesting that greater static core stability enhances sprinting capability. However, no significant correlations were observed between dynamic core stability (back extensions) and either agility or speed. Additionally, agility and speed showed a moderate correlation (r=0.569, p=0.027), indicating a mutual influence. **Conclusion:** These findings highlight the importance of static core stability for speed performance and suggest that training programs for basketball athletes could benefit from emphasizing static core exercises to enhance sprinting ability.

Keywords: Athletic Performance, Basketball, Core Stability.

Bayan Basketbolcularda Statik ve Dinamik Kor Stabilizasyonun Çeviklik ve Hız ile İlişkisi

ÖZ

Amaç: Bu çalışma, kadın basketbolcularda statik ve dinamik kor stabilizasyonunun çeviklik ve hız ile ilişkisini araştırmayı amaçlamaktadır. Statik ve dinamik bileşenleri içeren kor stabilitesi, dengeyi korumak ve atletik performansı artırmak için temel bir unsurdur. **Gereç ve Yöntemler:** Bandırma Basketbol Takımı'ndan 15 kadın sporcu çalışmaya katılmıştır. Katılımcılar, kor stabilitesi, çeviklik ve hız değerlendirmelerini içeren bir dizi teste tabi tutulmuştur. Bu testler arasında statik kor stabilitesi için plank ve çift bacak indirme testi, dinamik kor stabilitesi için sırt ekstansiyonları, çeviklik için Altıgen Engel Testi (HOT) ve hız için 20 metre sprint testi yer almıştır. **Bulgular:** Sonuçlar, statik kor stabilitesi (plank testi) ile hız performansı (r=0.576, p=0.025) arasında anlamlı bir pozitif korelasyon olduğunu ortaya koymuştur; bu da daha iyi bir statik kor stabilitesinin sprint yeteneğini artırdığını göstermektedir. Bununla birlikte, dinamik kor stabilitesi (sırt ekstansiyonları) ile çeviklik veya hız arasında anlamlı bir ilişki bulunmamıştır. Ayrıca, çeviklik ve hız arasında orta düzeyde bir korelasyon (r=0.569, p=0.027) saptanmış olup, bu iki parametrenin karşılıklı bir etkiye sahip olduğunu göstermektedir. **Sonuç:** Bu bulgular, hız performansı için statik kor stabilitesinin önemini vurgulamakta ve basketbol sporcuları için hazırlanacak antrenman programlarında sprint yeteneğini geliştirmek amacıyla statik kor egzersizlerine ağırlık verilmesi gerektiğini önermektedir.

AnahtarKelimeler: Atletik Performans, Basketbol, Kor Stabilite.

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INTRODUCTION

Basketball is a sport that encompasses various activities, including running and jumping. While both aerobic and anaerobic performance are crucial for basketball, it also demands muscle strength, endurance, flexibility, speed, agility, and basketball-specific skills (Pojskić et al., 2015). Enhancing these skills is known to contribute to overall athlete performance (Abdelkrim et al., 2007). In addition to basketball-specific skills, research suggests that postural stability plays a role in improving basketball performance (Hammami et al., 2014). Postural stability is defined as the ability to maintain the center of gravity within the support surface with minimal postural sway (Barati et al., 2013). The somatosensory system, visual system, and vestibular system collaborate to ensure postural stability (Gribble & Hertel, 2003).

Alongside postural stability, optimal core stability is vital for athletic performances involving body oscillation (Gribble & Hertel, 2003). The core, considered the center of the functional kinetic chain, provides proximal stability necessary for the distal mobility of extremities (Clark et al., 2018). Core strength is a prerequisite for various sports, including football, athletics, basketball, as well as daily activities like walking, standing upright, and climbing stairs (Ozmen, 2016; Räisänen et al., 2018) The core facilitates bidirectional force transmission between the lower and upper appendicular pathways while ensuring stability in the lumbosacral area (Akuthota et al., 2008; Huxel Bliven & Anderson, 2013). The core region is classified into two groups: local and global (Akuthota et al., 2008). The local group comprises small muscles responsible for deep stabilization between vertebrae, whereas the global group consists of large, superficial muscles transferring force between the rib cage and pelvis, playing a role in creating movement (Akuthota et al., 2008). Strengthening the core, the center of most kinetic chains, enhances balance, movement control, and extremity function, making movements more powerful and efficient (McCurdy et al., 2005). Core stabilization can be achieved through two basic types of training: static and dynamic. Static training involves engaging joints and muscles either by exerting force against an immovable object (maximal effort) or by holding a static position (submaximal effort) while resisting applied resistance (Huxel Bliven & Anderson, 2013). Dynamic training involves the repeated or continuous use of muscle force, concentrically or eccentrically, associating it with stabilization (Kulas et al., 2006). Core stabilization is evaluated using tests categorized as static and dynamic core stabilization (Parkhouse & Ball, 2011).

Agility, defined as the ability to change direction without losing speed, postural control, and core stability, is closely related to these components (Turner et al., 2011). Rapidly changing the direction and speed of the body's center of gravity is a fundamental locomotor ability in many sports. Muscles outside the core region have demonstrated that dynamic exercises are more effective for improving performance in dynamic tasks, whereas static exercises are better suited for enhancing static task performance. Isometric force duration has been reported to poorly correlate with dynamic performance (Haff et al., 2005). Studies in the literature indicate the positive effects of core training on agility and balance (Saeterbakken et al., 2011). Some sports disciplines also highlight the relationship between stability (Imai &Kaneoka, 2016); however, there is limited research focusing specifically on basketball players (Cengizhan et al., 2019). Similarly, studies examining the relationship between speed a critical factor in athletic performance and stabilization have reported varying results. While some studies suggest that stabilization training enhances speed in athletes (Luo et al., 2022), others report no significant effect (Werasirirat et al., 2022). Furthermore, to the best of our knowledge, no research in the literature has investigated the relationship between performance parameters such as agility and speed and both static and dynamic core stability. Therefore, this study aims to investigate the relationship between static and dynamic core stabilization with agility, and speed in basketball players.

MATERIAL AND METHODS

The study was conducted with the members of the Bandırma Basketball Team in the practice laboratories of the Bandırma Onyedi Eylül University Physiotherapy and Rehabilitation Department. The study was carried out during the period between May and June 2023. The sample size for the research was initially calculated as 15 using the G*power application ($\alpha = 0.05$, with a confidence interval of 0.90). Female basketball players under the age of 18 were included in the study, while individuals with a history of previous orthopedic injury or surgery, neurological, neuromuscular, or musculoskeletal deficits, as well as those with vestibular and systemic diseases, were excluded from the study.

This study was designed and conducted in compliance with the principles outlined in the 1975 Declaration of Helsinki (revised in 2013). Participants, who were informed about the study's scope, were required to sign the Informed Consent Form.

Data collection

Demographic Information Form: It is a form that inquires the personal details such as participant's no, age (years), heigh (cm), body weight (kg), body mass index (kg/m2) dominant extremity, health status, previous injuries, operations and existing diseases.

Static core stabilization tests

Plank: Plank is a test used to assess static core stabilization (Parkhouse & Ball, 2011). The use of the

plank test to assess global muscular endurance in athletes has demonstrated validity and reliability, with an ICC (Intraclass Correlation Coefficients) value= 0.99 (95% CI: 0.98-0.99) (Tong et al., 2014). The test is performed by recording the time that the participant, who is positioned flat on the forearms and feet in the prone position, can maintain this position.
Double Leg Lowering: The double leg lowering maneuver is a commonly used test especially to assess the strength of the abdominal muscles. Studies have indicated that this test is also a suitable tool for evaluating stabilization, with a high reliability of r=0.932 (Ladeira et al., 2005). During the test, participants lying on their backs are instructed to keep their legs 5 cm above the ground with knees straight, and the duration they can maintain this position is recorded in seconds (Parkhouse & Ball, 2011).

Dynamic core stabilization test

Back Extensions: This test is employed to assess the dynamic strength of the trunk extensor muscles (Moreland et al., 1997). In a study, the reliability of the test was reported to be high, with an intraclass correlation coefficient (ICC) of 0.98 and a standard error of measurement (SEM) of 1.0 repetitions (Lanning et al., 2006). The test involves recording the number of repetitions of trunk extensions performed in the prone position over a 2-minute duration as a score (Parkhouse & Ball, 2011).

Agility assessment

Hexagonal Obstacle Test (HOT): This test is utilized to evaluate agility, particularly in athletes. Participants position their feet facing forward in the center of a hexagon with each side measuring 66 cm and corners forming angles of 120 degrees on the ground. The test involves jumping clockwise from side to side, returning to the center, and completing the hexagon in this manner. The time taken to complete three rounds is recorded (Cengizhan et al., 2019).

Speed assessment

20 m Sprint (Speed) Test: This test comes in various variations and can be conducted at different distances, such as 5 meters, 10 meters, and 20 meters. The 20-meter sprint test, commonly encountered in the literature, is utilized for assessing speed. A timer is used to record and score the participant's time to complete the 20-meter course (Parkhouse & Ball, 2011).
Participants were provided with 2-minute rest intervals between tests. A single assessment session was conducted, and the evaluations lasted approximately 20 to 25 minutes.

Statistical analyses

IBM SPSS Statistics 23 (Statistical Package for Social Sciences) was used for statistical analyses. Descriptive statistics for demographic data and test results were provided. In descriptive statistics, numerical variables with Mean±Standard Deviation (SD) values, and categorical variables with frequency (n) and percentage (%) values were given. Shapiro-Wilk, and Skewness-Kurtosis values were used for normality analysis. Correlation data between static and dynamic core tests, agility and speed were analyzed using Pearson Correlation Analysis, as the data were normally distributed.

Ethical considerations

This descriptive study received approval from the Bandırma Onyedi Eylül University Faculty of Health Sciences Non-Invasive Clinical Research Ethics Committee (Date: 30.10.2020; Approval no: 2020-41).

RESULTS

The study involved a sample of 15 female basketball players with a mean age of 16.73±2.46 years. The participants had a mean weight of 60.86±7.71 kg, height of 174.06±7.89 cm, and a body mass index (BMI) of 20.06±2 kg/m². All participants were right-hand dominant, with no left-handed players in the study (Table 1).

Table 1. Demographic characteristics of participations (n=15).

Female Basketball Players (n=15)	X±SD
Age (year)	16.73±2.46
Weight (kg)	60.86±7.71
Height (cm)	174.06±7.89
BMI (kg/m²)	20.06±2.00
Dominant extremity (%)	
Right	15 (%100)
Left	0

Core Stability and agility correlation

Pearson correlation analysis revealed key relationships between static and dynamic core stability tests, agility (HOT), and speed tests. The plank test, used to assess static core stability, showed a significant positive correlation with the speed test (r=0.576, p=0.025), indicating that greater static core stability is associated with faster sprint performance. However, no significant correlation was observed between the plank test and the agility test (HOT) (r=0.436, p=0.104) (Table 2).

The double leg lowering test, used to assess abdominal muscle strength and core stabilization, did not show a significant correlation with either the agility test (r=0.172, p=0.39) or the speed test (r=-0.365, p=0.180) (Table 2).

For the back extensions test, which measures dynamic core strength, no significant correlation was found with agility (r=0.095, p=0.737) or speed (r=0.019, p=0.946).

Agility and speed correlation

A significant positive correlation was observed between the agility test (HOT) and the speed test (r=0.569, p=0.027), indicating that better agility is associated with faster sprinting ability among the basketball players (Table 2).

Summary of key findings

The results suggest that static core stability, as measured by the plank test, plays a crucial role in sprint performance. However, dynamic core stability, as measured by the back extensions test, does not appear to significantly influence agility or speed. Agility and speed are strongly correlated, suggesting that improvements in one may contribute to enhancements in the other.

These findings highlight the importance of static core stability in speed performance and suggest a potential focus for training programs aimed at improving basketball performance.

Table 2. Correlations of static and dynamic core stabilization tests with agility and speed(n:15).

		Plunk	Double Leg Lowering	Back Extensions	HOT	Speed Test
Plunk	**r**	1	0.196	-0.30	0.436	0.576
	p		0.485	0.915	0.104	0.025
Double Leg Lowering	**r**	0.196	1	-0.212	0.172	-0.365
	p	0.485		0.447	0.39	0.180
Back Extensions	**r**	-0.30	-0.212	1	0.095	0.019
	p	0.915	0.447		0.737	0.946
HOT	**r**	0.436	0.172	0.095	1	0.569
	p	0.104	0.39	0.737		0.027
Speed Test	**r**	0.576	-0.365	0.019	0.569	1
	p	0.025	0.180	0.946	0.027	

DISCUSSION

The current study aimed to investigate the relationship between static and dynamic core stabilization with agility and, speed in female basketball players. The findings indicate that static core stability, as assessed through the plank test, is significantly correlated with sprint performance, while dynamic core stability, as measured by back extensions, does not show a significant correlation with either agility or speed.

These results align with previous research suggesting that core stability is fundamental for athletic performance, particularly in sports requiring rapid changes in direction and speed (Gribble &Hertel, 2003). The significant correlation found between the plank test and the 20 m sprint test highlights the importance of static core strength in enhancing sprinting abilities. This is consistent with findings by Abdelkrim et al., who noted that muscle strength and endurance contribute to overall athletic performance (Abdelkrim et al., 2007). The ability to maintain core stability allows athletes to effectively transmit force through the kinetic chain, facilitating improved speed during dynamic movements (Akuthota et al., 2008). Although some studies in the literature suggest that core stabilization strengthening training does not affect speed in athletes (Werasirirat et al., 2022), more recent and comprehensive publications highlight the potential of core stabilization training programs to enhance speed (Luo et al., 2022).

In a 2019 study involving basketball players, researchers explored the relationship between postural stability, core muscle endurance, and agility (Cengizhan et al., 2019). Consistent with the findings of our study, no significant relationship was observed between core muscle endurance and agility. However, a statistically significant positive correlation was identified between agility and postural stability. This study employed the HOT to evaluate agility.

The HOT is a commonly used field test for measuring agility. In their study, Reiman and Manske reported excellent reliability for the HOT, with Intraclass Correlation Coefficient (ICC) values ranging from 0.86 to 0.95. Since the HOT is a time-based test, shorter completion times indicate greater agility (Reiman & Manske, 2009). Since the HOT is time-based, individuals who complete the test in shorter durations are considered more agile. Nesser et al. examined the connection between balance and agility in football players, reporting a moderate negative correlation between core muscle endurance, assessed via a core endurance test, and agility performance, measured using the pro-agility test (Nesser et al., 2008). In contrast, Sharrock et al. found no significant relationship between core stabilization and athletic performance in male and female collegiate athletes (Sharrock et al., 2011).

Additionally, several studies have explored the effects of static and dynamic core exercises on

athletic performance. For instance, Bayrakdar et al. reported improvements in both agility and speed performance in football players following training programs that incorporated static and dynamic core exercises (Bayrakdar et al,. 2020). However, (Sever, 2018) showed no significant changes in sprint or agility performance parameters in football players after similar core training programs. Moreover, a study conducted by Parkhouse demonstrated that while static and dynamic core exercises improved core endurance, they had no significant impact on performance in field-based fitness tests (Parkhouse & Ball, 2011).

This inconsistency in the literature may be attributed to variability in the accuracy and specificity of the training and exercises administered to athletes. Furthermore, errors in the implementation of both the exercises and the tests themselves could account for these discrepancies. While the direct evidence linking core training and core endurance to athletic performance remains limited, core exercises are a fundamental component of many athletic development programs. However, they are just one subset of the overall training regimen. Isolating the relationship between core muscles and athletic performance is inherently challenging, which may partially explain the conflicting results in the literature.

In contrast, the lack of significant correlation between the double leg lowering test and performance measures may suggest that isolated abdominal strength does not directly translate into improved agility or speed. This aligns with previous studies indicating that core stabilization requires a combination of strength and dynamic control (Haff et al., 2005). Moreover, the results from the back extensions test, which assesses dynamic strength, further underscore the complexity of core stability, suggesting that mere muscle strength may not suffice for enhancing agility or speed (Murphy, 1996).

The observed positive correlation between agility and speed ($r = 0.569$, $p = 0.027$) supports the notion that improvements in agility can directly influence sprinting performance. This finding is in agreement with previous research highlighting the interrelatedness of these performance parameters in basketball (Saeterbakken et al., 2011). The ability to change direction quickly, as demonstrated in the HOT, relies not only on leg strength but also on the effective engagement of core stabilizers to maintain balance and control (Imai &Kaneoka, 2016).

Strenghts and limitations of study

While the current study provides significant insights into the relationships between core stability, agility, and speed in female basketball players, it is essential to acknowledge certain limitations. The limited sample size (n=15) may impact the generalizability of the results. Future studies should involve larger and more diverse populations to confirm these findings and investigate targeted training interventions aimed at improving core stability and athletic performance.

CONCLUSION

In conclusion, this study emphasizes the crucial role of static core stability in improving sprint performance among female basketball players. Furthermore, agility and speed are positively correlated, suggesting that training aimed at enhancing agility may also benefit speed performance. Continued investigation into the dynamics of core stability training and its impact on various performance measures remains necessary to optimize athletic training programs.

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Conflict of Interest

The authors declare that they have no conflict of interest.

Author Contributions

Plan, design: KE, AB; **Material, methods and data collection:** KE, KŞ, TO; **Data analysis and comments:** EK; **Writing and corrections:** KE, AB, KŞ, TO.

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Ethical Approval

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Correlation of PE Teachers' Emotions, Attitudes, Anxiety, and Competence in Inclusive Education

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ABSTRACT

Objective: This research aims to investigate the relationships between physical education teachers' emotions, attitudes, anxieties, and perceived competence towards inclusive education practices. **Materials and Methods:** The study group comprises 256 participants, consisting of 152 (59.4%) female and 104 (40.6%) male teachers working in Balıkesir province during the fall semester of the 2024-2025 academic year. The research employed a relational survey model. Data collection instruments included a personal information form, the Emotions, Attitudes, and Anxieties Scale Regarding Inclusive Education, and the Teacher Competency Scale in Inclusive Practices. Descriptive statistics, Independent Samples T-Test, One-Way ANOVA, Pearson Correlation, and Regression tests were used for data analysis. **Results:** Analyses based on graduation status revealed no significant differences in emotion, attitude, anxiety, and competence levels. Furthermore, the attitude variable was found to have a decisive role in teacher competence and explained 11% of the variance in competence levels. **Conclusion:** The research findings indicate a moderate positive correlation between Attitude and competence, while no significant relationship was found between Emotion and Anxiety variables and competence. Additionally, a significant difference was observed in participants' anxiety levels based on gender. Teachers who knew, were related to, or had a student with special needs showed no significant difference in terms of emotion and attitude scores, but their anxiety and competence scores were higher.

Keywords: Inclusion, Physical Education, Attitude, Competence.

Beden Eğitimi Öğretmenlerinin Kaynaştırma Eğitiminde Duygu, Tutum, Kaygı ve Yeterlilik İlişkisi

ÖZ

Amaç: Bu araştırmanın amacı beden eğitimi öğretmenlerinin kapsayıcı eğitim uygulamalarına yönelik duygu, tutum, kaygı ve algılanan yeterlilikleri arasındaki ilişkileri incelemektir. **Gereç ve Yöntem:** Çalışma grubu, 2024-2025 eğitim-öğretim yılı güz döneminde Balıkesir ilinde görev yapan 152 (%59.4) kadın ve 104 (%40.6) erkek öğretmen olmak üzere toplam 256 katılımcıdan oluşmaktadır. Araştırma ilişkisel tarama modelindedir. Veri toplama araçları; Kişisel Bilgi Formu, Kaynaştırma Eğitime İlişkin Duygu, Tutum ve Kaygılar Ölçeği ve Kaynaştırma Uygulamalarda Öğretmen Yeterlilik Ölçeği'dir. Verilerin analizinde betimsel istatistikler, Bağımsız Örneklemler T Testi, ANOVA, Pearson Korelasyon ve Regresyon testleri kullanılmıştır. **Bulgular:** Mezuniyet durumuna göre yapılan analizlerde duygu, tutum, kaygı ve yeterlilik düzeylerinde anlamlı bir farklılık ortaya çıkmamıştır. Ayrıca tutum değişkeninin öğretmen yeterliliğinde belirleyici bir role sahip olduğu ve yeterlilik düzeylerindeki varyansın %11'ini açıkladığı bulunmuştur. **Sonuç:** Araştırma bulguları, Tutum ve yeterlilik arasında orta düzeyde pozitif bir korelasyon olduğunu gösterirken, Duygu ve Kaygı değişkenleri ile yeterlilik arasında anlamlı bir ilişki bulunamadı. Ek olarak, katılımcıların kaygı düzeylerinde cinsiyete göre anlamlı bir fark gözlemlendi. Özel gereksinimli bir öğrenciyi tanıyan, onunla akraba olan veya özel gereksinimli bir öğrenciye sahip olan öğretmenler, duygu ve tutum puanları açısından anlamlı bir fark göstermedi, ancak kaygı ve yeterlilik puanları daha yüksektir.

Anahtar Kelimeler: Kaynaştırma, Beden Eğitimi, Tutum, Yeterlilik.

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INTRODUCTION

The Universal Declaration of Human Rights emphasizes that everyone has the right to education. In this context, providing equal educational opportunities, regardless of individual differences, is recognized as a fundamental right for all students. In line with this right, students with special needs also have the same educational rights as their typically developing peers (Ismailos et al., 2022). The importance of education for individuals with special needs in schools is increasingly recognized. Inclusive education practices have been implemented to ensure that these students benefit from equal educational opportunities with their typically developing peers (Yılmaz & Melekoğlu, 2018). Inclusive education aims to bring together children with special needs and typically developing children in both academic and social domains through individualized educational programs (Singh, 2016).

Inclusive education is a process where individuals with special needs receive education alongside their typically developing peers, and teachers play a crucial role in this process (Akçamete, 2010). Teachers should be aware of their responsibilities, legal obligations, intervention methods, and assessment strategies related to individuals with special needs and develop instructional plans accordingly (Yetiştirme ve Özel Eğitim Müdürlüğü, 2006). Moreover, teachers have a vital role in understanding the individual needs of students with special needs and creating effective educational strategies to address these needs (Danyoli, 2019). Teachers' knowledge and experience in this area are critical to the successful implementation of inclusive practices.

Physical education teachers are responsible not only for creating individualized educational plans to develop the skills of individuals with special needs but also for fostering an inclusive environment. This requires teachers to offer effective and accessible sports activities that consider the physical, social, and emotional needs of students with special needs (Roth & Kearny, 2017). Physical education teachers must contribute to inclusive education by organizing activities suited to students' interests and abilities. Sports education not only enhances individuals' physical abilities but also improves social skills, helping them adapt to group dynamics. In this regard, physical education and sports teachers must design appropriate sports programs to enable students with special needs to participate with their peers in the classroom environment effectively (Fitzgerald & Stride, 2012).

Physical education and sports represent one of the most effective ways for integrated students to engage in physical, psychological, and social interaction with society (Akdenk et al., 1997). The significance of physical education and sports for individuals with special needs suggests that, within the context of inclusive education in our country, the emotions, attitudes, and anxieties of physical education teachers regarding inclusion practices can influence the effective implementation of this process. Furthermore, teachers' perceived competence in this area is a crucial factor in determining the quality of inclusive education practices (Avramidis & Norwich, 2002).

It can be argued that the emotions, attitudes, anxieties, and competence levels of physical education and sports teachers in inclusion practices directly impact the success of education. The cognitive, social, emotional, and motor skills of physical education and sports teachers play a decisive role in the inclusion process (Lindsay, 2007). In particular, the development of strategies by teachers that promote social harmony and create an inclusive classroom environment is of paramount importance. Teachers' positive perceptions of competence, attitudes, emotional states, and anxieties regarding inclusion practices are among the essential factors that enhance the success of these practices (Avramidis & Norwich, 2002).

Research indicates that the anxieties experienced by teachers during inclusive education processes often center on classroom management, meeting the needs of students with special needs, and implementing effective teaching methods (Sharma et al., 2011). Additionally, it has been determined that teachers' attitudes significantly influence the pedagogical approaches they adopt when working with students with special needs. Inclusive education, particularly for physical education teachers, can present various challenges in promoting participation in physical activities and increasing social interactions (Hutzler & Zach, 2013). Therefore, teachers' perceptions of competence and their knowledge base in this field are among the factors that directly affect the effectiveness of the process (Erbaş, 2019).

In this context, the aim of this study is to examine the relationships between physical education teachers' emotions, attitudes, anxieties, and perceptions of competence towards inclusive education practices. Based on existing findings in literature, it can be stated that a better understanding of the relationships between these factors is crucial for the success of inclusive education.

MATERIALS AND METHODS

Research model

In this study, the "relational survey model," a quantitative research method, was employed to examine the relationship between emotions, attitudes, anxieties, and competencies of Physical Education and sports teachers. This model is an approach where relationships between variables are evaluated without exposure to external influences (Büyüköztürk et al., 2015).

Research group

The research universe comprised 520 physical education teachers working in Balıkesir province during the fall semester of the 2024-2025 academic

year, with a sample consisting of 152 female and 104 male participants. The average age of the participants was found to be 34.73±6.38. Their educational backgrounds included 218 with undergraduate degrees and equivalents, 30 with master's degrees, and 8 with doctoral degrees. Furthermore, 55.5% of the participants reported having meaningful/significant interaction with an individual needing special education, while 44.5% did not. For efficiency in time and resource utilization, the sample selection was based on the principle of easy accessibility.

Data collection instruments

The data collection instruments used in the study were a Personal Information Form, a Scale of Emotions, Attitudes, and Anxieties Related to Inclusive Education, and a Teacher Competency Scale for Inclusion Practices.

Personal information form

Personal Information Form: Created by the researchers, it was designed to gather information on participants' gender, whether they had a close acquaintance/relative/student with special needs, and their educational background.

Feelings, Attitudes, and Concerns Regarding Inclusive Education Scale

The "Feelings, Attitudes, and Concerns Regarding Inclusive Education Scale (FACIES)," developed by Forlin et al. (2011), was adapted into Turkish by Bayar et al. (2015). This scale consists of a total of 15 items and is designed with a 4-point Likert-type structure. Total scores obtainable from the scale range from 15 to 60. Higher scores indicate that the individual has higher levels of feelings, attitudes, and concerns regarding inclusive education. The scale comprises three subscales, each containing five items. The total scores attainable from these subscales vary between 5 and 20. Since the items in the feelings subscale contain negative statements, these items were reverse-coded in statistical calculations. As a result of this coding process, negative total values in the feelings subscale indicate positive feelings regarding inclusion. Following the Turkish adaptation by Bayar et al. (2015), the Cronbach's Alpha reliability coefficient of this scale was determined to be 0.88. In the present study, as a result of the reliability analysis, the overall Cronbach's Alpha value of the scale was found to be .78.

Teacher Competency Scale in Inclusive Practices

The "Teacher Competency Scale in Inclusive Practices (TCSIP)," developed by Umesh Sharma et al. (2011), comprises 18 items. This scale is designed with a 6-point Likert-type structure. The rating options are: "Strongly Disagree" (1), "Disagree" (2), "Partially Disagree" (3), "Partially Agree" (4), "Agree" (5), and "Strongly Agree" (6). The Turkish adaptation by Bayar (2015) aims to determine the competencies of teachers in inclusive practices. As a result of exploratory factor analysis, the scale exhibited a three-dimensional structure. These dimensions were defined as "Teaching Competency" as the first dimension, "Collaboration Competency" as the second dimension, and "Classroom Management Competency" as the third dimension. The reliability study of the Turkish adaptation was conducted using Cronbach's Alpha test, and the internal consistency coefficient was determined to be 0.89. In this study, the reliability of the scale was also analyzed using Cronbach's Alpha test, and the internal consistency coefficient was found to be 0.96.

Data analysis

The data for this study were collected through online forms during the 2024-2025 academic year. Data collection instruments were sent to physical education and sports teachers who agreed to participate in the study. Data analysis was performed using SPSS software. Skewness and kurtosis values were examined to determine whether the data were normally distributed. These values were evaluated by checking whether they fell within the range of +2 to -2 (Tabachnick & Fidell, 2013). This evaluation revealed that the data exhibited a normal distribution, and accordingly, for data analysis, frequencies and percentages were first calculated for gender, graduation status, and interaction status with individuals with special needs, and mean ages were calculated. Independent samples t-tests were conducted to analyze differences in gender and interaction scores with individuals with special needs. ANOVA was conducted to determine whether teachers' educational levels differed in terms of their scores. Pearson correlation analysis was conducted to determine the relationship between teachers' levels of feelings, attitudes, concerns, and competencies towards inclusion. Linear regression analysis was conducted to analyze the effects of feelings, attitudes, and concerns on competency. The analyses were completed using SPSS 26.0 software and Excel databases.

Ethical considerations

Before the study was started, written approval was obtained from the author's Balikesir University Social and Humanities Research Ethics Committee (Date: 30.12.2024, Approval no: E-19928322-050.04-471588).

RESULTS

A total of 256 individuals participated in the study. The majority of the participants were female, accounting for 59.4% (n=152) of the total sample, while the remaining 40.6% (n=104) were male. In terms of educational background, the largest proportion of participants were university graduates or held an equivalent degree, making up 85.2% (n=218) of the sample. Additionally, 11.7% (n=30) had a master's degree, whereas only a small percentage, 3.1% (n=8), held a doctoral degree. When considering participants' previous interactions with individuals with special needs, 55.5% (n=142)

reported having experience in this area, while 44.5% (n=114) stated that they had no prior interaction.

Table 1. Sociodemographic characteristics of the study group (n=256).

Variables		n	%
Gender	Female Male	152 104	59.40 40.60
Graduation Status	University graduate and equivalent Master's degree Doctorate	218 30 8	85.20 11.70 3.10
Interaction with Individuals with Special Needs	Yes No	142 114	55.50 44.50
Total		**256**	**100.00**

n: Count, **%:** Column percentage.

Furthermore, the age distribution of the participants revealed an average age of 34.73 years, with a standard deviation of 6.38 years, indicating a relatively homogeneous age range within the sample (Table 1). Examination of the scores achieved by the physical education and sports teachers participating in the study on the subscales of the Inclusion Feelings, Attitudes, and Anxiety Scale revealed that the highest mean score was obtained from the attitude dimension (13.01±3.23), while the lowest mean score was obtained from the feelings dimension (10.50±2.91). The total score of physical education and sports teachers on the Inclusion Feelings, Attitudes, and Anxiety Scale was found to be above the median value (35.28±6.70). (Table 2).

Table 2. Mean scores of the subscales of the inclusion feelings, attitudes, and anxiety scale.

Inclusion Feelings, Attitudes, and Anxiety Scale Sub-Dimensions	Min.	Max.	X±S.D.
Feelings	5.00	20.00	10.50±2.91
Attitude	6.00	20.00	13.01±3.23
Anxiety	5.00	20.00	11.77±3.04
Total	18.00	60.00	35.28±6.70

Min: Minimum, **Max:** Maximum, **X:** Mean, **S.D.:** Standard deviation.

Analyzing the scores obtained by physical education and sports teachers on the subscales of the Inclusive Teacher Competency Scale reveals that the highest mean value was for collaboration competency (29.46±5.61), while the lowest mean value was for classroom management competency (29.42±5.67). The total score for physical education and sports teachers on the Inclusive Teacher Competency Scale was above the average (88.35±16.09). (Table 3).

Table 3. Mean scores of physical education and sports teachers on the subscales of the Inclusive Teacher Competency Scale.

Inclusion Teacher Competency Scale Sub-Dimensions	Min.	Max.	X±S.D
Teacher Competency	8.00	36.00	29.46±5.47
Collaboration Competency	10.00	36.00	29.46±5.61
Classroom Management Competency	9.00	36.00	29.42±5.67
Total	29.00	108.00	88.35±16.09

Min: Minimum, **Max:** Maximum, **X:** Mean, **S.D.:** Standard deviation.

The table analyzes whether the inclusion feelings, attitudes, anxiety, and inclusive teacher competency scores of female and male teachers differed by gender. No significant difference was found between genders in terms of feelings ($\bar{X}$female=10.47; $\bar{X}$male=10.53) and attitude ($\bar{X}$female=12.93; $\bar{X}$male=13.13) scores (p>0.05). However, male teacher candidates had significantly higher anxiety scores ($\bar{X}$=12.39) than females ($\bar{X}$=11.31) (p=0.005). No significant difference was found between female and male candidates in terms of inclusive teacher competency ($\bar{X}$female=88.43; $\bar{X}$male=88.22, p>0.05). This indicates that gender only created a difference in anxiety levels and had no significant effect on the other variables. (Table 4).

Table 4. T-test results of scale scores according to the gender variable.

Scales	Gender	N	$\bar{X}$	S.D.	t	P
Feelings	Female	152	10.47	2.96	-0.166	0.869
	Male	104	10.53	2.85		
Attitude	Female	152	12.93	3.02	-0.486	0.628
	Male	104	13.13	3.54		
Anxiety	Female	152	11.31	2.96	-2.838	0.005
	Male	104	12.39	3.04		
Inclusion Teacher Competency	Female	152	88.43	17.30	0.102	0.919
	Male	104	88.22	14.31		

p<0.05, $\bar{X}$: Mean, S.D.: Standard deviation.

The table analyzes whether teachers' inclusion feelings, attitudes, anxiety, and teacher competency scores differ based on whether they had an acquaintance/relative/student with special needs. In terms of feelings, the mean for those who had an acquaintance/relative/student with special needs was ($\bar{X}$=10.20), and for those who did not, it was ($\bar{X}$=10.86), with the p-value (p=0.690) indicating no significant difference. Attitude scores similarly showed no significant difference ($\bar{X}$ yes=13.00; $\bar{X}$ no=13.03, p=0.931). Regarding anxiety scores, teachers who had an acquaintance/relative/student with special needs had a significantly lower mean ($\bar{X}$=11.40) than those who did not ($\bar{X}$=12.23) (p=0.029). In terms of inclusive teacher competency, teachers with an acquaintance/relative/student with special needs had a significantly higher mean score ($\bar{X}$=90.56) compared to those without ($\bar{X}$=85.61) (p=0.014). This suggests that having an acquaintance/relative/student with special needs reduces teachers' anxiety levels and positively affects their perception of inclusion competency. (Table 5). Table 6 analyzes whether teachers' feelings, attitudes, anxiety, and inclusive teacher competency scores differ based on their graduation status (undergraduate, graduate, doctorate). No significant differences were found based on graduation status for feelings (F=0.522, p=0.594), attitude (F=0.172, p=0.842), and anxiety (F=0.615, p=0.541). Similarly, no significant difference was observed among graduation statuses in terms of inclusive teacher competency (F=0.427, p=0.653). These findings indicate that graduation status has no significant effect on these variables. (Table 6).

In Table 7, the relationship between Emotion, Attitude, Anxiety, and Competence scales were analyzed using the Pearson Correlation test. Accordingly, a moderate, positive, and significant relationship was found between Attitude and Competence (r = 0.290, p<0.01). No significant relationship was found between the Emotion and Anxiety variables and Competence. (Table 7).

Table 5. T-test results of scale scores according to the presence of an acquaintance/relative/student with special needs.

Scales	Having an Acquaintance/Relative/Student with Special Needs	N	$\bar{X}$	S.D.	t	P
Emotion	Yes	142	10.20	2.91	-1.823	0.69
	No	114	10.86	2.87		
Attitude	Yes	142	13.00	3.26	-0.086	0.931
	No	114	13.03	3.20		
Anxiety	Yes	142	11.40	3.14	-2.196	0.029
	No	114	12.23	2.86		
Inclusive Teacher Competency	Yes	142	90.55	15.31	2.466	0.014
	No	114	85.61	16.67		

p<0.05, $\bar{X}$: Mean, S.D.: Standard deviation.

Table 6. One-way ANOVA results of mean scale scores according to graduation status.

Scales	Graduation Status	N	X̄	S.D.	F	p
Emotion	**Undergraduate**	218	10.48	2.90	0.522	0.594
	Graduate	30	10.33	3.05		
	Doctorate	8	11.50	2.56		
Attitude	**Undergraduate**	218	12.96	3.24	0.172	0.842
	Graduate	30	13.33	3.36		
	Doctorate	8	13.12	2.64		
Anxiety	**Undergraduate**	218	11.74	3.05	0.111	0.895
	Graduate	30	11.83	3.11		
	Doctorate	8	12.25	2.96		
Inclusive Teacher Competency	**Undergraduate**	218	87.82	16.37	0.853	0.427
	Graduate	30	90.93	14.83		
	Doctorate	8	88.35	12.21		

p<0.05, X̄: Mean, S.D.: Standard deviation

Table 7. Correlation between Emotion, Attitude, Anxiety, and Competence.

		Teacher Competency
Emotion	**r**	-0.099
	p	0.114
Attitude	**r**	*0.290**
	p	<0.001
Anxiety	**r**	-0.118
	p	0.058

**p<0.01

The multiple linear regression analysis results in Table 8 show that the regression model is statistically significant (F=10.348; p<0.001). According to the standardized regression coefficient (β), the relative importance of the predictor variables on teacher competence is Emotion, Attitude, and Anxiety, respectively. Examination of the t-test results for the regression coefficients of the independent variables revealed that the Attitude variable (β=0.311; t=5.186; p<0.001) has a significant and positive effect on teacher competence, while the Anxiety variable (β=-0.103; t=-1.264; p=0.207) and the Emotion variable (β=-0.073; t=-0.891; p=0.374) do not have a significant effect on teacher competence. These variables explain 10% of the total variance in the dependent variable (R^2=0.110). (Table 8).

DISCUSSION

The findings of this study, which examined the levels of emotion, attitude, anxiety, and competence of physical education and sports teachers in inclusive practices, were interpreted by comparing them with similar studies in the literature.

The research findings indicate that teachers received the lowest mean score on the emotion dimension and the highest mean score on the attitude dimension of the emotion, attitude, and anxiety scales. This suggests that physical education and sports teachers have a positive attitude towards inclusion practices but may need support in the emotional dimension. The high attitude score indicates that teachers exhibit a positive stance on inclusive education (Orel, Zerey, and Töret, 2004), while the low score on the emotion dimension may indicate a need for more awareness and training in this area (Keskinkılıç and Yılmaz, 2023). This finding is consistent with the results of studies in the literature that emphasize the impact of teacher attitudes on inclusive practices (Metin, 2015; Mindivanlı Akdoğan, Koçak, and Subaşı, 2017; Sart et al., 2004; Smith 2001).

Physical education and sports teachers received the highest mean score on the collaboration competence dimension and the lowest mean score on the classroom management competence dimension of the inclusion competence scale. The collaboration dimension reveals teachers' ability to establish effective dialogue and collaborate with students and other partners in the inclusion process (Akay, 2011; Foster and Cue, 2009). The high score on this dimension may be due to teachers feeling competent in situations requiring collaboration. On the other hand, the low score on the classroom management competence dimension may indicate that teachers need more support in managing students with diverse needs in the classroom. The literature emphasizes the significant impact of classroom management skills in the inclusive education process and the need to develop these skills (Başkurt, 2024; Marzano, Marzano, and Pickering, 2003; Soodak, 2003).

Analyses conducted based on the gender variable in the study revealed no significant difference in emotion and attitude scores, while male physical education teachers scored higher on the anxiety sub-dimension compared to female physical education teachers. This situation may stem from male teachers' lack of experience with inclusion or societal expectations. When examining studies in the literature, Bayar and Üstün (2017) examined the

emotional and attitudinal levels of 502 teachers towards inclusion in terms of gender during the 2015-2016 academic year and found no significant difference, while they found a significant difference between anxiety levels and the gender variable, but this difference was in favor of female teachers. Similarly, Akdemir et al. (2022) stated that female teachers have higher anxiety levels than male teachers based on the gender variable. However, there was no significant difference between genders in terms of teacher competence in inclusive education. Similar studies in the literature have shown no significant difference between genders in terms of teacher competence in inclusive education (Dağlar, 2011; Güleryüz, 2014; Hofman & Kilimo, 2014; Şahbaz and Kalay, 2010). This might be attributed to the similar levels of education and experience of female and male physical education teachers.

Table 8. Regression Analysis Results of the Effect of Emotion, Attitude, and Anxiety on Teacher Competence.

Variables	B	SE	β	t	p
Constant	78.780	5.250		15.006	<0.001
Emotion	-0.401	0.450	-0.073	-0.891	0.374
Attitude	1.549	0.299	0.311	5.186	<0.001
Anxiety	-0.541	0.428	-0.103	-1.264	0.207
R=0.331 R^2adj=0.099		F=10.348 p=<0.001			

B: Unstandardized Coefficients Beta, **SE:** Standard Error, **β:** Standardized Beta, **F:** ANOVA**, R2:** R Square.

Upon examining the status of physical education and sports teachers who have a relative, close friend, or student with special needs, no significant difference was found in terms of emotion and attitude scores, but anxiety scores were found to be lower in this group. Furthermore, these teachers also had higher inclusion competency scores. The reason for the lower anxiety scores might be that these teachers have more opportunities for confidence and experience in interacting with individuals with special needs (Püllü et al., 2024). In addition, it is likely that teachers with inclusion experience approach the process with inclusion students more positively and demonstrate better competence in this practice (Önder, 2007). Literature reviews also emphasize that teachers who have a relative, close friend, or student with special needs have lower anxiety levels and higher competency levels regarding inclusion education (Camadan, 2012; Dağlar, 2011; Dolapçı, 2013; Sarı and Bozgeyikli, 2002).

In the analyses conducted according to the graduation status variable, no significant difference was found in emotion, attitude, anxiety, and competency levels. This suggests that graduation status does not have a significant effect on teachers' perceptions of inclusion practices. Similarly, Toy (2015) found no significant difference in teachers' inclusion competencies in terms of educational status. However, Sali-Bilgiç (2011), in her research with psychological counselors, found that primary school psychological counselors who graduated from faculty had significantly higher self-efficacy beliefs in psychological counseling than those with postgraduate education. These differences may stem from variations in factors (teachers' personal experiences, professional attitudes, practical skills, etc.) influencing the relationship between teachers' graduation status and their inclusion education competencies.

The research findings indicated a positive, moderate, and significant relationship between attitude and competency, but no significant relationship between emotion and anxiety variables and competency. A review of the literature revealed that Emam and Mohamed (2011), in their study examining the relationship between teachers' competencies and their attitudes towards inclusion education, found a significant relationship between competency and attitudes towards inclusion education. Similarly, Girgin (2019) found a significant relationship between teachers' perceived competency and their attitudes towards inclusion education. Consistent with the literature, the findings indicate that teachers' attitudes and competencies play a significant role in the development of their inclusion practices.

Another finding from the research revealed that the attitude variable plays a decisive role in teacher competency and explains 11% of the variance in competency levels. However, the relationship between teacher competency and anxiety and emotion variables was not found to be significant. These results suggest that attitude is an important factor in increasing teacher competency. Findings supporting the study were found when the literature was reviewed (Aküzüm and Akbulut, 2021; Özokçu, 2018; Sağın and Karadaş, 2023; Şahan, 2019). In this regard, the study's crimes indicate that developing positive attitudes towards inclusion education among teachers can strengthen their perception of competence and enable them to implement more effective educational practices.

CONCLUSION

In conclusion, this study examined the attitudes, emotions, anxieties, and competency levels of

physical education and sports teachers towards inclusion education and revealed the relationship between these variables. The findings indicate that teachers have high attitudes towards inclusion practices, and this attitude plays a decisive role on competency. However, it was found that emotion and anxiety variables did not show a significant relationship with competency. Teachers' collaborative competency was found to be high, while classroom management competency was lower, indicating that they need support, especially in classroom management, in inclusion practices. While factors such as gender and having a relative, close friend, or student with special needs influenced teachers' anxiety levels, graduation status did not have a significant effect on these variables. In this context, strengthening teachers' positive attitudes and developing their classroom management skills can contribute to more effective outcomes in inclusion education. Future research could investigate intervention programs focused on developing special education and classroom management skills to enhance teachers' competencies in inclusive education. In addition, more in-depth studies on the psychological and socio-cultural factors affecting teachers' anxiety levels could contribute to the development of more effective approaches in inclusion education.

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The author declares no potential conflicts of interest with respect to the research, authorship and/or publication of this article.

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Physical Performance Parameters of Korfball and Volleyball Athletes: A Cross-Sectional Study in Türkiye

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ABSTRACT

Objective: This study aimed to compare the physical performance parameters of korfball and volleyball athletes in a university**. Materials and Methods:** A total of 26 korfball (n=9) and volleyball (n=17) athletes voluntarily participated in this study. Body composition, aerobic and anaerobic capacity, muscle strength and endurance, static and dynamic balance, flexibility and hand grip strength were measured. **Results:** The average age of the athletes participating in this study was 22.2±2.2, 21.4±5.26 years (korfball, volleyball, respectively). There was no significant difference between the demographic features and body composition parameters of korfball and volleyball athletes ($p>0.05$). Skinfold thickness in four regions of volleyball athletes was significantly lower than korfball athletes ($p<0.05$). There was no significant difference in anaerobic and aerobic performance tests between groups. In addition, abdominal muscle strength of korfball athletes was significantly higher than volleyball athletes ($p=0.001$). The Flamingo balance test-right was lower and star excursion test-right was higher in korfball athletes than volleyball athletes ($p=0.032$, $p=0.033$, respectively). **Conclusion:** The korfball and volleyball athletes had similar performance parameters according to results of body composition, aerobic and anaerobic capacity, flexibility and hand grip strength except skinfold measurements, abdominal muscle strength and static and dynamic balance. This study supports the similarity of the physical and motoric values of these team players.

Key words: Volleyball, Exercise Test, Physical Functional Performance, Korfball.

Korfbol ve Voleybol Sporcularının Fiziksel Performans Parametreleri: Türkiye'de Kesitsel Bir Çalışma

ÖZ

Amaç: Bu çalışma, bir üniversitedeki korfbol ve voleybol sporcularının fiziksel performans parametrelerini karşılaştırmayı amaçladı. **Gereç ve Yöntemler:** Bu çalışmaya korfbol (n=9) ve voleybol (n=17) sporcularının oluşturduğu toplam 26 gönüllü sporcu katıldı. Vücut kompozisyonu, aerobik ve anaerobik kapasite, kas gücü ve dayanıklılığı, statik ve dinamik denge, esneklik ve el kavrama gücü değerlendirildi. **Bulgular:** Çalışmaya katılan sporcuların yaş ortalaması sırasıyla korfbol ve voleybol gruplarında 22.2±2.2 ve 21.4±5.26 yıldı. Korfbol ve voleybol sporcularının demografik özellikleri ve vücut kompozisyonu parametreleri arasında anlamlı bir fark bulunmadı ($p>0.05$). Voleybol sporcularının dört bölgede deri altı yağ kalınlığı, korfbol sporcularına göre anlamlı şekilde daha düşüktü ($p<0.05$). Gruplar arasında anaerobik ve aerobik performans testlerinde anlamlı bir fark görülmedi. Buun yanı sıra, korfbol sporcularının abdominal kas kuvveti ve enduransı, voleybol sporcularına göre anlamlı derecede daha yüksekti ($p=0.001$). Flamingo denge testi-sağ, korfbol sporcularında voleybol sporcularına göre daha düşük, star excursion test-sağ ise daha yüksekti ($p=0.032$, $p=0.033$, sırasıyla). **Sonuç:** Korfbol ve voleybol sporcuları, deri altı yağ kalınlığı, abdominal kas kuvveti ve endurasnı, statik ve dinamik denge dışında, vücut kompozisyonu, aerobik ve anaerobik kapasite, esneklik ve el kavrama gücü sonuçlarına göre benzer performans parametrelerine sahipti. Bu çalışma, bu takım sporcularının fiziksel ve motorik değerlerinin benzerliğini desteklemektedir.

Anahtar Kelimeler: Voleybol, Egzersiz Testi, Fiziksel Fonksiyonel Performans, Korfbol.

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INTRODUCTION

Korfball and volleyball are sports played both globally. Korfball, developed in the Netherlands, is a sport designed to score more points by throwing the ball into the opponent's basket (korf). Its primary aim is to create a game where men and women can play together without providing advantages or disadvantages to either gender. A korfball team consists of 4 male and 4 female players. Two males and two females are positioned in defense, while the other two males and two females play in offense. Each player is assigned a specific opponent to mark, requiring them to closely follow their counterpart. Korfball involves versatile movements, necessitating players to develop both offensive and defensive skills. The game includes short bursts of maximal or submaximal exertion (Summerfield & White, 1989).

Volleyball, a more advanced sport, is played with six players per team and involves skills such as passing, blocking, spiking, serving, diving, rolling, and defensive techniques. Both individual and team variations form a significant part of the game. These variations are shaped by mental, physical, and physiological functions, profoundly influencing performance. Volleyball is a popular sport among teams and athletes, combining technical and physical effort with aesthetic movements in a competitive setting. It contributes to the physical, emotional, mental, and social development of individuals (Olcucu et al., 2014).

As in many sports, anthropometric characteristics and physical performance capacities are among the most critical factors for success in volleyball, alongside technical and tactical skills. Although volleyball is primarily an aerobic sport in terms of energy production, neuromuscular performance and coordination also play significant roles. Additionally, volleyball is an interval-based sport where loading and resting phases are intertwined within short periods. It is a complex sport played on a 9-meter-long court, involving varying durations and intensities of movement, frequently requiring maximal force in actions such as running, rolling, and jumping. To recover the ball sent from the opposing court, players must execute sudden accelerations and skill-intensive movements flawlessly (Olcucu et al., 2014).

Both sports exhibit similar physical, physiological, and motor characteristics in addition to their technical requirements (Swann et al., 2015). As team sports classified as interval sports, korfball and volleyball utilize both aerobic and anaerobic energy systems. During training, it is challenging to isolate these systems entirely, although one may be more prominently utilized depending on the sport. Athletic performance can be defined as the total effort exerted to accomplish a specific athletic task. Evaluating sport-specific attributes such as strength, speed, endurance, flexibility, reaction time, and postural alignment is essential (Tsai et a., 2020). One of the factors influencing performance is the physical structure or physical characteristics of athletes, as these attributes directly impact physiological capacities. When an athlete's physical structure does not align with the demands of a specific sport, achieving the desired performance level becomes unlikely. Physical structure is an indicator of high performance and interacts with other performance metrics such as strength, power, flexibility, speed, endurance, and agility, collectively enhancing the athlete's overall performance (Tsai et al., 2020; Pereira et al., 2015).

As in many sports, fundamental attributes affecting the performance of korfball and volleyball players include body composition, strength, endurance, speed, and balance (Pereira et al., 2015). While numerous studies have examined performance parameters in volleyball players (Pereira et al., 2015; Bonato et al., 2022; Piatti et al., 2022), there is a lack of research evaluating the physical performance of korfball players in the literature. It is one of the few studies in this field that provides information about the physical and functional performance of korfball players. In this study, it is aimed to compare the physical performance parameters of volleyball and korfball athletes in a university.

MATERIALS AND METHODS

Study type

The single centered, cross-sectional study was performed through face-to-face interviews and assessments with Okan University Center of Sports from October-December 2024.

Study group

26 volleyball and korfball athletes between the ages of 17-25 were involved in this study. The inclusion criteria of participants were being a registered player for at least 2 years, playing in university volleyball or korfball team and training 2 hours a day and at least 2 days a week. Athletes having any systemic and/or neurological disease were not involved in this study. A power analysis was performed in the study with the G*POWER software.The effect size (f=1.332) for agility assessment, one of the performance parameters, was calculated based on Rathod L. (2018). It was determined that a total of 16 participants, with at least 8 athletes in each group, would be required to achieve an 80% statistical power level and a 5% significance level for the calculated effect size (Rathod, 2018).

Procedures

All assessments were made by blinded researchers under the same standard environment conditions. The age, gender, exercise habits, smoking and alcohol consumption of the athletes were questioned. Anthropometric measurements and performance parameters (aerobic, anaerobic, periodical performance, balance, flexibility, hand grip strength) were evaluated.

Anthropometric measurements

Anthropometric measurements and body composition of the athletes were measured using the TANITA Bioempedance Body Composition Analyzer and the fat ratio was measured using the 'Holtain Skinfold Calipper' brand skinfold. Skinfold measurements were made from biceps, triceps, suprailiac and subscapular by using J-P (Jackson-Pollock) method (Jagim et al., 2023). Height measurements were taken using a stadiometer with an accuracy of 0.01 cm. Body mass index (BMI) was determined by calculating the ratio of body weight (kg) to squared height (m^2) (Nuttall, 2015).

Performance evaluations

Aerobic test

The aerobic test was performed using the 12-minute Cooper test. Participants were instructed to run within a designated area for 12 minutes, aiming to cover the greatest possible distance. The stopwatch was started as soon as the individual began running, and the distance covered at the end of the 12 minutes was recorded. Maximal oxygen consumption ($maxVO_2$) was then calculated using the formula: $maxVO_2$=(distance covered (m)-504.9)/44.73 (Saritas et al., 2011).

Anaerobic tests

Horizontal jump test: The distance that the athletes jumped on two legs with the feet adjacent and without falling back was noted (Kotsifaki et al., 2021).

Vertical jump test: The test is designed to measure explosive power in the vertical direction. For the test, the athlete was instructed to stand with feet shoulder-width apart, evenly distributing their weight, and jump as high as possible. The starting point and the peak reached were identified and recorded. This vertical distance between these two marks was recorded as the final score. After test, the score calculation of the athletes was calculated with the formula of Power (watts) = 21.67 x body weight (kg) x vertical displacement (m) x 0.5 (Sales et al., 2018).

Slalom test: Slalom Test was employed to assess the multi directional speed, and agility of the participants. 6 obstacles were placed at 2 m intervals for the test. The athlete was instructed to run at peak speed following a slalom pattern, navigating obstacles in both forward and reverse directions from the starting point. The timer was started when the foot first crossed the starting line, and the time was recorded when the athlete crossed the same line again. The normative values of the test were based on (Alricsson et al., 2001).

20 m sprint test: Speed assessment was evaluated by 20-Meter Sprint test (Comfort et al., 2012). The athletes were instructed to complete the marked distance in the shortest time possible. The best time was noted after the evaluation was repeated twice.

Periodical performance tests

Sits Up: Abdominal muscle strength was evaluated by instructing the athletes to lie on a mat with their knees bent, feet resting flat on the ground, and arms folded across their chest.The knees were flexed at approximately 90° and the hips at 45°, the athletes were asked to raise themselves to the 90° position and then return to the same position. The number of sit-ups made in 30 seconds was noted (Reiman & Manske, 2009).

Push up: The athletes were instructed to assume a prone position with their hands placed shoulder-width apart and the weight of their lower limbs supported on their toes to evaluate the muscular strength and endurance of the upper limbs. They were then asked to extend their arms while keeping their head, shoulders, back, hips, knees, and feet aligned in a straight line. The total number of push-ups completed within 1 minute was recorded (Reiman & Manske, 2009).

Closed Kinetic Chain Upper Extremity Test (CKCUET): The athletes were asked to take a push up position to measure the strength, anaerobic power, and closed kineic chain stability of the upper limb. They were asked to put their hands on the floor, right next to the 2 lines drawn with an interval of 0.9 m. They were asked to move their hands from one line to the next in the shortest time possible. The total number of line touches in 15 seconds was noted (Reiman & Manske, 2009).

Balance tests

The Flamingo Balance Test: This test was conducted to evaluate static balance. The athletes were asked to maintain their balance for 1 minute on a wooden balance beam that measured 50 cm in length, 4 cm in height, and 3 cm in width. The number of falls per 60 seconds was noted as a score (Gokdemir et al., 2012).

Star Excursion Balance Test (SEBT: It was utilized to evaluate dynamic balance. Star shape with a 45° angle in 8 directions was drawn by placing tape measure on the floor. The athletes were asked to reach in predetermined directions, and the distance they reached was noted in cm. The test was performed bilaterally for the dominant and non-dominant foot (Gokdemir et al., 2012).

Flexibility

The athlete was asked to sit and touch the soles of the feet against the 26 cm marked flexometer (sit and reach box). The athlete was asked to reach slowly with both hands as far as he/she could and should stay in this position for about 2 seconds. Two attempts were made and the best result was noted (Ayala et al.,).

Hand Grip Strength

It was assessed by a JAMAR hand dynamometer. The dominant hand was measured only. Two attempts were made and the better force value was noted in kilograms (Tonak et al., 2021).

Statistical analysis

Statistical analysis was performed by the Statistical Package for Social Sciences version 22.0 (IBM) software. Descriptive features statistics were reported as mean, standard deviation, frequency, and percentages. The Shapiro-Wilk test was employed to

assess normality. To compare the parameters, the Chi-square test and Mann-Whitney U test were used. A significance level of 0.05 was set.

Ethical considerations

The study was approved by Scientific, Social, and Non-Interventional Health Sciences Research Ethics Committee of Okan University (09.10.2024-No:11). Athletes provided their informed consent to take part in the research, which was conducted in compliance with the principles of the Helsinki Declaration.

RESULTS

A total of thirty athletes were initially evaluated, but four athletes were excluded from the study because they did not fulfill the inclusion criteria. As a result, 26 athletes participated in the evaluations, including 9 korfball and 17 volleyball athletes, all of whom volunteered for the study.

The comparison of the demographic variables and physical fitness features of the athletes were shown in Table 1. No significant differences were found between the groups regarding demographic characteristics (age, gender, BMI, regularly exercise habits, smoking and alcohol consumption parameters) ($p>0.05$).

Despite the fact that there was no difference in body fat percentages between the groups, a significant difference was found between the results of the 4-site skinfold measurements. The biceps, triceps, subscapular and suprailiac measurements of the volleyball athletes were lower than korfball athletes. Volleyball and korfball athletes' waist/hip ratio were 0.79±0.07 and 0.75±0.05, in the same order, and this difference was not statistically significant ($p>0.05$).

Table 1. Demographic variables and body composition parameters of korfball and volleyball athletes.

	Korfball athletes (n=9)	Volleyball athletes (n=17)	
Demographic variables	Mean±SD	Mean±SD	p^a
Age (years)	22.2±2.2	21.4±5.26	0.687
			p^b
Female sex (n/%)	4(44.4%)	11(64.7%)	0.321
Regulary exercise habits (n/%)	6(66.7%)	8(47.05%)	0,341
Cigarette consumption (n/%)	5(55.6%)	5(29.4%)	0.192
Alcohol consumption (n/%)	8(88.9%)	9(52.9%)	0.065
Previous injuries story (n/%)	5(55.9%)	8(47.1%)	0.682
Physical fitness parameters			p^a
Weight (kg)	67.07 ±9.54	65.24±12.3	0.704
Height (cm)	174.44±7.82	175.29±8.94	0.817
BMI (kg/m^2)	22.01±2.57	21.22±3.81	0.584
Waist circumference (WC) (cm)	77.8±10.03	74±10.45	0.362
Hip circumference (HC) (cm)	97.6±4.3	97.3±7.8	0.915
Lean body mass (kg)	58.92±10.39	56.06±10.91	0.523
Body fat percentage (%)	12.32±7.77	13.41±8.95	0.762
4-sites skinfold measurements			p^a
Biceps	6.44±3.74	2.71±0.62	**0.001**
Triceps	8.84±3.93	3.52±1.33	**0.001**
Subscapular	11.36±5.58	6.38±3.63	**0.011**
Suprailiac	9.07±2.82	5.43±2.88	**0.001**

BMI:Body Mass Index, n: number of participants, SD: standard deviation, p^a Independent-samples t-test, p^b: Chi-square test.

It was noted that there was no difference in the results of the anaerobic and aerobic performance tests among the groups, but the number of repetitions sit ups that took in 30 seconds of korfball athletes was significantly higher than the volleyball athletes in the periodical performance tests (Table 2).

During the flamingo balance test on the right foot of the korfball athletes, the number of falls at 60 seconds were less than the volleyball athletes (p:0.032). In addition, korfball athletes reached longer distances in the star excursion balance test on the right foot than volleyball athletes (p: 0.033) (Table 2).

Table 2. Comparison of physical performance tests of korfball and volleyball athletes.

Physical Performance Tests	Korfball athletes (n=9)	Volleyball athletes (n=17)		
	Mean±SD	Mean±SD	z	p
Aerobic test				
12 minute run test (VO^2 max)	29.96±5.84	29.76±5.89	0.081	0.932
Anaerobic tests				
Horizontal jump test (cm)	186.77±30.69	188.65±41.07	-0.120	0.907
Vertical jump test	220.94±35.15	215.78±43.92	0.304	0.762
Slalom test (sn)	15.26±1.29	15.24±1.59	0.035	0.976
20m sprint test (sn)	3.84±0.51	3.65±0.41	1.024	0.314
Flexibility test				
Sit and reach test (cm)	24.22±9.08	31.14±11.07	-1.607	0.121
Periodical performance tests				
Sits up (n)	24.33±3.50	16.11±3.07	6.178	**0.001**
Push up (n)	25.11±12.25	22.88±7.75	0.570	0.579
Ckcuet (n)	17.87±3.64	19.82±3.04	-1.403	0.176
Handgrip Strength Test				
Right	25.88±8.62	30.11±11.48	-0.966	0.345
Left	26.59±10.98	27.52±8.22	-0.246	0.801
Static and dynamic balance tests				
Flamingo balance test-R	3.11±2.66	6.94±4.73	-2.232	**0.032**
Flamingo balance test-L	4.66±2.91	6.88±4.63	-1.298	0.204
Star excursion test-A	79.33±8.48	75.64±6.62	1.225	0.238
Star excursion test-R	107.33±13.69	95.52±12.70	2.196	**0.033**
Star excursion test-L	105.55±13.19	97.29±11.68	1.641	0.112

n: number of repetation, SD: standard deviation, R:right, L:left, A:anterior, p: Mann Whitney U test.

DISCUSSION

This study examined the anthropometric measurements, body composition and performance parameters of korfball and volleyball athletes. Analyses showed no differences were found between the athletes in regards to the demographic characteristic (age, sex, weight, height, BMI, regularly exercise habits, smoking and alcohol consumption parameters). Although there was no significant difference between the body fat percentages, lean body mass of the groups, there were significant differences between the 4-sites skinfold measurements. The biceps, triceps, subscapular and suprailiac measurements of the volleyball athletes were lower than korfball athletes. Also, analyses showed significant differences among korfball and volleyball athletes for number of repetition of sits up test, number of falling in flamingo balance test and star excursion balance test. However, no statistically significant differences were found among groups for flexibility, anaerobic and aerobic tests, handgrip strength test, and periodical performance tests except sits up test. The number of repetition sit ups that took 30 seconds of the korfball athletes was significantly higher than the volleyball athletes. During the flamingo balance test on the right foot, the number of falls at 60 seconds of korfball athletes were less than the volleyball athletes. The korfball athletes reached longer distances in the star balance test on the right foot than volleyball athletes.

Volleyball is a team sport that involves high-velocity and high-impact movements, such as jumping, hopping, and cutting. Korfball requires efforts from sprinting, sudden changes in direction, running,

jumping, shooting, and passing, interspersed with rest periods of about 20 to 30 seconds. Therefore, the anthropometric profile, particularly body composition, is a key factor in the physical performance of both korfball and volleyball athletes. In a previous study, male korfball athletes were found to be of similar height to volleyball athletes, but shorter than basketball players. However, they were lighter than both basketball and volleyball athletes (Godinho, Fragoso and Vieira, 1996). Additionally, Godinho et al. demonstrated that volleyball and basketball athletes had less limb fat compared to korfball athletes (Godinho, Fragoso and Vieira, 1996). Data analysis revealed that male korfball athletes had body fat levels similar to those of basketball athletes (9.0% to 10.6%) and lower relative fat compared to volleyball athletes. Female korfball athletes exhibited less relative fat and more lean body mass than athletes from other sports, including volleyball (25.3%) and basketball (20.8%) (Godinho, Fragoso and Vieira, 1996). In another study, the body height of volleyball players was higher than that of korfball players, while the body fat content and absolute body fat of volleyball players were lower compared to korfball players. However, no significant difference was observed in lean body mass and total body weight between the two groups (Chamoli and Alaspure, 2023). In a study, female volleyball players were found the tallest and the lowest values of body fat among the volleyball, handball, basketball athletes (Malousaris et al., 2008). In previous studies, it has been reported that volleyball players are taller, leaner, and have a lower body fat percentage (Mala et al., 2015; Bayios et al., 2006). These studies also found that female volleyball players are taller and heavier compared to female korfball players. In the same studies, female handball players were observed to be shorter, but heavier and more muscular. The fact that female volleyball players are leaner and have less body fat than korfball players may be attributed to the number of training sessions and diets followed by the athletes. In handball, players defend one-on-one, while in korfball, both men and women play together equally, but players can only defend against opponents of the same sex from the opposing team. The greater muscularity observed in handball players may be due to the strength training required for defense. On the other hand, korfball is a sport based on skill rather than strength. In korfball, skill-based training plays a more prominent role in training programs than strength training, which may explain why female athletes tend to be leaner. In contrast to previous studies, there were no significant differences between both groups in the weight, height, BMI, the body fat percentages, lean body mass in present study. However, in line with the studies, the 4-sites skinfold measurements of the volleyball athletes were lower than korfball athletes.

Previous studies have shown that VO2max in passers (42.25±9.45 ml/kg min-1) was higher than in liberos (39.88±6.65 ml/kg min-1) and spikers (39.38±7.71 ml/kg min-1) for aerobic capacity in volleyball athletes (Gabbett and Georgieff, 2007). Some studies have reported VO2max values of 45.2 ml/kg min-1 or higher in elite volleyball athletes, while other studies have found values of 44.2 and 41 ml/kg min-1 or more (Kalinski, Norkowski, Kerner and Tkaczuk, 2002). On the other hand, in this study Vo2max values are lower in both korfball and volleyball athletes (29.96±5.84 ml/kg min-1, 29.76±5.89 ml/kg min-1, respectively), in addition no significant differences were found between groups.

In the present study, anaerobic tests include the horizontal and vertical jump tests, slalom test, and 20 m sprint test. Vertical and horizontal jumps are performed frequently by volleyball and korfball athletes during practices and games. In various defensive and offensive maneuvers, athletes are required to jump either vertically or horizontally as high as or as far as they are capable of doing. In this study, findings showed that there were no statistically significant differences among volleyball and korfball athletes for anaerobic tests included in horizontal and vertical jumps. Erzeybek et al. compared the anaerobic power and motor skills of korfball and basketball players and they reported that korfball players had higher vertical jump scores compared to basketball players. In addition, Erzeybek et al. reported that basketball players had higher hand grip strength and leg isokinetic strength compared to korfball players (Erzeybek, Yuksel, Kaya and Onen, 2022). Kalinski et al. (2002) compared anaerobic performance using the Wingate anaerobic test across team sports, including basketball, volleyball, handball, rugby, and soccer, and found that athletes in basketball, volleyball, and handball exhibited higher relative and peak anaerobic power than those in other team sports (Kalinski, Norkowski, Kerner and Tkaczuk, 2002). Since there are very few studies on korfball athletes, it is difficult to compare and interpret performance parameters. At the same time, korfball is similar to both basketball and handball team games. Due to the limited number of studies evaluating the performance parameters of korfball players, we can consider that korfball, as a team sport, involves similar maneuvers to basketball and handball and make inferences accordingly. The previous study that consists of 20 male korfball athletes and 20 male netball (similar with basketball) athletes investigated agility between groups. The illinois agility test was used to conduct agility test for both groups. It was found that netball athletes have good agility compared to korfball athletes. The mean of netball athletes in the shuttle run is 14.31 second compared to korfball athletes' mean of 15.57 second (Kaur, 2015). On the other hand, Malousaris et al. showed that hitters and liberos were significantly faster and had better agility than setters and middle

blockers in volleyball athletes (Malousaris et al., 2008). Kasabalis et al., reported that measurements of vertical jump and Wingate scores indicated higher values for volleyball athletes than nonathletes in different ages (adults, junior, youth) (Kasabalis, Douda and Tokmakidis, 2005).

In a study, which was conducted with 50 subjects-25 from basketball and 25 from korfball team sports-the explosive power of the legs and flexibility were investigated. Basketball athletes demonstrated higher strength compared to korfball athletes, whereas korfball athletes exhibited better flexibility in the sit and reach test than basketball athletes (Rameshkannan and Chittibabu, 2014). In current study, no statistically significant differences were found among volleyball and korfball athletes for flexibility.

The result of this study showed there was significant difference in abdominal strength endurance between korfball and volleyball athletes. The number of repetition sit ups test of korfball athletes were significantly higher than the volleyball athletes (24.33±3.5, 16.11±3.07, respectively). Rameshkannan et al. compared the maximum number of sit-ups completed in one minute between handball and volleyball athletes and reported no difference in abdominal strength endurance between these athletes. (Rameshkannan and Chittibabu, 2014). In another study, abdominal strength and endurance of handball players was higher than volleyball players (Lanning et al., 2006). Therefore, no statistically significant differences were found among groups for push up and CKCUET tests in current study.

In present study, during the flamingo balance test on the right foot, the number of falls at 60 seconds of korfball athletes were less than the volleyball athletes. The korfball athletes reached longer distances than volleyball athletes in the star balance test on the right foot. Similar results were noted in a previous study, in the postural control assessment with the star excursion balance test, the anterior reach distance was significantly lower than the other side measures for volleyball athletes playing various positions (Elahe, Narges, Mahdieh and Somayeh, 2013). On contrast, Lanning et al. found that the dynamic balance values of female volleyball athletes were higher than the values of female football athletes (Lanning et al., 2006).

Study Limitations and Strengths

This study is strong in terms of the objective tests conducted for evaluating performance parameters and its contribution as a reference to the literature on korfball players. However, the small number of korfball players in the sample size is considered a limitation.

CONCLUSION

The korfball and volleyball athletes had similar performance parameters according to results of body composition, aerobic and anaerobic capacity, muscle strength and endurance, flexibility and hand grip strength except skinfold measurements, abdominal muscle strength and static and dynamic balance. This study supports the similarity of the physical and motoric values of these team players. In addition, the structural and functional characteristics of athletes are crucial for success in korfball, as in other sports. This study compared the similarities between volleyball and korfball players. It is one of the few studies in this field that provides information about the physical and functional performance of korfball players.

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Conflict of Interest

The author declare no potential conflicts of interest with respect to the research, authorship and/or publication of this article.

Author Contributions

Plan, design: GA, EA; **Material, methods and data collection:** GA, EA, TCS; **Data analysis and comments:** GA; **Writing and corrections:** GA, EA.

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Ethical Approval

Institution: Scientific, Social, and Non-Interventional Health Sciences Research Ethics Committee of Istanbul Okan University.
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The Relationship Between Neurocognitive and Psychosocial Functioning in Major Depressive Disorder: A Multicenter Retrospective Study

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ABSTRACT

Objective: This study provides a holistic perspective of the effects of Major Depressive Disorder (MDD) and related factors on functioning and examines the relationship between neurocognitive and psychosocial impairments. **Materials and Methods:** This retrospective archive study was conducted by analyzing data obtained from eight different clinics in Turkey. The study included 98 patients diagnosed with MDD (DSM-5 criteria) and 68 matched healthy controls. Retrospective evaluations included the Montgomery-Asberg Depression Scale (MADRS), Sheehan Disability Scale (SDS), Perceived Deficit Questionnaire (PDQ-D), Digital Symbol Substitution Test (DSST), and SF-36 Health Survey. **Results:** Neurocognitive and psychosocial functioning levels were found to be low in MDD patients. Patients with MDD scored significantly lower on all domains of SF-36 and PDQ-D scores. While severity of depression and age of onset had a statistically significant impact on PDQ-D scores, educational level had a statistically significant impact on DSST scores. A negative correlation was observed between the PDQ-D and domains of the SF-36 other than the social functioning domain. **Conclusion:** The present study's findings related to the Turkish population emphasize the burden of MDD on functioning. Furthermore, the two-way relationship between impairments in cognitive and psychosocial functioning indicates a different aspect of depression symptomatology.

Keywords: Depressive Disorder, Quality of Life, Psychosocial Functioning, Neurocognitive Disorders,

Majör Depresif Bozuklukta Nörobilişsel ve Psikososyal İşlevsellik İlişkisi: Çok Merkezli Retrospektif Bir Çalışma

ÖZ

Amaç: Bu çalışma, Majör Depresif Bozukluk (MDD) ve ilgili faktörlerin işlevsellik üzerindeki etkilerine dair bütünsel bir bakış açısı sunmakta ve nörobilişsel ve psikososyal bozukluklar arasındaki ilişkiyi incelemektir. **Gereç ve Yöntem:** Çalışma retrospektif tipte olup, Türkiye'deki sekiz farklı klinikten elde edilen verilerin analiz edilmesiyle yürütülmüştür. Çalışmaya DSM-5 kriterlerine göre MDD tanısı almış 98 hasta ile yaş, cinsiyet ve eğitim düzeyi açısından eşleştirilmiş 68 sağlıklı kontrol dahil edilmiştir. Veriler, Montgomery-Asberg Depresyon Ölçeği (MADRS), Sheehan Yetiyitimi Ölçeği (SYYÖ), Algılanan Bilişsel Kusurlar Anketi (ABKA), Sayı-Sembol Eşleme Testi (SSET) ve SF-36 Sağlık Anketi kullanılarak retrospektif olarak değerlendirilmiştir. **Bulgular**: MDD hastaları, SF-36'nın tüm alt alanlarında ve ABKA skorlarında anlamlı derecede daha düşük puan almıştır. Depresyon şiddeti ve başlangıç yaşı, ABKA skorlarını istatistiksel olarak anlamlı şekilde etkilerken, eğitim düzeyi SSET skorları üzerinde belirleyici bulunmuştur. ABKA ile SF-36'nın sosyal işlevsellik dışındaki tüm alt ölçekleri arasında negatif bir ilişki gözlenmiştir. **Sonuç:** MDD hastalarında nörobilişsel ve psikososyal işlevsellik düzeyleri düşük bulunmuştur. Depresyon şiddeti ve başlangıç yaşının bilişsel işlevsellik üzerindeki etkisi belirgin olup, eğitim düzeyinin yürütücü işlevlerle ilişkili olduğu saptanmıştır. Bulgular, MDD'nin işlevsellik üzerindeki etkisini vurgulamakta ve depresyon semptomlarının bilişsel ve psikososyal yönleri arasındaki karşılıklı ilişkiye dikkat çekmektedir.

Anahtar Kelimeler: Depresif Bozukluk, Yaşam Kalitesi, Psikososyal İşlevsellik, Nörobilişsel Bozukluklar, Bilişsel Disfonksiyon.

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INTRODUCTION

Major depressive disorder (MDD) is one of the most prevalent lifetime psychiatric disorders (Gutiérrez-Rojas et al., 2020) and a prominent cause of disability in young adults around the world (Morey-Nase et al., 2019). MDD negatively impacts quality of life, causing physical and mental disability. It often emerges during adolescence and young adulthood, critical periods for neurocognitive and psychological development (Morey-Nase et al., 2019). Studies have shown impairment in cognitive and psychosocial functioning to be common in MDD (Cambridge et al., 2018), including cognitive impairments in verbal fluency, executive function, working memory and attention (Matthew J. Knight et al., 2018). Working memory, executive functions, and attention are most affected (Matthew J. Knight et al., 2018). Neurocognitive impairment can emerge before depression, persist alongside depressive symptoms, and continue even after clinical recovery. Many studies have reported the persistence of impairments in cognitive functioning despite symptomatic remission, preventing functional recovery (Matthew J. Knight et al., 2018; Schwert et al., 2018).

The functional impairment associated with MDD has social and economic consequences. The psychosocial functionality of those diagnosed with MDD is affected in such domains as working capacity, productivity, daily life activities and interpersonal relationships (Hammer-Helmich et al., 2018). In addition, the broad cognitive impairment associated with MDD affects many areas of psychosocial functioning (Matthew J. Knight & Baune, 2018). The cognitive domains affecting psychosocial functioning include executive function, memory, verbal learning, language and attention (Cambridge et al., 2018). Studies of the impacts on the domains of executive function, memory and verbal fluency have revealed them to be predictive of reduced levels of academic, professional and daily functioning (Lee et al., 2012). Furthermore, persistent cognitive impairment despite symptomatic remission may interact with existing emotional and social vulnerabilities and cause recurrent depressive episodes (Cha et al., 2017). Despite the above, the relationship between neurocognitive and psychosocial functioning in MDD is still an under-investigated issue.

The clinical features seen in the course of MDD may affect the development of neurocognitive impairment, including age of onset of the disease, education level, disease duration and severity of depression (Cambridge et al., 2018), although the effect of clinical features on the relationship between neurocognitive impairment and psychosocial functionality remains unknown.

The diagnosis and treatment of cognitive and psychosocial impairments are crucial for depressive people if they are to achieve the premorbid level of functioning. An MDD treatment that focuses solely on mood symptoms will fall short of making an adequate contribution to quality of life and functionality in patients, compelling researchers to focus increasingly on comorbid cognitive disorders with MDD and the decline in quality of life resulting in impairment in functioning. There have been many studies of comorbid cognitive disorders, MDD and the reduction of psychosocial functioning to date, although studies thoroughly analyzing the neurocognitive and psychosocial functioning of patients and quality of life are lacking in literature. Furthermore, which cognitive domains are predictors of psychosocial dysfunction is still currently unknown. This study provides a holistic perspective of the effects of MDD and related clinical factors on functioning and examines the relationship between neurocognitive and psychosocial impairments.

MATERIALS AND METHODS

Study type

The present retrospective archive study was conducted with data from eight clinics from in the cities of Ankara, Aydin, Balikesir, Izmir, Manisa, and Tekirdag in Turkey, which were analyzed retrospectively.

Study group

The inclusion criteria for the study, which was granted ethics committee approval, included: aged 18–65 years, volunteering to take part, meeting the DSM 5 criteria supporting a diagnosis of MDD, not being on any psychotropic medication, and being sufficiently competent to follow the study's instructions and to comply with the study scales. The exclusion criteria were having substance use disorder, having had a (hypo)manic episode, presenting with psychotic characteristics, presence of any other psychiatric disease (except anxiety disorder in remission), presence of physical and/or neurologic diseases, having treatment-resistant depression (if relevant to the duration of the current disorder), being pregnant or breast-feeding, having undergone an ECT procedure within the past six months, and being on antipsychotics within the past two months or having been on depot antipsychotics within the past six months.

The study included 98 patients who fulfilled the specified criteria. The control group consisted of 68 healthy controls matched for age, sex and education level. The Sociodemographic Data Form, Montgomery-Asberg Depression Scale, Sheehan Disability Scale, Perceived Deficit Questionnaire (PDQ), Digital Symbol Substitution Test (DSST), and SF-36 Health Survey were retrospectively evaluated from patient records.

Dependent and independent variables

The dependent variables of this study are neurocognitive and psychosocial functioning. The independent variables include depression severity, disease duration, age of onset, and educational level.

Procedures

The data were collected using a sociodemographic characteristics form and validated psychometric scales. The Montgomery-Asberg Depression Scale (MADRS) assesses depression severity, with higher scores indicating more severe symptoms. The Sheehan Disability Scale (SDS) evaluates the impact of emotional symptoms on daily functioning. The Perceived Deficits Questionnaire (PDQ-D) is a 20-item self-report measure assessing subjective cognitive deficits, with higher scores reflecting greater impairment. The Digit Symbol Substitution Test (DSST) measures executive functions, attention, and psychomotor speed, while the SF-36 Health Survey assesses quality of life across multiple domains. Ethics approval was obtained for the study, and patient data were anonymized and retrospectively analyzed.

Statistical analysis

The statistical analysis was carried out in SPSS (Version 15.0. Chicago, SPSS Inc.). A Chi-square test was applied to categorical variables and a T-test to continuous variables. The correlation between the neurocognitive tests (PDQ-D and DSST) and psychosocial functioning scale scores (SF-36, Sheehan Disability Scale) was measured with a Pearson correlation coefficient analysis. A regression analysis was conducted for all functioning estimations to evaluate all reciprocal relationship in which the PDQ-D, DSST and SF-36 scales were taken as the dependent variables, and age, depression severity (MADRS), duration of the latest episode, duration of disease, age of disease onset, educational level and the number of episodes were taken as independent variables.

Ethical considerations

The study was approved by the institutional ethics committee, and all patient data were anonymized to ensure confidentiality. Written approval was obtained from the author's Balikesir University Ethics Committee (Date: 18.10.2022, Approval no: 2022/95).

RESULTS

Sociodemographic and clinical characteristics

The study included 98 patients and 68 healthy controls who met the specified criteria. The mean age of the patient and control groups were 34.92±10.6 years and 35.44±9.9 years, respectively. In addition, 68.7% of the sample group was female. No statistically significant difference was recorded between the patient and control groups in terms of age, sex and educational level (Table 1).

The age of disease onset was 30.68±10.2 years (min. 16, max. 65), and the average duration of disease was determined to be 4.1±5.2 years (ranging from 1–28 years). The number of past depressive episodes, ranging from 1 to 8, was on average 2.3±4.2, and the mean duration of the latest depressive episode was recorded as 5.85±6.1 months (ranging from 1 to 36 months). On average, the number of hospital admissions with a diagnosis of MDD was 0.61±0.2 (ranging from 0 to 2). The mean MADRS score in the patient group was determined as 31.06±6.4 (Table 2).

Table 1. Demographic Characteristics and Clinical Assessment Results of Participants

Variables		Mean*/%**
Age (year)	Patient	34.92±10.6*
	Control	35.44±9.9*
Gender	Female	68.7%**
	Male	31.3%**
Education level	Elementary	22.50%**
	Secondary	16.50%**
	High School	27.50%**
	College	33.50%**

This table presents the demographic characteristics and clinical data of participants, including age, gender, education level, age of onset, and disease duration. The comparison between major depressive disorder (MDD) patients and healthy controls ensures a balanced evaluation of neurocognitive and psychosocial functioning. n: Count, *: mean value **: Column percentage

Psychosocial functionality parameters

In the evaluation of the patients' psychosocial functionality parameters, the average score from the Sheehan Disability Scale was 18.61±5.5, while the mean score of the SF-36 for the physical functioning domain was recorded as 70.20±24.4, and 3943±22.9 for the social functioning domain, 45.66±41.7 for the physical role limitations domain, 11.89±22.6 for the emotional role limitations domain, 30.29±15.2 for the mental health domain, 25.40±15.02 for the vitality domain, 55.36±24.0 for bodily pain domain, and 34.13±20.2 for the general health perceptions domain. Patients scored lower in all SF-36 survey domains when compared to the general population, to a statistically significant degree ($p<0.05$) (Table 3).

As revealed in the regression analyses (Table 4), among the variables affecting the social functioning domain, depression severity was found to be statistically significant ($p<0.05$) while age of onset was found to have just failed significance ($p= 0.057$). It was further shown that age of onset and depression severity affected the SF-36 emotional role limitations domain ($p<0.05$), and that depression severity, duration of disease and male gender were predictors of vulnerability to the SF-36's vitality domain ($p<0.05$). The number of episodes and educational level were both significant predictors of bodily pain ($p<0.05$).

As a result, a negative correlation was observed between the MADRS score and the SF-36's social functioning, physical role limitation, emotional role limitation, mental health and vitality domains in the effect of depression severity on psychosocial functionality ($p<0.05$).

Neurocognitive functioning parameters

PDQ-D and DSST were administered to measure the patients' neurocognitive functions. The mean PDQ-D

score was 25.87±18.6 and the mean DSST score was 38.93±13.5. A statistically significant difference was noted between the PDQ-D scores of the patient and control groups ($p<0.05$), and a positive correlation was observed between the PDQ-D and DSST scores ($p<0.05$).

A regression analysis revealed depression severity and age of onset significantly affected PDQ-D scores. Additionally, educational level had a notable impact on DSST scores. ($p<0.05$). Moreover, a later age of disease onset was observed to have just failed significance over DSST scores ($p= 0.057$) (Table 4).

The relationship between neurocognitive functioning parameters and psychosocial functionality parameters

A Pearson correlation coefficient analysis was carried out to measure the relationship between all neurocognitive functioning ratings and depression severity, and psychosocial functioning.

A positive correlation was observed between the SDS and PDQ-D scores ($p<0.05$), and a negative correlation was observed between the PDQ-D and all domains of the SF-36 other than the social functioning domain ($p<0.05$). No statistically significant association was noted between DSST scores and the other SF-36 domain scores or the Sheehan Disability Scale.

Figure 1 illustrates the correlation patterns between neurocognitive (PDQ-D, DSST) and psychosocial (SDS, SF-36) functioning parameters, demonstrating significant negative correlations between PDQ-D scores and all SF-36 domains except social functioning.

Table 2. Clinical characteristics of patients.

Variables	Mean
MADRS	31.1±6.5
The age of disease onset (year)	30.6±10.2
Duration of disease (year)	4.1±5.2
Duration of the latest depressive episode (month)	5.8±6.1
The number of past depressive episodes	2.3±4.2
The number of hospital admissions	0.6±0.3

This table provides clinical data of patients diagnosed with MDD, including the severity of depression (MADRS score), age of onset, duration of illness, number of past depressive episodes, duration of the most recent episode, and frequency of hospital admissions. **MADRS:** Montgomery-Asberg Depression Rating Scale

Table 3. Comparison of SF-36 Subdimensions Between Patients with Major Depressive Disorder and Healthy Controls

Variables	Depression Group (%)	General population's norm value (%)	p
Physical functioning	70.2±24.4	86.6±25.2	0.000
Social functioning	39.4±22.9	94.8±14.2	0.000
Physical role limitations	45.7±41.7	89.5±29.6	0.000
Emotional role limitations	11.9±22.6	94.7±20.9	0.000
Mental health	30.3±15.2	73.5±11.6	0.000
Vitality	25.4±15.0	67.0±13.8	0.000
Bodily pain	55.4±24.0	86.1±20.6	0.000
General health perceptions	34.1±20.2	73.9±17.5	0.000

This table presents the demographic characteristics and clinical data of participants, including age, gender, education level, age of onset, and disease duration. The comparison between major depressive disorder (MDD) patients and healthy controls ensures a balanced evaluation of neurocognitive and psychosocial functioning. **p:** p-value, **%:** Column percentage.

DISCUSSION

Psychosocial functionality of patients with major depressive disorder

The SF-36 scores of the patients in all domains were statistically significantly lower than those of the population norms. Furthermore, a negative correlation was recorded between depression severity and the social functioning, physical role limitation, emotional role limitation, mental health and vitality domains of the SF-36 survey and the SDS scores. Based on these results, MDD can be considered to have a negative impact on the general health perception of patients, to disrupt their functioning in all psychological, social and physical areas, and to lowers the quality of life. The greater the severity of depression, the greater the limitations in physical and

emotional areas, and the greater the interference in social functioning and health perceptions.

An international multicenter study revealed that people with MDD reported marked functional impairment with lower SDS total scores (Hammer-Helmich et al., 2018). Sumiyoshi et al. (2019) reported a positive correlation between depression severity and psychosocial function, as measured by the SDS, concurring with the findings of the present study. Furthermore, worse depressive symptoms were associated with lower work productivity in the domains of presenteeism, overall work impairment, general activity impairment and lower quality of life. Aydemir et al. (2009) found that MDD patients scored statistically significantly lower in all domains of the SF-36 than population norm, with the mental health quality parameters being observed to have a high level of correlation with depression severity, and the physical domain to have a moderate level of correlation (Aydemir et al., 2009).

Table 4. The impact of sociodemographic and clinical characteristics on psychosocial and cognitive functionality parameters.

Variables	Depression Group	General population's norm value
SF-36 social functioning domain		
Severity of depression	0.016	-0.814
The age of disease onset	0.057	0.418
Sf-36 emotional role limitations domain		
Severity of depression	0.016	-0.246
The age of disease onset	0.006	0.292
Sf-36 vitality domain		
Severity of depression	0.034	-0.510
Duration of disease	0.027	-0.851
Male gender	0.031	7.559
Sf-36 bodily pain domain		
The number of past depressive episodes	0.013	1.781
Education Level	0.046	4.940
PDQ-D		
Severity of depression	0.014	0.599
The age of disease onset	0.002	-0.496
DSST		
The age of disease onset	0.057	-0.248
Education Level	0.000	5.666

This table demonstrates the effects of sociodemographic and clinical characteristics such as depression severity, age of onset, duration of illness, number of depressive episodes, and education level on psychosocial and neurocognitive functioning in MDD patients. Statistically significant predictors for each domain are highlighted. **p**: p-value, **SF-36**: 36-Item Short Form Health Survey, **PDQ-D**: Perceived Deficit Questionnaire for Depression, **DSST:** Digit Symbol Substitution Test.

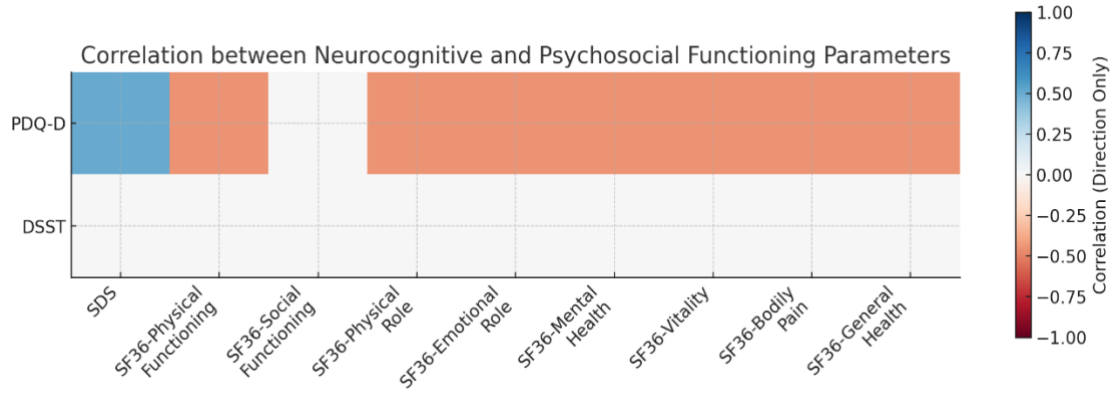

Figure 1. Correlation Between Neurocognitive and Psychosocial Functioning Parameters in MDD

The present study reveals the social functioning and emotional role limitation domains of SF-36 to be affected by depression severity and late onset of the disease. Furthermore, the vitality domain was affected by depression severity, duration of disease and male gender, while the bodily pain domain was affected by the total number of episodes and educational level. Reviews of literature reveals similar findings, with depression severity reported to have an impact on emotional functioning (Choenarom et al., 2005; Murray et al., 2006). A systematic review of 103 studies by Cabello et al. (2012) found the vitality domain to be negatively affected by depression severity and its chronicity but positively affected by the female gender. On the other hand, the bodily pain domain was negatively affected by the chronicity and female gender factors, while being positively affected by daily-life activities and self-care.

Neurocognitive functioning of patients with major depressive disorder

In the present study, MDD patients were found to score statistically significantly low in the scales measuring objective and subjective neurocognitive functioning. Cognitive dysfunction in MDD is related to the specific core symptoms of depression, and has a negative impact on the functioning of patients.

Studies have revealed a high prevalence of objective cognitive impairment in MDD (Sumiyoshi et al., 2019). Davis et al. (2017) found that, compared to healthy controls, substantial deficits were observed in patients with depression in terms of such executive functions as verbal learning, memory, visual-spatial problem solving and visual attention. While no statistically significant difference was observed in psychomotor speed, substantial differences were observed in the reaction time and processing speed. A meta-analysis of 23 studies found attention, verbal memory, visual memory, verbal reasoning, processing speed/reaction time and verbal learning to be significantly poorer in the depressed samples (Goodall et al., 2018).

A bidirectional relationship exists between neurocognition and depression. For example, depressive symptoms such as comorbid anxiety, rumination, insomnia, negative thinking style, and lack of motivation negatively affect neurocognition, while poorer neurocognition causes amotivation, based on withdrawal from activities associated with neurocognitive functions (Morey-Nase et al., 2019). Depressive individuals reported experiencing negative affective responses to their experience of neurocognitive difficulties, and this reaction is associated with a lower awareness of the depression-neurocognition relationship (Morey-Nase et al., 2019).

The present study reveals that depression severity and early onset age have an impact on subjective cognitive dysfunction, that education level influences objective cognitive dysfunction, and that a later age of disease onset was observed to have just failed significance over DSST score. The identified correlation between depression severity and poor subjective cognition was consistent with the results of the "The Prospective Epidemiological Research on Functioning Outcomes Related to Major Depressive Disorder" (PERFORM) studies conducted in Europe and Japan (Hammer-Helmich et al., 2018; Sumiyoshi et al., 2019). Recent studies have also reported the age of onset to be related to cognitive impairment in MDD (Cambridge et al., 2018). Given the association between older age and more significant cognitive deficits, the negative effect of age of onset may be partly attributed to the contribution of the average age-related cognitive decline and the effect of MDD.

The lack of association between the DSST and MADRS scores indicates a lack of association between objective neurocognitive impairment and depressive symptoms, unlike subjective neurocognitive impairment. The DSST assesses cognitive performance by measuring the speed of psychomotor performance, which is relatively independent of depressive symptoms. The PDQ, on the other hand, is a self-report scale that measures subjective cognition, which tends to be affected by depressive symptoms. Mood disturbance due to MDD is a symptom that is defined subjectively by the patient, and so therefore, it is reasonable that the subjective cognition-depression relationship more

apparent. This result concurs also with the findings of the PERFORM J study (Sumiyoshi et al., 2019).

A study examining the relationship between the objective and subjective levels of neurocognitive impairment in MDD patients and healthy controls revealed that individuals reporting high subjective cognitive impairment were not necessarily those with high objective cognitive impairments in both groups (Schwert et al., 2018). Schwert et al. (2018) reported that a significant majority of depressed patients underestimate their memory-related cognitive abilities, whereas the majority of healthy individuals overestimate their memory functions. According to the cognitive model of depression, depressed patients have negatively biased perceptions of the self, others and the future, and as a result of negative perceptions of the self, patients with MDD may be pessimistic in their self-referent evaluations.

The impact of neurocognitive dysfunction on psychosocial functioning

Empirical evidence suggests that the cognitive dysfunction associated with MDD can lead to impairments in psychosocial functioning during both acute depressive episodes and remission.

The present study revealed a negative correlation between PDQ-D scores and SDS scores and all domains of SF-36, aside from the social functioning domain. As the PDQ-D addresses such domains as attention/concentration, retrospective memory, prospective memory, and planning/organization, the study demonstrates a correlation between these functions, including the core symptoms of depression and impairment in psychosocial functioning, identifying also a cause for the increase in disability.

This study identified no statistically significant association between the DSST and SF-36 scores, nor the Sheehan Disability Scale scores, indicating that psychomotor speed and visual learning have no effect on impairments in psychosocial functioning.

Cambridge et al. (2018) reported impairments in attention, memory and executive functions to be associated with longitudinal impairments in daily, social and occupational functioning in MDD. It was reported in the same study that depression severity increased the negative effects of cognitive deficits on psychosocial dysfunction, concurring with the findings of the present study. The results of the Perform J study revealed the objective cognitive impairments measured by the DSST, and disturbances of subjective cognition measured by the PDQ-D to be associated with a poor quality of life and impairment in neurocognitive functions. Significant decreases in DSST scores and increasing PDQ-D scores have been reported to be associated with higher SDS scores (Sumiyoshi et al., 2019). Consistent with the present study, Hammer-Helmich et al. (2018) reported subjective cognitive impairment to be associated with impairment in psychosocial functioning through SDS scores. Cha et al. (2017) also identified a positive correlation between the PDQ-5-D and SDS scores, as well as a strong relationship between subjective cognitive impairment and loss of functionality in work/school, family and home responsibilities, and lost economic days.

In the present study, while perceived subjective cognitive functioning is noted to have a significant effect on psychosocial functioning, objective cognitive functioning is mainly affected by age of onset and is unrelated to depression severity or psychosocial functioning.

Limitations and strengths of the study

Due to the cross-sectional design of the study, the temporal relationship of impairments in both neurocognitive and psychosocial functioning was not studied, and so there is a need to replicate the study using a similar methodology but with a longitudinal design.

The strengths of this study, on the other hand, are primarily its inclusion of eight different units and eight different types of institution, its simultaneous measurement of all parameters of functioning, its inclusion of a control group and its comparison of psychosocial functionality with the population norms.

CONCLUSION

The present study's findings related to the Turkish population emphasize the burden of MDD on functioning and contribute to the findings of previous studies conducted in different cultures. Furthermore, the two-way relationship between impairments in cognitive and psychosocial functioning indicates a different aspect of depression symptomatology with an effect on depression severity. Our findings highlight the significant impact of neurocognitive impairments on psychosocial functioning in MDD patients. Given the observed associations between perceived cognitive deficits and functional impairment, interventions targeting cognitive functioning -such as cognitive remediation therapy, psychoeducation programs, and structured neuropsychological interventions- should be integrated into standard treatment approaches. Addressing both affective symptoms and cognitive dysfunction could enhance patients' overall functional recovery and improve their quality of life. Our findings emphasize that major depressive disorder not only affects mood but also has a significant impact on cognitive and psychosocial functioning. The bidirectional relationship between neurocognitive impairments and psychosocial functioning highlights the complexity of depressive symptomatology, suggesting that a comprehensive treatment approach should address both cognitive and functional impairments. These findings suggest a need for therapeutics targeting the cognitive impairment of MDD, as well as further studies investigating the predictors of functioning in depression.

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The author declares no potential conflicts of interest with respect to the research, authorship and/or publication of this article.

Author contributions
Plan, design: ÖA; **Material, methods and data collection:** All authors; **Data analysis and comments:** DA, ÖA; **Writing and corrections:** DA, ÖA.

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Management of a Zygomatic Implant Complication Using Custom-Made Subperiosteal Implants: A Case Report

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ABSTRACT
Introduction: Zygomatic implants are effective for treating edentulism when conventional implants are unsuitable due to insufficient bone volume. Despite high success rates, complications such as sinusitis and osseointegration failure may occur. This report presents a case in which a custom subperiosteal implant was successfully used to manage a zygomatic implant complication. **Case Presentation:** A 52-year-old female with severe maxillary bone loss underwent zygomatic implant placement. Four months later, a complication with the right posterior zygomatic implant was identified, leading to its removal and the subsequent repair of an oroantral fistula. A custom subperiosteal implant was then successfully placed. **Discussion:** Complications with zygomatic implants require innovative solutions. Subperiosteal implants provide an effective management option, especially in cases involving severe bone loss. **Conclusion:** This case demonstrates the successful use of subperiosteal implants to manage zygomatic implant complications, underscoring the need for further research in this field.
Keywords: Zygomatic Implants, Subperiosteal Implants, Implant Complications, Maxillary Bone Loss.

Özel Yapım Subperiostal İmplantlarla Zigomatik İmplant Komplikasyonunun Yönetimi: Bir Olgu Sunumu

ÖZ
Giriş: Zigomatik implantlar, yetersiz kemik hacmi nedeniyle geleneksel implantların uygun olmadığı durumlarda dişsizliği tedavi etmek için etkilidir. Yüksek başarı oranlarına rağmen sinüzit ve osseointegrasyon başarısızlığı gibi komplikasyonlar meydana gelebilir. Bu rapor, zigomatik implant komplikasyonunu yönetmek için özel bir subperiosteal implantın başarıyla kullanıldığı bir vakayı sunmaktadır. **Olgu Sunumu:** Şiddetli maksiller kemik kaybı olan 52 yaşında bir kadına zigomatik implant yerleştirildi. Dört ay sonra, sağ posterior zigomatik implantta bir komplikasyon tespit edildi ve bu da implantın çıkarılmasına ve ardından oroantral fistülün onarılmasına yol açtı. Daha sonra özel bir subperiosteal implant başarıyla yerleştirildi. **Tartışma:** Zigomatik implantlardaki komplikasyonlar yenilikçi çözümler gerektirir. Subperiosteal implantlar, özellikle şiddetli kemik kaybının olduğu vakalarda etkili bir yönetim seçeneği sunar. **Sonuç:** Bu vaka, zigomatik implant komplikasyonlarını yönetmek için subperiosteal implantların başarılı bir şekilde kullanıldığını göstererek bu alanda daha fazla araştırma yapılması gerektiğini vurgulamaktadır.
Anahtar Kelimeler: Zigomatik İmplantlar, Subperiostal İmplantlar, İmplant Komplikasyonları, Maksiller Kemik Kaybı.

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INTRODUCTION

Zygomatic implants have emerged as a reliable solution for edentulism, especially in cases where conventional implant placement might be challenging due to inadequate bone volume or quality in the posterior maxilla. Traditional intraosseous implants often face significant challenges in the posterior maxillary region due to the proximity to the maxillary sinus and poor bone quality (Kämmerer et al., 2023). In such scenarios, zygomatic implants and custom subperiosteal implants offer alternative solutions. Zygomatic implants, anchored in the zygomatic bone, are particularly favored when maxillary bone height is insufficient (Brånemark et al., 2004; Wang et al., 2015).

Despite their high success rates, complications such as chronic sinusitis, lack of osseointegration, and prosthetic issues can occasionally arise, necessitating specialized approaches for resolution (Molinero-Mourelle et al., 2016). The management of these complications often poses a clinical challenge, requiring innovative strategies to ensure successful outcomes. This case report delves into the management of a complication associated with zygomatic implants through the innovative use of subperiosteal implants.

Subperiosteal implants, historically known for their application in compromised bone situations, offer a promising alternative when dealing with complex complications (Weiss et al., 2005; Strappa et al., 2022). Their unique design and placement technique allow for the circumvention of areas with inadequate bone while providing stable support for dental prostheses. In this report, we present a detailed account of a 52-year-old female patient who experienced a complication four months after the placement of a zygomatic implant. The patient was successfully treated with a custom-made subperiosteal implant.

The case provides insights into the clinical presentation, diagnostic assessment, and successful utilization of subperiosteal implants in addressing complications associated with zygomatic implants. The intricate nature of zygomatic implant complications often requires tailored solutions, and this case demonstrates the efficacy of subperiosteal implants as an effective remedial strategy. By detailing the clinical process, complication management, and follow-up assessment, this report aims to contribute to the expanding knowledge base on managing complex scenarios related to zygomatic implantology. It offers valuable considerations for clinicians encountering similar challenges in their practice.

CASE REPORT

A 52-year-old female patient, with no known systemic diseases, presented to the Istanbul University Oral and Maxillofacial Surgery Clinic seeking implant surgery. During her detailed medical history, it was noted that she had been using a total removable prosthesis in the upper jaw since the age of 20. Radiographic examinations, including panoramic radiography and cone-beam computed tomography (CBCT), revealed significant bone resorption in the maxilla, which precluded the use of conventional implants. Consequently, a treatment plan was formulated involving the placement of zygomatic implants in the maxilla and four implants in the mandible following the all-on-four concept.

Under intravenous sedation and local anesthesia, a surgical plan was executed involving the placement of two zygomatic implants in the upper jaw. Additionally, two 3.2 mm x 10 mm (JD Evolution) implants were placed in the anterior maxillary region, and two 4.9 mm x 40 mm (JD Zygoma) zygomatic implants were placed in the posterior maxilla to maximize the anchorage and stability. In the mandible, four 3.5 mm x 12 mm (Bredent CopaSKY) implants were inserted following the all-on-four protocol, ensuring optimal support for the prosthetic superstructure.

The surgical procedure was uneventful, and the patient tolerated the procedure well. She was reviewed one week postoperatively, and clinical examination revealed a smooth recovery of the soft tissues with no signs of infection or inflammation.

After a four-month osseointegration period, the patient returned for the prosthetic phase of her treatment. During the follow-up visit, the patient reported no issues and indicated that she had an uneventful postoperative period. However, during the session aimed at placing the gingival formers for the prosthetic stage, it was observed that sufficient torque could not be achieved on the right posterior zygomatic implant. This indicated potential failure of osseointegration or mechanical stability of the implant.

To further investigate, the zygomatic implants were removed using reverse torque technique, and a comprehensive CT scan was performed to assess the condition of the surrounding bone and sinus structures (Figure 1).

The CT scan did not reveal any signs of sinusitis, fractures, or cracks. However, it became evident that the bone in the region where the right posterior zygomatic implant was removed appeared thin and compromised. This suggested that adequate anchorage for a new zygomatic implant could not be achieved due to the substantial defect area, particularly in the buttress region. Consequently, re-implantation of the zygomatic implant was deemed unfeasible. Instead, a subperiosteal implant was considered a more suitable and less invasive option for the compromised bone structure.

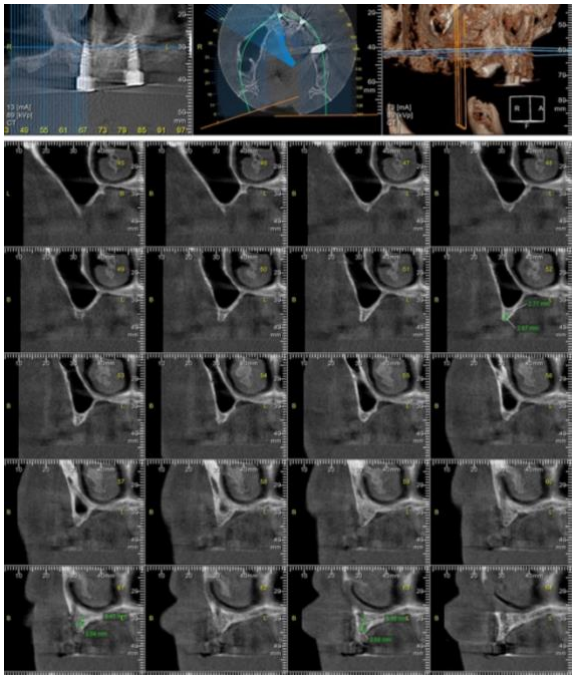

Figure 1: Three-dimensional sections of the defect area post-removal of the zygomatic implant, highlighting the compromised bone structure and defect area.

With the support of computed tomography, a flap was raised to directly examine the region. During this examination, an oroantral fistula was detected at the neck of the removed zygomatic implant. The presence of this fistula was likely contributing to the implant's failure. The fistula was meticulously closed using connective tissue harvested from the palate to ensure a robust and functional closure. Following this, a subperiosteal implant was planned to provide a fixed prosthesis solution that would offer stability and durability in the existing bone structure.

Three weeks post-closure of the oroantral fistula, the patient was called for a follow-up. Complete healing of the soft tissue in the surgical area was observed, indicating successful closure of the fistula. Customized subperiosteal implants, designed using preoperative imaging and 3D modeling, were then fabricated to fit the patient's unique anatomical structure. These implants were placed under local anesthesia with precision to ensure optimal fit and integration (Figure 2).

Postoperative management included a regimen of oral amoxicillin/clavulanic acid to prevent infection and flurbiprofen to manage pain and inflammation.

The patient was reviewed 10 days post-implant placement, exhibiting uneventful recovery with no signs of infection or adverse reaction. The patient reported no discomfort or complications, indicating a successful adaptation to the new subperiosteal implants.

Impressions were taken for the fabrication of temporary fixed prostheses, which were applied within the same week. The temporary prostheses

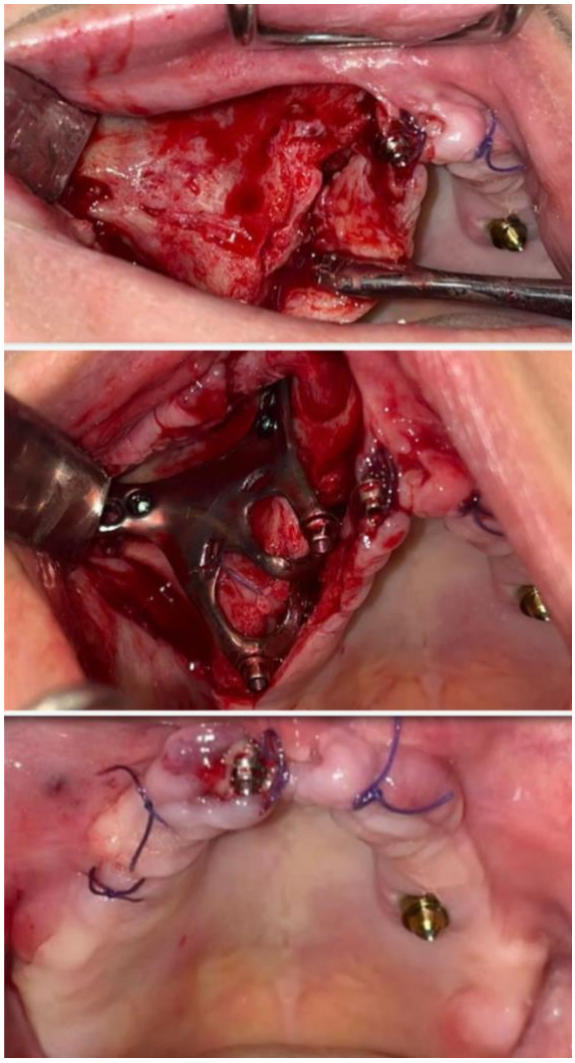

Figure 2: Placement of the customized subperiosteal implant under local anesthesia, demonstrating the tailored fit to the patient's anatomical structure and the precision of the surgical technique.

provided functional and esthetic restoration while allowing for further observation of the integration and stability of the subperiosteal implants.

DISCUSSION

Zygomatic implants are frequently used to support dental prostheses in patients with severe maxillary bone loss. However, placing these implants can be technically challenging and may lead to various complications. This review examines the complications associated with zygomatic implants and explores the management of these complications using subperiosteal implants as documented in the literature.

Zygomatic implants offer a significant solution for dental rehabilitation, especially in patients with severe maxillary atrophy. These implants stabilize by anchoring in the zygomatic bone, providing support where traditional implants are insufficient. Literature reports high success rates and longevity for

prostheses supported by zygomatic implants (Aparicio et al., 2014; Chrcanovic et al., 2016).
Various complications can arise during and after the placement of zygomatic implants, including sinus perforation, sinusitis, soft tissue infections, implant displacement, and nerve damage (Brånemark et al., 2004; Candel-Marti et al., 2012). Sinus perforation is one of the most common complications and is often associated with sinusitis (Chrcanovic et al., 2016).
Managing complications associated with zygomatic implants poses a clinical challenge and often requires innovative approaches to ensure successful outcomes. Subperiosteal implants have proven to be an effective strategy in addressing complications encountered with zygomatic implants.
Complications in zygomatic implantology may range from prosthetic-related issues, such as prosthetic screw loosening or fracture, to more complex concerns like sinusitis, infection, or even zygomatic implant failure. In a review of 56 complications, incidences were reported as 9.53% for sinusitis, 7.5% for soft tissue infection, 10.78% for paresthesia, 4.58% for oroantral fistula formation, and 6.91% for surgery-related complications and prosthesis-related problems. A significant decrease in these incidences was observed when anatomy guidance was used, and the rate of paresthesia decreased from 10.78% to 0.55% (Kämmerer et al., 2023). The reported case exhibited an implant fracture, necessitating a meticulous approach to preserve function and aesthetics.
Only highly qualified surgeons with significant expertise should perform the placement of zygomatic implants to minimize postoperative complications. It is crucial to note that various anatomical structures adjacent to the zygomatic bone may be at risk of damage during the implantation process (Candel-Marti et al., 2012). Additionally, the loss of bone integration leading to the development of a bucco-sinus fistula results in substantial bone destruction in the surrounding area. This condition is further marked by alterations in the sinus mucosa and the functionality of the osteomeatal complex. Addressing such a situation necessitates specific treatments, including the removal of the implicated implant, curettage of the mucosa, and closure of the fistula, before considering a new reconstructive procedure. Upon the restoration of normal anatomy and sinus functionality, if there is a requirement for posterior anchorage replacement, a reconstructive approach involving bone grafting is recommended.
Subperiosteal implants are used as an alternative solution in cases of advanced bone resorption where traditional implants cannot be placed. These implants consist of a metal framework fixed under the periosteum on the bone surface. They have been shown to yield successful results in patients with severe bone loss (Weiss et al., 2005).
Subperiosteal implants offer an effective solution for managing complications arising from zygomatic implants. Literature documents successful cases where subperiosteal implants were used to treat complications such as sinus perforation and sinusitis (Misch, 1999). They are also effective in managing soft tissue infections (Weiss et al., 2005).
Brånemark and colleagues (2004) reported several cases where complications from zygomatic implants were successfully managed using subperiosteal implants. Similarly, Misch (1999) found that subperiosteal implants were effective in managing soft tissue infections.
Systematic reviews on the success of zygomatic implants contribute significantly to the literature and are essential for future surgeries. In a systematic review encompassing 25 studies with an average follow-up duration of 42.2 months (ranging from 0 to 144 months) and a collective inclusion of 1541 zygomatic implants, Goiato et al. identified a consistent survival rate of 97.86% after 36 months (Goiato et al., 2014). Another review reported similar success rates, highlighting the long-term viability of zygomatic implants when appropriately placed and managed (Chrcanovic & Abreu, 2013).
In the study by Göker, 69 zygomatic implants were placed in 25 patients and as a result of the follow-up of these patients between 65-88 months, a total of two patients had post-operative complications, one subcutaneous fistula and one oro-anal communication. However, no luxation was observed in any of the zygomatic implants (Goker, 2020).
Zygomatic implants provide an effective solution for dental prostheses in patients with severe maxillary bone loss, yet they are not without complications. Subperiosteal implants have emerged as a viable alternative for managing these complications. Literature demonstrates the success of subperiosteal implants in treating complications associated with zygomatic implants, highlighting the need for further clinical studies and case reports to expand the knowledge base and improve treatment outcomes. Future research should also explore advancements in biomaterials and implant design to enhance the efficacy and longevity of subperiosteal implants in managing complex cases.

CONCLUSION

This case highlights the effective use of subperiosteal implants in managing complications arising from zygomatic implants. The patient's successful treatment underscores the potential of subperiosteal implants as a viable alternative in scenarios where traditional approaches fail. This report contributes to the growing body of evidence supporting subperiosteal implants' role in complex dental rehabilitations, emphasizing the importance of innovative solutions in overcoming implantology challenges. Further studies and clinical evaluations are recommended to refine these techniques and improve outcomes for patients with severe maxillary bone loss.

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