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Evaluation of clinical and demographic characteristics of elderly patients receiving inpatient treatment in a university hospital psychiatry clinic

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■ MAIN POINTS

- This retrospective study analyzed 252 geriatric inpatients (≥ 65 years) treated in a university psychiatry clinic between 2018 and 2023. The most common diagnoses were anxiety disorders (46%), depression (25.0%), mood disorders (10.7%), and psychotic disorders (8.3%).
- Rehospitalization occurred in 22.8% of patients, mainly due to anxiety; 39% of these had chronic comorbidities.
- Depression co-occurred with anxiety in 15.3% of cases.
- Dementia was detected in 37.5% of patients undergoing cognitive screening.
- The rate of female patients hospitalized due to psychotic disorders was higher than that of males and chronic diseases were more common among patients covered by Yeşil Kart.

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■ ABSTRACT

Aim: In this study, we aimed to examine the sociodemographic and clinical characteristics of geriatric patients receiving inpatient treatment in the psychiatry clinic of a university hospital.

Materials and Methods: This retrospective study was conducted by examining the medical records of patients aged 65 and over who received psychiatric treatment between January 1, 2018 and December 31, 2023. Data related to the patients were obtained from the electronic patient database of the hospital.

Results: A total of 252 patients, consisting of 124 females and 128 males, were included in the study. The mean age of the patients was 70.67 ± 5.01 years, and the average length of hospital stay was 17.35 ± 12.18 days. The diagnoses were, respectively, anxiety disorder (46.8%), depression (25.0%), mood disorder (10.7%), psychotic disorders (8.3%), alcohol/substance dependence (2.0%), psychiatric disorders related to general medical conditions (4.8%), dementia (1.2%), and intellectual disability (0.4%). In total, 22.8% had received inpatient treatment more than once. The condition that most often caused repeated hospitalizations was anxiety disorder, and 39% of these patients had a coexisting chronic disease. Depression was the most common mental disorder accompanying anxiety (15.3%). Mild or higher dementia was detected in 24 of 64 patients who underwent Mini-Mental State Examination. While the rates of comorbid chronic diseases were high in patients with Yeşil Kart (s form of preliminary social security), the rate of female patients hospitalized due to psychotic disorders was higher than that of males.

Conclusion: Determining the frequency of psychiatric disorders in hospitalized elderly patients and knowing the characteristics that cause repeated hospitalization will contribute to the planning and development of appropriate treatment strategies.

Keywords: Old age, Psychiatry, Demographic characteristics, Repeated hospitalization

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■ INTRODUCTION

Aging is a physiological process in which physical and mental abilities are irreversibly reduced. The World Health Organization (WHO) has determined the beginning of this process as the age of 65, and has classified it as 65-74 as young-old, 75-84 as old-old and 85+ as oldest-old [1].

As is the case worldwide, the elderly population in our country is also rapidly increasing. According to data from the Turkish Statistical Institute (TUIK), the proportion of the elderly population increased by 21.4% in the last five years and reached 8 million 722 thousand 806 people in 2023. This ra-

tio is expected to increase to 12.9% in 2030 and 25.6% in 2080 [2]. This demographic change feeds into increasing life expectancy and decreasing birth rates, and is certainly a happy situation [3,4]. Because most elderly people are in good shape in terms of both mental and physical health and continue to contribute to their families and society. On the other hand, physiological changes and social and economic losses that occur with aging pave the way for the development of mental illnesses as well as physical illnesses in the elderly.

Studies report that approximately 25% of elderly individuals have a significant mental disorder [5]. Perhaps the most com-

mon psychiatric illness in elderly patients is depression. Depression is a significant risk factor for disability and death. WHO reports that global depressive disorder among older adult's ranges from 10% to 20%. Among all mentally ill, the rate of depressive disorder patients is 40%. However, although depression is a common mental health problem among the elderly population, approximately 50% of cases remain undiagnosed [6]. The psychiatric diseases frequently seen in the elderly population are the anxiety disorders (AD). The prevalence of anxiety in community samples varies between 1.2% and 15% while in clinical settings, it varies between 1% and 28%. The prevalence of anxiety symptoms is much higher, ranging from 15% to 52.3% in community samples and 15% to 56% in clinical samples [7]. In a study conducted in our country involving 462 individuals aged over 65, the current prevalence of all anxiety disorders was reported as 17.1% and the lifetime prevalence as 18.6% [8]. However, anxiety often accompanies depression, and almost half of the patients exhibit significant symptoms of depression and anxiety [9,10].

Panic disorders and obsessive-compulsive disorder are less common in the elderly, while specific phobias and generalized anxiety disorder (GAD) are more common mental disorders. The rate of psychotic disorders seen in the elderly varies between 0.1% and 0.5%, and psychotic attacks seen during this period may occur for the first time as a continuation of a pre-existing disease or mostly due to organic causes. The prevalence of manic episodes tends to decrease with aging [11]. Dementia is one of the most common neurological diseases in the geriatric population. Alzheimer's type dementia is the most common type in this group and constitutes 50-75% of all dementia cases [12].

Although psychiatric illnesses are common in the elderly population, they are often difficult to recognize. The fact that psychiatric diseases in the elderly may show different clinical findings compared to adults, patients denying or forgetting these conditions, the perception that the symptoms of some diseases, especially dementia and depression, are a natural part of the aging process, and the masking of symptoms by chronic diseases and medications used, can make it difficult for a correct diagnosis [5]. As the elderly population increases, it is anticipated that these and similar negativities will cause an increase in the need for care services and treatment costs in addition to individual losses in the future [13]. Moreover, aging and the challenges associated with it affect not only the individual but also the society to which the individual belongs. Therefore, identifying the characteristics and diagnostic distributions of elderly individuals with mental illness is essential for setting service goals, improving service quality, and ensuring that these individuals can lead meaningful and dignified lives.

Despite the rapidly increasing elderly population in our country, data on the assessment of mental health and the utilization of mental health services in this age group remain quite limited. In particular, there is a lack of systematic data re-

garding the psychiatric admission profiles, diagnostic distributions, and hospitalization patterns of individuals aged 65 and older.

The aim of this study is to determine the sociodemographic characteristics and diagnostic profiles of patients aged 65 and over who received inpatient psychiatric treatment at the Psychiatry Clinic of İnönü University Faculty of Medicine Hospital between 2018 and 2023. Additionally, the study seeks to examine clinical and cognitive factors that may be associated with repeated hospitalizations in this population.

In doing so, this study aims to contribute to a better understanding of the mental health needs of elderly individuals, provide a scientific basis for mental health service planning, and establish a region-specific dataset that may serve as a reference for future research.

■ MATERIALS AND METHODS

In this retrospective study, data of patients aged 65 and older who received inpatient treatment at the Psychiatry Clinic of İnönü University Faculty of Medicine Hospital between January 1, 2018, and December 31, 2023, were examined. Patient-related information such as age, gender, type of health insurance (Emekli Sandığı, Bağ-Kur, SSK, Yeşil Kart), admission diagnosis, history of comorbid chronic illnesses (e.g., diabetes mellitus, congestive heart failure, hypertension, chronic obstructive pulmonary disease), length of hospital stay, number of repeated hospitalizations, and Mini-Mental State Examination (MMSE) scores were obtained from the hospital's electronic medical records and documented by the researchers.

In our clinic, psychiatric diagnoses are made based on the DSM-5 diagnostic criteria [14]. Due to the small sample size, diagnoses were classified under broader disease categories.

Sample size

Using the G*Power program, with an effect size of 0.3, alpha error of 0.05, and a power of 0.95, the minimum required sample size was calculated to be 220 (15).

Mini mental state examination (MMSE)

The MMSE is a simple screening test used to assess cognitive functions. It consists of 11 items, categorized under five cognitive domains, with a maximum possible score of 30 [16]. Its validity and reliability in Turkish were established by Güngen et al. in 2002 [17]. Scores between 24 and 30 are considered indicative of normal cognitive function; 19–23 suggest mild, 10–18 moderate, and ≤ 9 severe cognitive impairment [18].

Statistical analysis

The data were analyzed by transferring them to the IBM SPSS Statistics 22.0 (Armonk, NY: IBM Corp.) package program. Qualitative data from the variables included in the study were summarized by number (percentage). The conformity of

quantitative data to normal distribution was evaluated using the Kolmogorov-Smirnov test, and normally distributed data were summarized with mean $\pm$ standard deviation. In statistical analyses, categorical variables were compared using the chi-square test and the Yates-corrected chi-square test. The results were evaluated at a 95% confidence interval and a significance level of $p < 0.05$.

■ RESULTS

Our psychiatric ward has a capacity of 32 beds. Between 2018 and the end of 2023, 2,264 patients underwent inpatient treatment, among whom 252 were aged 65 years or older. The mean age of the patients analyzed within the scope of the study was 70.67 ± 5.01 and 49.2% (n:124) were female. When hospitalization diagnoses were evaluated, 46.8% had anxiety disorder, 25.0% depression, 10.7% mood disorder, and 8.3% had psychotic disorder. The mean initial hospitalization period was 17.35 ± 12.18 days.

Table 1. Demographic characteristics of patients, hospitalization diagnoses, MMSE scores, re-hospitalization rates.

	Mean $\pm$ SD
Age (Mean $\pm$ SD)	70.67 $\pm$ 5.01
Initial hospitalization duration (mean $\pm$ SD)	17.35 $\pm$ 12.18
	n (%)
Health Insurance	
Emekli Sandığı	77 (30.5)
Bağ-Kur	39 (15.5)
SSK	94 (37.3)
Yeşil Kart	42 (16.7)
Gender n(%)	
Female	124 (49.2)
Male	128 (50.8)
History of additional chronic diseases n(%)	
Yes	143 (56.7)
No	109 (43.3)
Initial hospitalization primary diagnosis n (%)	
Anxiety Disorder	118(46.8)
Depression	63(25)
Psychotic Disorders	21(8.3)
Adjustment Disorders	2(0.8)
General Medical Condition	12(4.8)
Intellectual Disability	1(0.4)
Mood Disorder	27(10.7)
Alcohol/Substance Addiction	5(2)
Dementia	3(1.2)
MMSE n(%)	
Normal	40(62.5)
Mild Dementia	23(35.9)
Moderate Dementia	1(1.6)
Severe Dementia	0 (0.0)
Repeated hospitalization	
Yes	55(22.8)
No	197(77.2)

MMSE was applied to 64 patients during their inpatient treatment; 35.9% of the patients who underwent MMSE had mild dementia (n:23) and 1.6% (n:1) had moderate dementia.

Demographic data, hospitalization diagnosis, MMSE scores, repeated hospitalization diagnoses and hospitalization duration of the patients included in the study are given in Table 1.

Findings regarding the distribution of hospitalization diagnoses according to demographic and clinical variables are given in Table 2. The proportion of female patients hospitalized due to psychotic disorders was 11.7% (n=15), while the proportion of male patients was 4.8% (n=6), and the difference between them was statistically significant ($p=0.048$). The rate of hospitalization due to mental disorders related to general medical condition (GMC) in patients with Yeşil Kart health insurance was 14.3% (n=6), and this was statistically significantly higher than those with other health insurance ($p=0.012$).

The psychiatric diagnoses accompanying anxiety disorder were, depression (15.3%; n=18), alcohol/substance use (3.4%; n=4) and psychotic disorder (3.4%; n=4), sleep disorder (1.2%; n=2), respectively, while the psychiatric diagnoses accompanying dementia were anxiety (50%; n:12), depression (33.3%; n:8), mood disorder (12.5%; n:3) and psychotic disorder (4.2%; n:1), respectively.

According to the neuropsychiatric test results performed during hospitalization, 33.3% (n: 9) of 27 male patients were diagnosed with mild dementia, 37.8% (n:14) of 37 female patients were diagnosed with mild dementia, and 2.7% (n:1) were diagnosed with moderate dementia. When evaluated according to age groups, it was found that 32.7% (n:16) of patients aged 65-74 had mild dementia, 50.0% (n:7) of patients aged 75-84 had mild dementia, and 7.1% (n:1) had moderate dementia. Information on the distribution of dementia diagnoses by gender and age is given in Table 3.

Of the 55 patients with repeated hospitalizations, 41.8% (n:23) were male and 58.2% (n:32) were female, and their mean age was 71.08 ± 5.09 . Of the 109 patients with additional chronic diseases, 33.9% (n:37) had repeated hospitalizations. In the comparison made to determine whether there was a relationship between repeated hospitalization and clinical and demographic variables, no significant difference was detected ($p > 0.05$). The evaluation of the data of patients with repeated hospitalizations regarding age, gender, initial hospitalization duration, additional chronic disease and presence of dementia is given in Table 4.

When the diagnostic distribution of 55 patients with repeated hospitalizations was examined, the most common condition leading to rehospitalization was anxiety disorder (36.4%), followed by depression (32.7%). Other diagnoses were observed at lower frequencies, including psychotic disorders (12.7%), mood disorders (9.1%), alcohol/substance use disorders (3.6%), dementia (1.8%), adjustment disorder (1.8%), and psychiatric conditions due to general medical ill-

Table 2. Distribution of psychiatric diagnoses according to demographic and clinical variables.

	Anxiety Disorder		Depression		Psychotic Disorders		GMC		Mood Disorders		Dementia	
N (%)	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No
Gender												
Female	53(41.4)	75(58.6)	34(26.6)	94(73.4)	15(11.7)	113(88.3)	5(3.9)	123(96.1)	15(11.7)	113(88.3)	15(11.7)	113(88.3)
Male	65(52.4)	59(47.6)	29(23.4)	95(76.6)	6(4.8)	118(95.2)	7(5.6)	117(94.4)	12(9.7)	112(90.3)	9(7.3)	115(92.7)
p	0.080		0.561		0.048		0.517		0.600		0.228	
Age												
65-74	92(47.2)	103(52.8)	51(26.2)	144(73.8)	18(9.2)	177(90.8)	8(4.1)	187(95.9)	19(9.7)	176(90.3)	16(8.2)	179(91.8)
75-84	25(46.3)	29(53.7)	12(22.2)	42(77.8)	2(3.7)	52(96.3)	4(7.4)	50(92.6)	8(14.8)	46(85.2)	8(14.8)	46(85.2)
85≥	1(33.3)	2(66.7)	0(0.0)	3(100)	1(33.3)	2(66.7)	0(0.0)	3(100)	0(0.0)	3(100)	0(0.0)	3(100)
p	0.889		0.5065		0.124		0.557		0.472		0.292	
Health Insurance												
Emekli Sandığı	38(49.4)	39(50.6)	24(31.2)	53(68.8)	7(9.1)	70(90.9)	1(1.3)	76(98.7)	5(6.5)	72(93.5)	6(7.8)	71(92.2)
Bağkur	23(59)	16(41)	6(15.4)	33(84.6)	3(7.7)	36(92.3)	2(5.1)	37(94.9)	3(7.7)	36(92.3)	7(17.9)	32(82.1)
SSK	43(45.7)	51(54.3)	27(28.7)	67(71.3)	5(5.3)	89(94.7)	3(3.2)	91(96.8)	12(12.8)	82(87.2)	9(9.6)	85(90.4)
Yeşil Kart	14(33.3)	28(66.7)	6(14.3)	36(85.7)	6(14.3)	36(85.7)	6(14.3)	36(85.7)	7(16.7)	35(83.3)	2(4.8)	40(95.2)
p	0.131		0.080		0.370		0.012		0.287		0.205	
Additional Chronic Disease												
Yes	46(42.2)	63(57.8)	25(22.9)	84(77.1)	11(10.1)	98(89.9)	9(8.3)	100(91.7)	12(11)	97(89.0)	6(5.5)	103(94.5)
No	72(50.3)	71(49.7)	38(26.6)	105(73.4)	10(7)	33(93)	3(2.1)	140(97.9)	15(10.5)	128(89.5)	18(12.6)	125(87.4)
p	0.199		0.509		0.256		0.023		0.895		0.058	
GMC: General Medical Condition												

GMC: General Medical Condition

Table 3. Distribution of dementia diagnosis by gender and age groups.

	Normal n(%)	Mild Dementia n(%)	Moderate Dementia n(%)	Severe Dementia n(%)
Gender				
Male	18 (66.7%)	9 (33.3%)	0 (0.0%)	0 (0.0%)
Female	22 (59.5%)	14 (37.8%)	1 (2.7%)	0 (0.0%)
Age Groups				
65-74	33 (67.3%)	16 (32.7%)	0 (0.0%)	0 (0.0%)
75-84	6 (42.9%)	7 (50.0%)	1 (7.1%)	0 (0.0%)
85 and older	1 (100.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)

ness (1.8%). The distribution of primary diagnoses among elderly patients with multiple psychiatric hospitalizations is presented in Table 5.

■ DISCUSSION

In this study, the diagnostic distribution and demographic characteristics of elderly patients receiving inpatient treatment in a psychiatric clinic were examined.

Previous studies have shown that sociodemographic characteristics such as age, gender, marital status, economic level, social environment, and previous health care experiences, as well as the duration and severity of mental disorder, are effective in seeking psychiatric help [19]. None of the demographic variables examined in this study were found to be effective in psychiatric hospitalization. However, it has been determined that the rate of hospitalization due to GMC-related disorders in patients with health insurance and Yeşil Kart is higher than

in individuals with other health insurances. The additional chronic disease rates of these patients were also found to be higher than the others. Yeşil Kart is a health insurance program offered in our country to individuals who do not own property and have low economic income [20]. In this context, it is known that Yeşil Kart patients are expected to experience financial difficulties. Financial difficulties create serious obstacles to the prevention and treatment of diseases due to many reasons such as poor living conditions, malnutrition, increased stress levels, and restricted access to health services. Therefore, this result can be interpreted as the economic difficulties experienced may have negatively affected not only the physical health of individuals but also their mental health.

It has been reported in the literature that women with psychotic disorders are hospitalized less often than men, have shorter hospital stays, and have lower relapse rates [21,22,23].

Table 4. Relationship between repeated hospitalization and age, gender, duration of hospitalization, additional chronic disease and dementia.

		Repeated Hospitalization	n	Mean±SD	p
Age		No	197	71.08±5.090	0.087
		Yes	55	69.22±4.453	
Gender	Female	No	96	38.1%	0.055
		Yes	32	12.7%	
	Male	No	101	40.1%	
		Yes	23	9.1%	
Hospitalization duration		No	197	16.00±11.99	0.673
		Yes	55	22.01±11.73	
Additional chronic disease n(%)	No	No	125	49.6%	0.357
		Yes	18	7.1%	
	Yes	No	72	28.6%	
		Yes	37	14.7%	
Dementia n(%)	No	No	29	72.5%	0.663
		Yes	11	27.5%	
	Yes	No	18	75.0%	
		Yes	6	25.0%	

Table 5. Distribution of primary diagnoses of patients with repeated hospitalizations.

Primary Diagnose	n(%)
Anxiety Disorder	20(36.4)
Depression	18(32.7)
Psychotic Disorders	7(12.7)
Mood Disorder	5(9.1)
Alcohol/Substance Addiction	2(3.6)
Dementia	1(1.8)
Adjustment Disorders	1(1.8)
General Medical Condition	1(1.8)

In this study, contrary to expectations, it was found that the proportion of female patients treated with a diagnosis of psychotic disorder was higher than that of males. Although our study was not designed to explain this result, this difference may be attributable to a shift in the onset of psychotic disorders from a male predominance in the early twenties to a female predominance in older ages, leading to more severe symptoms in elderly women [24]; the effects of hormonal changes that occur with aging on psychological well-being [25]; and the lower resistance of women to seeking psychiatric help [26]. Earlier onset of psychosis, more frequent medication uses with associated side effects, and increased physical illnesses linked to gender may contribute to shorter lifespans in male psychotic patients. Therefore, this result may be a reflection of the shorter life expectancy of male psychotic patients [27].

Despite its relative neglect, numerous studies suggest that anxiety is highly prevalent among older adults and is associated with significant distress and morbidity [28]. In their study examining 304 elderly individuals who visited the outpatient clinic between 2016 and August 2018, Harmacı et al. reported that the most frequently diagnosed mental disorder

was generalized anxiety disorder [13]. Similarly, Kalenderoğlu et al. examined 57 patients who applied to a psychiatry clinic between 2004 and 2005 and showed that the most common diagnosed conditions were anxiety disorder (31.6%), dementia (17.5%) and depression (10.5%), respectively [29]. Şen B et al. found that among 95 elderly patients who received inpatient treatment between 2010 and 2017, the most common diagnosis was depression (38.9%), followed by anxiety disorder (16.7%), psychotic disorder (11.1%) and bipolar disorder (15.3%) [13]. In this study covering a 5-year period, it was found that the most common reason for hospitalization of the elderly group was anxiety disorders (46.8%), followed by depression (25%), mood disorders (10.7%), psychotic disorders (8.3%), GMC (4.8%), alcohol/substance dependence (2%), adjustment disorders (0.8) and dementia (1.2%). Moreover, it was observed that the most frequent diagnosis among the reasons requiring repeated hospitalization was anxiety disorder (36.4%). This result was consistent with previous studies. The high prevalence of anxiety among elderly individuals can be explained by factors such as a decline in physical strength with aging, an increase in physical illnesses, economic difficulties, changes in circumstances, social isolation, decreased autonomy, and awareness of mortality [11, 30].

As seen in studies showing a high prevalence of anxiety and chronic disease comorbidity, our study also found that patients with anxiety disorders had a high rate of chronic disease comorbidities (39%). Studies have shown that anxiety is effective in the development of many diseases such as inflammatory bowel disease, cardiovascular diseases, diabetes, and chronic pain, especially by causing disruptions in the stress response. In addition, the coexistence of these two conditions may lead to an exacerbation of symptoms and/or masking of existing symptoms, preventing early diagnosis and treatment of the underlying disease and worsening the prognosis

[31,32]. Therefore, the findings highlight the need to be careful about comorbid physical diseases, especially in elderly patients presenting with anxiety disorders.

One of the most common neurological diseases in elderly patients is dementia. Epidemiological studies have reported a worldwide prevalence of dementia of 5% to 7% in people aged 60 years and older [33]. According to World Health Organization estimates, the number of patients with dementia, which is currently over 55 million, is expected to reach 75 million by 2030 and 132 million by 2050. Studies show that a new dementia diagnosis is made every three seconds and 60-80% of them are Alzheimer's patients. According to the 2022 Türkiye Health Survey Report published by TÜİK, the prevalence of Alzheimer's disease in individuals over the age of 65 in our country is 5.5% [34]. Almost two-thirds of patients with dementia have a comorbid mental illness and therefore need psychiatric help and sometimes hospitalization [35]. In this study, the number of patients hospitalized due to dementia was initially only three; however, following further testing, this rate increased to approximately 9.5%. Moreover, it was found that 87% of these patients had a comorbid psychiatric disorder, with anxiety (50.0%) and depression (33.3%) being the most common. Dementia is a disease that leads to a decline in cognitive functions, daily living activities, and disruptions in emotional and behavioral domains. People with dementia often need care. Family members, while caring for these patients, often face significant pressure and challenges related to finances, personal matters, marriage, and relationships. In addition, the chronic nature of the disease also leads to an increased burden on healthcare services. In 2018, the worldwide cost of dementia was \$1 trillion, and is expected to rise to \$2 trillion by 2030 [36]. Therefore, giving due importance to neurocognitive examinations of elderly patients applying to the clinic will help in early diagnosis of the disease, reduce the burden on the individual and the family, and contribute to the protection of the global economy.

One of the notable results of this study is the higher number of geriatric patients seeking psychiatric care compared to previous studies. In our study, the number of patients who received inpatient treatment over a 5-year period was 252, while Şen et al. reported this number as 95 over a 7-year period [5]. This result suggests that over time, the proportion of the elderly population has increased, mental health services have become more widespread, and societal prejudices related to seeking psychiatric help may have changed.

Limitations

This study has a number of limitations. Firstly, the study included patients treated at a single center, meaning that the results obtained do not reflect the general population. Secondly; the retrospective nature of the study and the use of electronic records limited the investigation of factors that may influence the development of mental health issues, such as marital status, occupation, living environment, life stressors,

and the type of comorbid disease. Thirdly, the small sample size prevented the analysis of disease subgroups. Lastly, the absence of MMSE data for some patients may have limited the ability to assess the relationship between cognitive status and other variables (e.g., length of hospitalization, repeated admissions, diagnosis). Future multicenter studies with larger sample sizes and more detailed data could help in developing more definitive conclusions. Despite these limitations, our study is the first to investigate this patient group in our region and can provide preliminary data for future studies.

CONCLUSION

In conclusion, the study is significant in terms of examining the distribution of diagnoses and socio-demographic variables in elderly patients. Social difficulties, multiple physical problems and sensory deficits increase the prevalence of psychiatric disorders in the elderly. Proper detection and management require specialist expertise and skills as well as multidisciplinary collaboration. Understanding the main mental issues of old age can guide the development of appropriate intervention methods. This approach can lead to more accurate and accessible treatment, ultimately improving the quality of life for both patients and their families.

Ethics Committee Approval: The study was approved by the Inonu University Non-Interventional Clinical Research Ethics Committee (Decision number: 2024/5974).

Informed Consent: This retrospective study was approved by the institutional ethics committee. Since the data were collected from existing medical records and anonymized, informed consent was not required.

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An increase in neuropathic complaints corresponds to the severity of central sensitization-related symptoms in women with fibromyalgia: A cross-sectional study

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■ MAIN POINTS

- CS symptoms, reflected by higher CSI scores, were closely associated with the intensity of neuropathic complaints.
- The strong overlap between CSI and S-LANSS supports the interaction of central sensitization (CS) and neuropathic mechanisms in FM.
- These findings underline the clinical utility of combining CSI and S-LANSS to better phenotype FM-related pain and guide treatment.

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■ ABSTRACT

Aim: This study aimed to investigate the relationship between central sensitization (CS)-related symptoms and neuropathic complaints in female patients with fibromyalgia (FM).

Materials and Methods: Demographic and clinical variables, including disease duration, current medication, severity of pain, and the FM survey questionnaire, were all recorded. The Fibromyalgia Impact Questionnaire (FIQ) was used to assess the severity of the FM. Neuropathic complaints were investigated by the Self-Leeds Assessment of Neuropathic Symptoms and Sign (S-LANSS) and CS-related symptoms by the Central Sensitization Inventory (CSI), and patient data were compared according to the CSI severity levels. Patients with CSI scores that are at least moderate ($CSI \geq 40$) were considered to have central sensitization syndrome (CSS).

Results: One hundred and forty female FM patients were included in the study. The mean (SD) S-LANSS score was calculated as 15.06 (5.61) for all patients. A total of 135 patients (96.4%) had CSS; the mean (SD) CSI-A score for all patients was 61.39 (13.03). Of them, 81.4% ($n = 114$) were in the very severe CSS group. There was an increase in pain intensity, FIQ, and S-LANSS scores in parallel with the severity of CS-related symptoms ($p < 0.001$). CS-related symptoms and disease severity were shown to have significant effects on S-LANSS variation in hierarchical regression analysis ($\beta: 0.34$, CI: 0.08-0.26, $p < 0.001$; $\beta: 0.25$, CI: 0.01-0.20, $p = 0.035$, respectively).

Conclusion: Neuropathic complaints become evident in tandem with the severity of CS-related symptoms in female FM patients. Clarifying its potential association to CS-related symptoms may help clinicians to understand neuropathic complaints in FM patients in more detail.

Keywords: Central nervous system, Central nervous system sensitization, Chronic pain, Fibromyalgia

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■ INTRODUCTION

Fibromyalgia (FM) is a disorder characterized by the presence of chronic, widespread musculoskeletal pain, fatigue, sleep disturbances, and other cognitive symptoms such as memory, concentration, and mood issues. With a prevalence of around 2% in the global general population, FM is a prevalent syndrome that typically occurs in women [1]. This wide range of FM symptoms typically includes neuropathic complaints, the pathophysiology of which is still poorly understood. The available evidence suggests that certain pathologies, such as central pain dysregulation and small fiber polyneuropathy

(SFN), are the source neuropathic complaints of these patients [2].

Central sensitization (CS) is a maladaptive response of the central nervous system characterized by an increased response to normal and/or subthreshold stimuli. Several mechanisms, including the hyperexcitability of the spinal and supraspinal centers and the dysfunction of inhibitory modulatory systems, are potentially involved in the mechanisms of CS that result in an enhanced pain state [3]. Recently, the pathophysiological basis of pain perception in FM has been reshaped within the framework of the concept of nociplastic

pain (NocP). NocP describes a type of chronic pain that occurs due to changes in pain processing mechanisms at the central nervous system level, without obvious tissue damage or a structural lesion in the somatosensory system. FM is one of the syndromes most frequently associated with this type of pain, and CS forms the basis of this pathophysiological process [4]. However, sensory complaints similar to neuropathic pain (NeuP)—such as burning, tingling, allodynia, and hyperalgesia—are frequently reported in FM patients, suggesting a clinical overlap between NocP and NeuP [5]. Apart from pivotal role of CS in FM and NocP, its involvement with the pathophysiology of NeuP implies a possible association between neuropathic complaints and CS in these individuals [6].

Although a direct approach to establishing CS in humans does not yet exist, using quantitative sensory testing (QST) to identify heightened pain sensitization gives clinicians important diagnostic information [7]. Cost, time, and experience requirements restrict the utility of QST in clinical practice, and its associations with patient-reported outcome measures differ according to the patient cohort and the procedure performed. The implementation of self-report questionnaires, which investigate the clinical relevance of CS through sensitization-related symptoms, has increased as a result of these disadvantages [8]. The Central Sensitization Inventory (CSI) stands out as a tool that is frequently preferred for this purpose and has been shown to be valid and reliable in FM patients [9]. In addition, CSI's considerable correlation with various QST modalities is an additional attribute that enhances its significance in clinical practice [10]. Based on a score system that measures the intensity of symptoms related to CS, CSI assists in understanding the negative impact of CS on the individual. FM patients with more severe CS-related symptoms (higher CSI score) also reported longer and more intense pain, according to a recent study [11].

Screening questionnaires are often the first step in identifying the neuropathic component of pain, especially in complex medical settings [12]. The Self-Leeds Assessment of Neuropathic Symptoms and Signs (S-LANSS), for example, is recognized as an easy-to-use and reliable tool for distinguishing neuropathic from nociceptive pain [13]. In fact, for FM patients, S-LANSS scores have been shown to correlate with pressure-pain threshold values, a key indicator of pain sensitization [14].

The connection between neuropathic complaints and CS-related symptoms has been established through the correlation of S-LANSS and CSI scores in various conditions like cervical dystonia and knee osteoarthritis [15, 16]. Given CS's pivotal role in both FM and neuropathic pain, we anticipated an even stronger relationship in FM patients. Therefore, this study aimed to investigate the relationship between CS-related symptoms and neuropathic complaints in female FM patients. We hypothesized that neuropathic complaints are directly linked to the CS-related symptoms experienced by

these patients.

■ MATERIALS AND METHODS

This cross-sectional study was conducted with patients admitted to the physical medicine and rehabilitation outpatient clinic in a tertiary center between October 2022 and 2023. The inclusion criteria for this study were the following: women patients diagnosed with FM according to American College of Rheumatology (ACR 2016) criteria aged between 18 to 65 years, being literate, and agreeing to participate in the study. Only female patients were included in the study due to the relatively small number of male FM patients. Patients with concomitant active infection, malignancy, or central or peripheral nervous system diseases (multiple sclerosis, stroke, radiculopathy, etc.) were excluded. To preserve clinical representativeness, patients using medications commonly prescribed for FM were not excluded. Their medication use was systematically documented and considered during data interpretation. All patients underwent a standard clinical evaluation by a physical medicine and rehabilitation specialist to exclude conditions such as carpal tunnel syndrome (CTS) and cervical disc herniation, which have the potential for symptomatic overlap with FM. Phalen and Tinel tests were performed for CTS, and the Spurling test and a detailed neurological examination were performed for cervical radiculopathy. In cases where clinical findings were suspicious, advanced diagnostic methods such as electromyography or cervical magnetic resonance imaging were used. In this way, peripheral or central nervous system diseases that could accompany or mimic a FM diagnosis were systematically excluded. Initially, a total of 178 patients diagnosed with FM according to the 2016 ACR criteria were screened for inclusion in the study. During the evaluation process, 38 patients with central or peripheral nervous system diseases were excluded from the study. These diseases were determined by a detailed neurological examination performed by a specialist physician, examination of the patients' medical history, and neuroimaging or electrophysiological tests when deemed necessary. As a result, 140 patients who did not have neurological comorbidities and met all inclusion criteria were included in the study.

Verbal and written consent was obtained from all participants with the approval of the local ethics committee for the study (protocol number: 22/640, approval date: 30.12.2022). This study protocol was registered with ClinicalTrials.gov (ClinicalTrials.gov identifier: NCT05701696) and performed following the STROBE Statement [17].

Clinical variables

Demographic and clinical data of all participants were collected through interviews and clinical scales. The duration of the disease and current medical treatments were recorded. The pain intensity was assessed on an 11-point visual analog scale (VAS) (0: no pain, 10: most severe pain imaginable).

Primary outcome measurements

Central Sensitization Inventory (CSI)

The CSI, which is divided into two parts, A and B, has been developed primarily to identify CS findings in individuals with chronic pain. Twenty-five items in Part A include somatic and psychosocial health-related symptoms, which are often present in conditions associated with CS. Respondents rate each item on a 5-point Likert scale, ranging from ‘never’ (0) to ‘always’ (4), resulting in a maximum possible score of 100. Patients with 40 points and above are considered to have central sensitization syndrome (CSS), and greater scores correspond to more severe CSS [18]. The suggested CSI cut-off values for FM patients in this study were used to classify the patients into four groups: 21 between remission and mild severity, 30 between mild and moderate severity, 37 between moderate and severe disease, and 51 between severe and very severe disease [9]. The patient is questioned in Part B about any medical conditions that fall within the category of CSS diagnoses [19]. The Turkish adaptation of the CSI has been established as valid and reliable [20] (Appendix A).

The Self-Leads Assessment of Neuropathic Symptoms and Sign (S-LANSS)

The S-LANSS pain scale has been developed to detect individuals with chronic pain that is primarily driven by neuropathic processes. A score of 12 or above out of 24 points on the scale consisting of 7 items is considered in favor of NeuP [13]. It has been demonstrated that the Turkish version of S-LANSS is valid and reliable for identifying neuropathic components in chronic pain patients [21] (Appendix B).

Secondary outcome measurements

Fibromyalgia Severity Scale (FSS)

Widespread Pain Index (WPI)

Five regions total—the axial region, the lower right and left regions, and the upper right and left regions—are noted on this scale with the locations of pain experienced during the prior seven days. The total score ranges from 0 to 19, with a WPI of 7 or more considered essential for the diagnosis of FM.

Symptom Severity Scale (SSS)

In Part A of this scale, fatigue, waking unrefreshed, and cognitive symptoms in the last week are questioned, and each question is scored between 0 and 3 (maximum score of 9). In Part B, the presence of headache, pain, or cramps in the lower abdomen and depression in the last 6 months is evaluated (maximum score of 3). The final SSS is between 0 and 12.

The FSS is the sum of the WPI and SSS. $WPI \geq 7$ and $SSS \geq 5$, or $WPI = 4-6$ and $SSS \geq 9$, is in favor of FM (Appendix C) [22].

Fibromyalgia Impact Questionnaire (FIQ)

This questionnaire was developed by Burckhardt et al. to determine the degree of disease impact on the current health status of women with FM [23]. The FIQ is composed of 10 items in total, with the initial item being structured as an 11-item Likert scale. The total value ranges from 0 to 100, and higher scores indicate more severe effects on daily activities. Its reliability and validity have been established for assessing functional disability among Turkish women with FM [24] (Appendix D).

Hospital Anxiety and Depression Scale (HADS)

This scale was developed by Zigmond and Snaith in 1983 to screen for anxiety and depression in individuals with physical illness [25]. The HADS comprises a total of 14 questions, with 7 focusing on anxiety and 7 on depression. Participants respond to these questions using a four-point Likert scale (0–3). The Turkish validity and reliability of the scale have been demonstrated, and a score above 10 for anxiety and above 7 for depression is considered significant [26] (Appendix E).

Data analysis

This study was completed with 140 patients overall, and the minimal sample size determined based on the previous study was 111 to achieve an error alpha of 0.05 for a 95% confidence interval (CI) and a power of 0.95 [14]. G*power (v3.1.9.4; University of Dusseldorf, Dusseldorf, Germany) was used for the computation of sample size.

Statistical analysis

Statistical model selection was based on normality tests, and Shapiro-Wilk tests, skewness-kurtosis, and histogram graphs were used to assess data distribution. Data having an absolute skew value less than two and an absolute kurtosis (proper) value less than seven was considered to have a normal distribution [27]. Due to the parametric distribution of the data, continuous variables were presented using the mean and standard deviation (SD). Using the independent t-test for continuous data, Pearson’s chi-square, and Fisher’s exact test for categorical variables, patient variables were compared based on the presence of NeuP. A one-way ANOVA was used to compare the following clinical variables at three levels of CSI: symptom duration, WPI, VAS, SSS, FIQ, S-LANSS, and HADS. Post-hoc multigroup comparisons were applied with the Tukey test.

To investigate the linear association between S-LANSS and CSI scores and selected clinical parameters, bivariate correlation analysis was applied. Finally, hierarchical regression models were constructed, and the variables included in the model and the order of inclusion were determined by taking into account the results of univariate regression analysis and previous similar studies [14, 28]. Before the regression model was

fitted to a dataset, assumptions were tested, including linearity, independence, multicollinearity, and normality. To assess the potential for multicollinearity across all of the explanatory factors, we used the variance inflation factor (VIF). No significant multicollinearity was found, as indicated by a $VIF < 5$ [29]. The effect of medical treatment on the S-LANSS score was examined by regression analysis, whereby the sub-categories were coded as dummy variables. Four (n-1) dummy codes representing the treatment categorical variable were included in the regression analysis. The patient group that did not receive medical treatment was selected as the reference category and was not included in the regression model as a predictor. With a 95% CI, a value of $p < 0.05$ was considered statistically significant in all analyses conducted using SPSS version 26.0 (IBM Corporation, Armonk, NY, USA).

■ RESULTS

The mean (SD) age of 140 female patients participating in the study was 44.38 (10.77) years, and the mean (SD) BMI value was 27.58 (5.13) kg/m^2 . Patients' mean (SD) pain intensity was 7.55 (SD: 1.52) on a 0–10 scale, and the mean (SD) pain

duration was 55.57 (SD: 43.82) months. Out of the total patients, 102 were on duloxetine (72.9%), 8 were on pregabalin (5.7%), 5 were on amitriptyline (3.6%), and 8 were on a combination of pregabalin and duloxetine (5.7%). The mean daily dose was 40.91 mg (SD = 14.50) in 110 patients using duloxetine, 285.00 mg (SD = 50.71) in 15 patients using pregabalin, and 25.00 mg (SD = 0) in 5 patients using amitriptyline. Of the patients, 12.1% were not receiving any medical treatment (Table 1). The mean (SD) values of patients for WPI, SSS, and FSS were calculated as 11.88 (3.55), 8.66 (2.15), and 20.48 (4.73), respectively.

A total of 135 patients (96.4%) had a CSS, and the mean (SD) CSI score for all patients was found to be 61.39 (13.03). When the patients were categorized according to the severity levels of CSI, the percentages were calculated as mild 2.1% (n = 3), moderate 0.7% (n = 1), severe 15.7% (n = 22), and very severe 81.4% (n = 114), respectively.

The mean (SD) S-LANSS score of the participants was 15.06 (5.61), and there were 115 patients (82.1%) with NeuP. There was no CSS and NeuP in 5 patients (3.6%); 20 patients (14.3%) had CSS but no NeuP; and 115 patients (82.1%) had both CSS and NeuP. Table 2 presents a comparison of clinical scales based on the presence of NeuP.

At different CSI levels, the S-LANSS score had a significant difference in the one-way analysis of variance ($p < .001$) (Table 3). Pearson correlation coefficients between CSI and S-LANSS scores and the VAS, SSS, FIQ, and HADS anxiety subscore were statistically significant ($p < .05$), indicating a significant linear relationship for both scales with these clinical parameters. Only the CSI score was statistically significantly correlated with the WPI and HADS depression subscores ($p = .011$ for WPI, $< .001$ for HADS). Age, BMI, and the duration of symptoms did not significantly correlate with CSI and S-LANSS ($p > .05$). The correlation analysis of S-LANSS and clinical parameters is represented in the scatter plots in Figure 1. The analysis revealed no statistically significant correlation between the administered drug dosages and S-LANSS scores ($p > .05$).

In univariate linear regression analysis, CSI, VAS, FIQ, SSS, FSS, and HADS-anxiety were significantly associated with S-LANSS ($p \leq .001$). Four variable blocks were implemented in a hierarchical multiple regression analysis to examine the variables' efficacy in predicting variations in S-LANSS scores. The results of hierarchical regression showed that patients' disease-related factors, including VAS, SSS, FSS, and FIQ, tested in block 1, explained 20% of the variance in their S-LANSS score ($F(4,131) = 8.32$, $p < .001$, $R^2 = 0.20$). Only the FIQ score ($p = .001$) was associated with the S-LANSS increase; other disease-related factors were not statistically significant ($p > .05$). In block 2, medical treatment variables were included in the model, but no significant effect of treatment on the variance of the S-LANSS score was found ($F(4,127) = 4.75$, $p = .341$, $R^2 = 0.23$, $\Delta R^2 = 0.03$). The third block ($F(2,125) = 3.75$, $p = .954$, $R^2 = 0.23$), which included HADS

Table 1. Comparison of patients' characteristics according to the presence of neuropathic pain (values are presented as mean $\pm$ standard deviation or n (%), as appropriate).

	FM patients (n=140)		P-value
	NeuP- (n=25)	NeuP+ (n=115)	
Age (year), mean (SD)	47.60 (12.49)	43.68 (10.29)	0.153
Marital status			
Married	18 (72)	96 (83.5)	0.181
Single	7 (28)	19 (16.5)	
Education level			
Primary school	12 (48)	2 (33)	0.277
Middle school	2 (8)	20 (17.4)	
High school	5 (20)	36 (31.3)	
University	6 (24)	21 (18.3)	
Job			
Housewife	12 (48)	61 (53)	0.148
Student	2 (8)	13 (11.3)	
Laborer	0 (0)	6 (5.2)	
Servant	2 (8)	12 (10.4)	
Retired	5 (20)	5 (4.3)	
Self-employment	4 (16)	18 (15.7)	
BMI (kg/m^2)	28.93 (5.11)	27.27 (5.10)	0.151
Symptom duration (months)	61.68 (45.81)	54.22 (43.46)	0.462
VAS	6.68 (1.77)	7.75 (1.39)	0.008*
Medical treatment			
Duloxetine	18 (72)	84 (73)	0.738
Pregabalin	1 (4)	7 (6.1)	
Amitriptyline	1 (4)	4 (3.5)	
Duloxetine+ Pregabalin	1 (4)	7 (6.1)	
None	4 (16)	13 (11.3)	

BMI: Body mass index, VAS: Visual analog scale. *statistically significance.

Table 2. Comparison of clinical scales according to the presence of neuropathic pain (values are presented as mean $\pm$ standard deviation or n (%), as appropriate).

	FM patients (n=140)		P-value
	NeuP- (n=25)	NeuP+ (n=115)	
WPI	11.56 (3.04)	11.93 (3.62)	0.597
SSS	8.00 (2.47)	8.79 (2.04)	0.144
FSS	19.56 (4.29)	20.64 (4.76)	0.269
FIQ	59.64 (17.05)	70.14 (12.03)	0.007*
CSI-A	52.40 (16.80)	63.35 (11.22)	<0.001*
CS severity			
Moderate	7 (28)	13 (11.3)	<0.001*
Severe	3 (12)	32 (27.8)	
Extreme	10 (40)	70 (60.9)	
CSI-B			
Restless leg syndrome	3 (12)	12 (10.4)	0.732
Chronic fatigue syndrome	3 (12)	10 (8.7)	0.703
Temporomandibular joint disorder	1 (4)	3 (2.6)	0.549
Tension headaches/migraines	7 (28)	42 (36.5)	0.418
Anxiety or panic attacks	7 (28)	37 (32.2)	0.684
Depression	10 (40)	47 (40.9)	0.936
HADS-Anxiety	10.92 (4.04)	11.48 (3.63)	0.529
HADS-Depression	9.04 (3.06)	9.08 (3.61)	0.955
S-LANSS	5.36 (3.78)	17.17 (3.19)	<0.001*

WPI: Widespread pain index, SSS: Symptom severity scale, FSS: Fibromyalgia severity scale, FIQ: Fibromyalgia Impact Questionnaire, CS: Central sensitization, CSI: Central sensitization inventory, HADS: Hospital Anxiety Depression Scale, S-LANSS: Self-leads assessment of neuropathic symptoms and sign, NeuP: Neuropathic pain. *statistically significance.

Table 3. Clinical features and post-hoc results of patients according to the Central Sensitization Inventory severity levels (values are presented as mean $\pm$ standard deviation).

	CS+			P-value	Post-hoc
	Moderate (I) (n=20)	Severe (II) (n=35)	Extreme (III) (n=80)		
Symptom duration	58.80 (41.37)	46.09 (32.73)	58.56 (48.53)	0.352	-
VAS	6.95 (1.54)	7.15 (1.56)	7.99 (1.23)	0.001*	I vs III, II vs III
WPI	10.95 (3.41)	11.40 (2.77)	12.30 (3.86)	0.212	-
SSS	6.30 (1.81)	8.20 (1.80)	9.59 (1.69)	<0.001*	I vs II, II vs III, I vs III
FIQ	57.54 (11.29)	64.92 (13.61)	73.64 (10.10)	<0.001*	I vs III, II vs III
HADS-Anxiety	7.85 (2.80)	10.29 (3.29)	12.89 (3.17)	<0.001*	I vs II, II vs III, I vs III
HADS-Depression	6.80 (3.05)	8.35 (3.31)	9.99 (3.40)	<0.001*	I vs III, II vs III
S-LANSS	11.45 (5.36)	16.11 (3.84)	16.29 (5.14)	<0.001*	I vs II, I vs III

BMI: Body mass index, VAS: Visual analog scale, WPI: Widespread pain index, SSS: Symptom severity scale, FIQ: Fibromyalgia Impact Questionnaire, CS: Central sensitization, CSI: Central sensitization inventory, HADS: Hospital Anxiety Depression Scale, S-LANSS: Self-leads assessment of neuropathic symptoms and sign. *statistically significance.

anxiety and depression subscores, did not yield a significant change in variation compared to the second block. Overall, the final model, including all variables, explained 30.5% of the S-LANSS variance ($F(1,124) = 3.75$, $p < .001$, $R^2 = 0.30$), while the CSI explained an additional 7.4% of the variance when included in the model. The results of the hierarchical regression analysis indicated that FIQ and CSI were independently associated with S-LANSS variation ($p = .036$ and $< .001$, respectively) and that the models constructed were statistically significant ($p < .01$). The regression analysis results are detailed in Table 4.

DISCUSSION

This study investigated the association between neuropathic complaints and CS-related symptoms in female FM patients. This study offers a novel perspective by revealing a graded association between CS symptom severity and neuropathic complaints in female FM patients, using validated tools. Our results indicate that higher CSI and S-LANSS scores are associated with greater disease activity, as reflected by increased SSS and FIQ scores, highlighting their relevance in assessing overall symptom burden in FM.

Using S-LANSS, the prevalence of NeuP was found to be 82.1%, and the severity of neuropathic complaints increased

Table 4. Hierarchical regression analysis results examining the relationship between the Self-Leeds Assessment of Neuropathic Symptoms and Sign and selected clinical parameters.

Predictors	S-LANSS						
	B	SE B	β	R ²	p	95% CI for B	
Step 1				0.20	<0.001*		
VAS	0.46	0.37	0.12		0.222	-0.28	1.20
SSS	0.22	0.30	0.08		0.467	-0.37	0.81
FSS	-0.10	0.13	-0.08		0.453	-0.35	0.16
FIQ	0.15	0.04	0.35		0.001*	0.06	0.23
Step 2**				0.23	0.300		
Duloxetine	2.64	1.40	0.21		0.062	-0.01	5.24
Pregabalin	1.80	2.21	0.08		0.545	-2.24	6.19
Amitriptyline	4.56	2.64	0.15		0.121	-0.64	9.50
Duloxetine+ Pregabalin	3.43	2.23	0.14		0.188	-0.65	7.87
Step 3~				0.23	0.751		
HADS-Anxiety	-0.45	0.14	-0.03		0.751	-0.33	0.24
HADS-Depression	-0.01	0.16	-0.01		0.940	-0.34	0.31
Step 4				0.30	<0.001*		
VAS	0.51	0.36	0.14		0.161	-0.21	1.24
SSS	-0.11	0.26	-0.04		0.483	-0.70	0.33
FSS	-0.06	0.13	-0.05		0.650	-0.30	0.19
FIQ	0.10	0.05	0.25		0.036*	0.01	0.20
Duloxetine	2.85	1.33	0.21		0.058	0.20	5.50
Pregabalin	2.22	2.13	0.08		0.369	-2.01	6.44
Amitriptyline	5.06	2.54	0.16		0.068	0.03	10.09
Duloxetine+ Pregabalin	4.14	2.15	0.17		0.071	-0.34	8.27
HADS-Anxiety	-0.19	0.14	-0.13		0.402	-0.47	0.19
HADS-Depression	-0.10	0.16	-0.06		0.524	-0.42	0.21
CSI	0.15	0.04	0.34		<0.001*	0.08	0.26

S-LANSS: Self-leeds assessment of neuropathic symptoms and sign , VAS: Visual analog scale, WPI: Widespread pain index, SSS: Symptom severity scale, FIQ: Fibromyalgia Impact Questionnaire, HADS: Hospital Anxiety Depression Scale, CSI: Central Sensitization Inventory, CI: Confidence interval, **Step 2 includes variables in step 1, ~Step 3 includes variables in step 2, *Statistically significant.

in parallel with CS-related symptoms. In research including 78 FM patients, NeuP was detected in 92.1% of the patients based on LANSS and 82.9% of the patients based on DN4 [30]. The prevalence of NeuP in FM patients as assessed using different questionnaires appears to be in line with this study's findings. However, it is emphasized that these questionnaires should be used to identify patients who deserve further clinical evaluation for NeuP rather than to make a definitive diagnosis [12]. Current guidelines state that a comprehensive clinical evaluation, including QST, should be the cornerstone of NeuP diagnosis. The findings of the examination should be bolstered by imaging, neurophysiology, biopsies, and laboratory testing [31]. Although it is not difficult to meet these requirements of NeuP in certain disease groups, this is not the case for FM.

The processes behind the development of NeuP, one of the primary clinical features of FM, are still not fully understood. Although there is not enough evidence to draw a definitive conclusion in these patients, there are opinions supporting the idea that NeuP is of peripheral or central origin. Small fiber neuropathy (SFN) is the most commonly postulated peripheral pathophysiological cause of NeuP, and the presence of SFN is supported by QST, skin biopsy, and confocal microscopy in these patients [32]. On the other hand, struc-

tural and functional neuroimaging studies support the hypothesis that FM and neuropathic complaints in these patients arise from dysfunction in the central pain processing [2]. A third possibility refers to a combination of peripheral and central involvement; in FM patients with SFN, alterations have been documented in the structural and functional connections of the encephalon that favor CS [33]. Furthermore, given the central role that CS plays in NeuP, some viewpoints suggest that it is not clinically possible to differentiate between CS pain and NeuP [34]. This hypothesis is supported not only by the involvement of CS in the pathophysiology of NeuP but also by the similarities between the QST findings, which are characterized by hyperalgesia and allodynia, and the medications used to treat NeuP and CS. By raising membrane excitability and synaptic effectiveness and lowering inhibition in nociceptive pathways, CS is hypothesized to have a key role in NeuP. While numerous molecules are known to play a part in the CS-NeuP relationship, animal models offer sufficient proof that Brain-Derived Neurotrophic Factor (BDNF) acts as a crucial function in regulating this association [35]. It has also been reported that serum BDNF levels are increased in FM patients and correlate with QST parameters [36]. These findings may make the relationship between neuropathic complaints and CS-related symp-

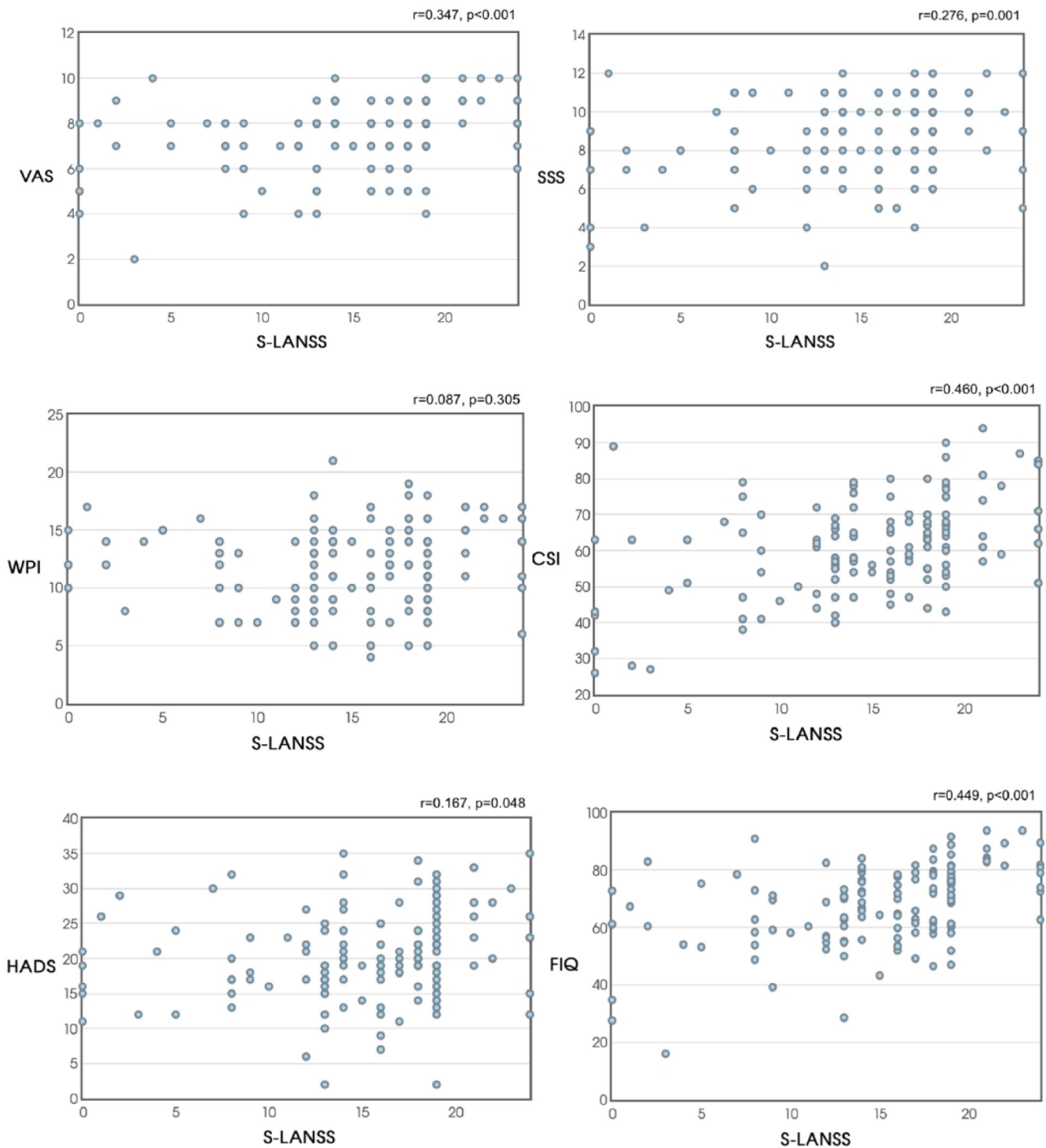


Figure 1. Scatter plots show the relationship between the Self-Leeds Assessment of Neuropathic Symptoms and Sign and other clinical scales.

toms more understandable in FM.

When evaluating the results, it is important to recognize the constraints of questionnaire utilization, even though these associations make sense given the role of CS in FM. The initial step in assessing the patient's symptom burden from CS is frequently to use CSI as a helpful tool. Comparably, in clinical practice, the initial step in evaluating NeuP frequently involves an array of questionnaires. However, it is unclear how

well these NeuP scales work in the context of nociplastic pain because they were designed to differentiate between nociceptive and NeuP. A study involving patients with lumbar stenosis further implies that the correlation between PainDETECT and CSI might be brought about by factors that overlap, including widespread pain [37]. Yet although they may appear similar at first glance, NeuP and CS-related symptoms have fundamental differences. Unlike typical neuropathic com-

plaints limited to nervous system involvement, CS-related symptoms arise from hypersensitivity in multiple physiological systems. In addition to pain hypersensitivity, CS-related symptoms are linked to a more extensive hypersensitivity impacting several organs and systems across all sensory modalities, including light, sound, smell, and taste [38].

The diversity of the patients' medical treatments is another factor that could have an impact on the study's findings. Regression analysis revealed, however, that the treatment administered had no noticeable effect on the S-LANSS score. Only 10 to 25 percent of FM patients who are taking medication report being able to reduce their symptoms, including NeuP, and research indicates that a multimodal therapeutic approach may be helpful [2]. Consequently, it is not unexpected that the S-LANSS score is unaffected by the patients' drug use.

The clinical importance of CS-related symptoms in FM patients stems from their close relationship with disease severity and comorbidities [9]. This study result confirms that, in tandem with the severity of CS-related symptoms, there is an increase in pain intensity, disability, and psychological issues in FM. Despite the fact that FM is the prototype for central sensitivity syndromes, the clinical assessment of patients with FM does not usually include CS-related symptoms. It has been noted that because FM is a complex and clinically changeable condition, it is inappropriate to use a single symptom, such as pain severity, as a clinical outcome measure [39]. Similar to the findings of this study, Neblett et al. reported that the CSI score in FM patients tends to be at very severe levels and correlates with disease parameters [40]. An impression of the disease activity in FM may be obtained by combining CS-related symptoms with other clinical indicators such as pain and symptom severity, as well as neuropathic complaints.

The CSI and S-LANSS scores reported in our study reveal both overlapping and divergent aspects of CS and NeuP components in FM. It is reported that these two mechanisms often coexist in FM and may interact in the clinical presentation [5]. Our findings underline the complementary roles of CSI and S-LANSS in evaluating pain mechanisms in FM. While both scales may capture overlapping symptom domains, CSI primarily reflects CS processes, whereas S-LANSS identifies neuropathic features based on patient-reported symptoms and clinical signs. Using these tools together in FM may help identify distinct pain phenotypes and support more personalized treatment strategies in clinical practice.

Limitations

Limitations of this study include its cross-sectional design, inclusion of only female patients, and lack of quantitative methods to assess both CS and NeuP. Since the majority of FM patients in clinical practice are female, we think that this will not have a major impact on the interpretation of the results. However, it is not feasible to generalize the present findings

to male FM patients. The fact that the participants were receiving medical treatment is not seen as a limitation; rather, we believe that in cases where patients cannot receive optimal treatment, the results may be misleading. Additionally, in this study, NeuP was assessed only with the S-LANSS scale. The fact that other scales such as PainDETECT or DN4 were not used may limit the comprehensive assessment of NeuP.

CONCLUSION

In this cross-sectional study, the frequency of NeuP investigated with S-LANSS in female FM patients was found to be 82.1%. Concomitant CSS was present in all cases with NeuP, and CSI had a significant effect on S-LANSS variation. Despite being excluded from the diagnosis of NeuP due to the lack of a particular lesion localized in the nervous system, FM patients' pain experiences are not substantially different from those of those who meet the International Association for the Study of Pain (IASP) definition. Whether or not there is disease involvement in the peripheral or central nervous systems, "neuropathic complaints" in FM may be considered one of the manifestations of CS when regarding shared pathophysiological mechanisms and the findings of this study. We hope that elucidating NeuP, which is frequently encountered in FM and still remains a gray zone, and its relationship with CS-related symptoms will be a guide in understanding this issue.

Ethics Committee Approval: Local ethics committee approval was obtained (University of Health Sciences Hamidiye Scientific Researchs Ethics Committee, protocol number: 22/640, approval date: 30.12.2022).

Informed Consent: All participants were informed about the purpose, methods, potential risks, and benefits of the study. Verbal and written informed consent was obtained from all participants prior to their inclusion in the study, in accordance with the Declaration of Helsinki.

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Analysis of intestinal parasitic infections seen in the Southeastern Anatolia Region tertiary hospital between 2019-2024

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■ MAIN POINTS

- This retrospective cross-sectional study evaluated 6,291 stool samples collected between 2019 and 2024 in a tertiary healthcare center in Southeastern Turkey to assess the epidemiology of intestinal parasitic infections (IPs).
- The overall prevalence of IPs was 5.9%, with *Entamoeba histolytica* (48.3%), *Blastocystis hominis* (28.2%), and *Giardia intestinalis* (22.5%) constituting the predominant protozoan species.
- A statistically significant correlation was found between age and IPI positivity ($p=0.006$), while gender-based differences were not significant ($p=0.528$).

■ ABSTRACT

Aim: The objective of this study was to determine the prevalence of intestinal parasites over time among patients who presented with dyspeptic complaints and sought stool samples from a Turkish tertiary hospital, and to investigate the correlation between intestinal parasites and age and gender.

Material and Methods: A retrospective study was conducted between 2019 and 2024 at Siirt Education and Research Hospital to determine the intestinal parasites (IP) trend. We assessed the association between IP and age and gender groupings, as well as the distribution of IP types by year. Stool samples were analyzed using the nativ-lugol technique under a direct light microscope. All data lacking sociodemographic characteristics and the year of stool examination were excluded from the study.

Results: Data from 6291 patients were analyzed. In total, 56.9% of the patients were male. The presence of parasites in accord with the gender did not differ significantly ($p=0.528$). The prevalence of parasites was 5.7% in the 18–65 age group and 9.0% in the over-65 age group ($p=0.006$). The most common IP species were *E. histolytica* (48.3%), *B. hominis* (28.2%), and *G. intestinalis* (22.5%, $n=84$). The incidence of *H. nana* (1.1%, $n=4$) was very low.

Conclusion: IP is a serious threat to health, particularly in developing countries. The prevalence of IP will decrease as our awareness increases together with efficient diagnosis, treatment, and prevention strategies.

Keywords: Intestinal parasites, Trend analysis, Turkey

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■ INTRODUCTION

Intestinal parasites (IP) represent a significant health concern, particularly in underdeveloped and impoverished nations [1]. Globally, approximately three billion individuals are affected by various intestinal parasites, often leading to considerable morbidity [2]. These parasites pose a worldwide public health threat in both industrialized and developing nations. Their prevalence is notably higher in disadvantaged populations, especially in tropical and subtropical regions, primarily due to hot, humid climates, inadequate sanitation, and/or limited access to safe drinking water [3]. Beyond geographical factors, several socioeconomic determinants, including age, climate, and hygiene, also influence their occurrence [4].

Globally, over 10.5 million new cases are reported annually, with *Ascaris lumbricoides*, hookworms, *Trichuris trichiura*, *Giardia lamblia*, *Entamoeba histolytica*, and *Schistosoma* sp. being the most prevalent IP [5]. The most common mode of transmission for these parasites is the consumption of contaminated food and water. Additionally, infection can occur through the active penetration of the epidermis by infective larval stages from polluted soil. Intestinal parasites are a primary cause of various gastrointestinal issues, such as vomiting, diarrhea, dysentery, anorexia, and abdominal distension. They can also contribute to growth retardation, behavioral abnormalities, and iron deficiency anemia. These clinical issues disproportionately affect high-risk groups, includ-

ing children, pregnant women, and immunocompromised individuals [5].

The aim of this study was to examine the prevalence and distribution of intestinal parasites in stool samples provided by patients presenting with dyspeptic symptoms to a tertiary hospital in the Southeastern Anatolia Region.

■ MATERIALS AND METHODS

Study hypothesis

This retrospective study's primary outcome was the presence of intestinal parasites (IP) in stool samples, categorized as a binary variable (positive or negative). Beyond overall positivity, the study further hypothesized to evaluate:

- The distribution of IP positivity by specific parasite species.
- The association between IP positivity and gender.
- The association between IP positivity and age groups.

These additional stratifications aimed to provide a comprehensive understanding of the epidemiological characteristics of intestinal parasitic infections. Furthermore, all data were statistically analyzed to identify trends over time (2019–2024) and to determine which demographic groups were more frequently affected by intestinal parasites throughout the study period. This study received approval from the institutional review board of Siirt University (Date: 15.01.2025; No: 129496).

Sample size

This retrospective cross-sectional study employed a complete enumeration (census) sampling method. To determine the prevalence of intestinal parasites in the Siirt region, the sample size was calculated using G*Power statistical software (version 3.1.9.7) [6]. Based on a one-sample t-test design with a power of 0.99, an effect size of 0.5 (representing a moderate effect), and a Type I error rate (α) of 0.05, the minimum required sample size was 76 participants. However, the study ultimately included data from 6,291 individuals, significantly exceeding the calculated minimum sample size, thereby enhancing the statistical reliability and generalizability of the findings.

Data collection

IP data were retrospectively examined from 6,291 patients who submitted stool samples to Siirt Education and Research Hospital between January 2019 and November 2024. These patients presented with gastrointestinal (GIS) dyspeptic complaints, including abdominal pain, constipation, tension, bloating, burning, belching, postprandial bloating, nausea, and vomiting. The study evaluated the distribution of IP types across years and the relationship between IP positivity

and gender and age groups. Patients for whom sociodemographic characteristics or the year of stool examination were not determined were excluded.

As this was a retrospective observational study, no blinding (masking) method was applied. Blinding is typically employed in interventional studies, such as randomized controlled trials (RCTs), to reduce potential bias through the concealment of group allocation. However, in this study, data were obtained retrospectively from existing patient records, and no interventions or treatments were administered, rendering a blinding procedure neither applicable nor necessary. Stool samples were processed within one hour of collection. Macroscopic inspection for IP was performed, followed by microscopic examination of native-Lugol preparations under a direct light microscope. Direct microscopic examination is considered the gold standard for parasitological diagnosis [25]. Additionally, the *Entamoeba histolytica* (*E. histolytica*)/*Entamoeba dispar* (*E. dispar*) antigen was identified in stool samples using the Entamoeba Antigen Cassette Test (True Line China).

Parasite species were classified into two groups: helminths and protozoa. The protozoa group included *E. histolytica*, *Giardia intestinalis* (*G. intestinalis*), and *Blastocystis hominis* (*B. hominis*), while *Hymenolepis nana* (*H. nana*) was categorized within the helminth group. Both microscopic and antigen cassette test results were evaluated qualitatively as 'positive' or 'negative.' In the analysis of diagnostic data, direct microscopy was considered the reference test, and antigen card tests were evaluated as screening tests.

Statistical analysis

All statistical analyses were conducted using IBM SPSS Statistics for Windows version 24.0 (Armonk, NY, USA) (trial version). Frequency and percentage were calculated as descriptive statistics. The association between parasite groups and age and gender groups was assessed using the chi-square test or Fisher's exact test. A p-value < 0.05 was considered the threshold for statistical significance.

■ RESULTS

In total, 6,291 individuals examined, 2,713 (43.1%) were men and 3,578 (56.9%) were women (Table 1).

Temporal and demographic distribution of cases

The distribution of cases by year shows that 2022 had the highest number of instances (25.0%), followed by 2024 (23.2%), 2023 (17.2%), 2019 (16.7%), 2021 (13.4%), and 2020 (4.5%), respectively. This indicates a fluctuation in the number of cases over the study period (Table 1).

Regarding gender distribution, women constituted a larger proportion (56.9%, n=3578) compared to men (43.1%, n=2713). The majority of cases were in the 18–65 age group (93.3%, n=5867), with a smaller representation from the over 65 age group (6.7%, n=424) (Table 1).

Overall parasite prevalence and species distribution

Overall, intestinal parasites were detected in 5.9% (n=373) of cases, while 94.1% showed no parasites, indicating a relatively low infection rate within the general case distribution (Table 1). The most common parasite species identified was *E. histolytica* (48.3%, n=180), followed by *B. hominis* (28.2%, n=105) and *G. intestinalis* (22.5%, n=84). *H. nana* was detected at a very low frequency (1.1%, n=4) (Table 1). In terms of parasite groups, Protozoa were overwhelmingly dominant at 98.9% (n=369), while Helminthes accounted for a very low rate of 1.1% (n=4) (Table 1).

Annual trends in parasite presence and species

The presence of IP varied annually (Table 2). Parasite detection rates were: 4.8% (n=50) in 2019, 2.8% (n=8) in 2020, 3.7% (n=31) in 2021. There was a notable increase in 2022 (8.0%, n=126) and a peak in 2023 (10.1%, n=110). In 2024, the rate decreased to 3.3% (n=48).

E. histolytica/*E. dispar* remained the most common parasite species throughout the years, with varying detection rates: 80.0% (n=40) in 2019, 75.0% (n=6) in 2020, 48.4% (n=15) in 2021, 50.8% (n=64) in 2022, 30.9% (n=34) in 2023, and 43.8% (n=21) in 2024.

G. intestinalis detection rates were 16.0% (n=8) in 2019, 25.0% (n=2) in 2020, 25.8% (n=8) in 2021, 21.4% (n=27) in 2022, 34.5% (n=38) in 2023, and 2.1% (n=1) in 2024.

B. hominis showed an increasing trend in later years: 4.0% (n=2) in 2019, 0.0% in 2020, 12.9% (n=4) in 2021, 27.8% (n=35) in 2022, 34.5% (n=38) in 2023, and 54.2% (n=26) in 2024.

Table 1. IP distribution.

		n	%
Year	2019	1050	16.7
	2020	284	4.5
	2021	840	13.4
	2022	1571	25.0
	2023	1085	17.2
	2024	1461	23.2
Gender	Male	2713	43.1
	Female	3578	56.9
Age group	18-65	5867	93.3
	65>	424	6.7
Presence of parasites	Parasites negative	5918	94.1
	Parasites positive	373	5.9
Parasite type	Protozoa		
	• <i>E.histolytica</i>	180	48.3
	• <i>G.intestinalis</i>	84	22.5
	• <i>B.hominis</i>	105	28.2
	Helminths		
	• <i>H.nana</i>	4	1.1
Parasite group	Protozoa	369	98.9
	Helminths	4	1.1

H. nana was detected only in 2021 at a rate of 12.9% (n=4), with 0.0% in other years (Table 2).

Regarding parasite groups by year, Protozoa constituted 100.0% of parasite cases in all years except 2021. Helminthes were detected only in 2021 at a rate of 12.9% (n=4), with 0.0% in other years.

Parasite presence and groups by gender and age

When examining parasite presence by gender (Table 3), 5.7% (n=155) of men and 6.1% (n=218) of women were positive for parasites. There was no statistically significant difference in parasite presence between genders (p=0.528).

For age groups (Table 3), 5.7% (n=335) of individuals aged 18–65 years had parasites, compared to 9.0% (n=38) in the over 65 age group. The difference in parasite presence across age groups was statistically significant (p=0.006).

Regarding parasite groups by gender, Protozoa accounted for 98.7% (n=153) of parasite cases in men and 99.1% (n=216) in women, while Helminthes were 1.3% (n=2) in men and 0.9% (n=2) in women. There was no statistically significant difference in parasite group distribution between genders (p=0.730; Fisher’s exact test).

When parasite groups were examined by age (Table 3), Protozoa comprised 98.8% (n=331) of cases in the 18–65 age group and 100.0% (n=38) in the over 65 age group. Helminthes were found in 1.2% (n=4) of the 18–65 age group but were absent (0.0%) in the over 65 age group. There was no statistically significant difference in parasite group distribution across age groups (p=0.498; Fisher’s exact test).

These findings indicate that Protozoa are consistently more dominant across all age groups and genders, with no significant difference in the distribution of Protozoa versus Helminthes based on either gender or age.

DISCUSSION

Intestinal parasite infections (IPI) remain a significant global health burden, particularly in developing nations. Their persistence is largely attributed to factors such as poverty, inadequate sanitation, malnutrition, and illiteracy [5]. Even when asymptomatic or presenting with atypical symptoms, IP can negatively impact national economies, public health, and contribute to mental and physical developmental delays, as well as workforce loss.

Regional epidemiological data are crucial for effective parasite prevention and treatment strategies. Numerous studies highlight the variability of parasite prevalence across different years and locations. For instance, research conducted in Senegal between 2011 and 2015 reported an IPI prevalence of 15.8% [7]. Other studies have indicated prevalences of 1.0% in Pakistan (52.8%), Nepal (31.5%), Ghana (17.33%), and the West African country of Burkina Faso (60.8%) [8-11]. In South America’s intertropical zone, Brazil recorded a frequency of

Table 2. IP group, type and presence by year.

		Year											
		2019		2020		2021		2022		2023		2024	
		n	%	n	%	n	%	n	%	n	%	n	%
Presence of parasites	Parasites negative	1000	95.2	276	97.2	809	96.3	1445	92.0	975	89.9	1413	96.7
	Parasites positive	50	4.8	8	2.8	31	3.7	126	8.0	110	10.1	48	3.3
Parasite type	<i>E.histolytica/E.dispar</i>	40	80.0	6	75.0	15	48.4	64	50.8	34	30.9	21	43.8
	<i>G.intestinalis</i>	8	16.0	2	25.0	8	25.8	27	21.4	38	34.5	1	2.1
	<i>B.hominis</i>	2	4.0	0	0.0	4	12.9	35	27.8	38	34.5	26	54.2
	<i>H.nana</i>	0	0.0	0	0.0	4	12.9	0	0.0	0	0.0	0	0.0
Parasite group	Protozoa	50	100.0	8	100.0	27	87.1	126	100.0	110	100.0	48	100.0
	Helminths	0	0.0	0	0.0	4	12.9	0	0.0	0	0.0	0	0.0

Table 3. Distribution of parasite presence according to gender and age groups.

		Presence of parasites				p value
		Parasites negative		Parasites positive		
		n	%	n	%	
Presence of parasites	Male	2558	94.3	155	5.7	0.528
	Female	3360	93.9	218	6.1	
Parasite group	18-65	5532	94.3	335	5.7	0.006
	65>	386	91.0	38	9.0	

Table 4. Distribution of parasite groups according to gender and age groups.

		Parasite group				p value
		Protozoa		Helminths		
		n	%	n	%	
Presence of parasites	Male	153	98.7	2	1.3	0.730
	Female	216	99.1	2	0.9	
Parasite group	18-65	331	98.8	4	1.2	0.498
	65>	38	100.0	0	0.0	

70.7% in 2005 [12]. These figures clearly demonstrate substantial international variations, which are influenced by diverse geographic characteristics and environmental circumstances. A survey conducted in Turkey between 2012 and 2014 found an overall IP prevalence of 3.7% [13]. In our study, conducted in the Southeastern Anatolia Region, the prevalence of IP was determined to be 5.9%. (It is worth noting that some recent meta-analyses on intestinal parasites in school-aged children in Turkey report higher pooled prevalences, such as 29% overall and 41% specifically in the Southeastern Anatolia region, highlighting regional variations and the specific population studied [ResearchGate search results, specifically, "Prevalence of intestinal parasites in school-age children in Turkey: A systematic review and meta-analysis", published June 25, 2025])).

The prevalence of parasitic illnesses in a community is a complex interplay of factors including the parasite species, the host individual, the environment, local infrastructure, and the degree of community knowledge [14]. Age and socioe-

conomic status are also significant determinants of prevalence disparities [15]. A review of the literature, including a study conducted in Somalia, revealed higher parasite prevalence among individuals aged 0–15 years (45.5%) compared to other age groups. Similarly, intestinal parasite infections were commonly found among schoolchildren in Mauritania (2009) and Moroccan school-age individuals (68.1%) [5]. In our study, the rate of parasite positivity in the group over 65 years of age was 9.0%, and we observed a statistically significant variation in the prevalence of parasites by age group (p=0.006).

When analyzing the distribution of the parasite population by gender in our study, no statistically significant difference was discovered (p=0.528), with a parasite occurrence rate of 6% in women and 5.7% in men. This finding is consistent with the Somalia research, which also reported no statistically significant gender difference (p=0.235), with prevalence rates of 52.2% in women and 47.8% in men [5]. Similarly, a Senegalese study indicated that IPIs were more common in women

(50.7%) than in men (49.3%), though this difference was not statistically significant [7]. A study on intestinal protozoa in Malaysia also found similar proportions between males (51%) and females (49%) [16]. Other research further supports that there is no discernible difference in intestinal parasite prevalence between men and women [14]. However, some studies present conflicting results; for example, a study conducted in Turkey reported IPIs to be more common in women (53%) than in men (47%) [17], and an Ethiopian study found rates of 35.9% in women and 32.1% in men [18]. Conversely, studies in Nepal and Brazil have reported higher IPI rates in men compared to women [19, 20]. Despite these variations, the overall proximity of parasite rates between genders suggests that significant variation in frequency between men and women may not be a universal finding.

In our research, the most common IP species identified were *E. histolytica* (48.3%), *B. hominis* (28.2%), and *G. intestinalis* (22.5%). *H. nana* was detected at a very low frequency (1.1%). In comparison, a study in Somalia analyzing 56,824 stool samples found IP in 11.9% of them, with the most prevalent species being *G. lamblia* (60.84%), *E. histolytica* (33.07%), and *A. lumbricoides* (3.18%); other parasite species had extremely low prevalence [5]. Research conducted in Egypt reported *G. lamblia* (12.6%), *E. histolytica/dispar* (10%), *A. lumbricoides* (8.8%), and *H. nana* (8.6%) as the most prevalent [21]. In Ethiopia, the most common parasites found in asymptomatic food handlers were *G. lamblia* (3%), *A. lumbricoides* (4%), and *E. histolytica/dispar* (5.5%) [22]. Another study indicated that hookworm (22%), *E. histolytica/dispar* (24.5%), *A. lumbricoides* (13.6%), and *G. lamblia* (11.4%) were the most common IP. This particular research also highlighted a strong association between the source of drinking water, handwashing habits, unclean nails, and *E. histolytica/dispar* infection [2]. These comparisons underscore the notable variations in the most prevalent parasite species among different nations, which are often attributable to their unique geographic characteristics and climatic circumstances.

Limitations

Our research was retrospective and single-centered, encompassing a limited geographic area within the Southeastern Anatolia region of Turkey. The subjective nature of direct microscopic inspection means that the expertise and educational background of the healthcare professional conducting the evaluation could influence diagnostic outcomes. Furthermore, highly sensitive molecular methods were not employed for diagnosis. These factors highlight the inherent limitations of our study.

CONCLUSION

Intestinal parasites continue to pose a serious public health threat, particularly in developing nations. Reducing their incidence necessitates comprehensive educational initiatives for

the public regarding IP, coupled with the implementation of effective diagnostic, treatment, and preventive measures.

Ethics Committee Approval: The procedures used in this study adhere to the tenets of the Declaration of Helsinki. The ethics committee approval of the study was obtained from the Siirt University Ethics Committee (Ethics code: 2025/01/01/6 - 8754).

Informed Consent: Not necessary for this manuscript.

Peer-review: Externally peer-reviewed.

Conflict of Interest: The authors declare no conflict of interest.

Author Contributions: Conception: AK, LG; Design: AK; Supervision: AK, LG; Materials: AK, LG; Data Collection and/or Processing: AK, LG; Analysis and/or Interpretation: AK, LG; Literature Review: AK, LG; Writing: AK; Critical Review: AK.

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Investigation of the prognostic impact of proline-rich protein 11 (PRR11) transcription levels in early-stage bladder cancer

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■ MAIN POINTS

- PRR11 is expressed in bladder cancer.
- A negative correlation was observed between PRR11 transcription levels and survival outcomes in patients with early-stage bladder cancer.
- PRR11 transcription levels in bladder cancer may be a useful biomarker for predicting prognosis.

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■ ABSTRACT

Aim: To investigate proline-rich protein 11 (PRR11) transcription levels and its prognostic effect in early-stage (non-metastatic) bladder cancer.

Materials and Methods: Thirty-one patients diagnosed with early-stage (non-metastatic) bladder cancer were included in the study. Tumor tissues of the patients at the time of diagnosis were obtained from the pathology laboratory, PRR11 transcription levels were analyzed, and "median fold change" values for PRR11 transcription levels were obtained. According to the median PRR11 transcription level determined from these values, the patients were divided into two groups (n = 16 and n = 15). The demographic and clinicopathological characteristics of the patients were examined, and the survival outcomes of the two groups were compared.

Results: The determined median PRR11 transcription level was 1.386 (range: 0.135- 2.016). In the patient group with a median PRR11 transcription level ≤ 1.381 (n=16), median disease-free survival (mDFS) was 19 months (95% CI: 2.1-48.4 months); in the group with >1.381 (n=15), mDFS was 11 months (95% CI: 7.5-14.4 months). In the group with ≤ 1.381 , median overall survival (mOS) was 27 months (95% CI: 4.1-58.3 months), and in the group with >1.381 , mOS was 14 months (95% CI: 8.1-19.8 months).

Conclusion: Our study revealed a negative correlation between PRR11 transcription level and survival outcomes in patients with early-stage bladder cancer. The PRR11 transcription level may be a prognostic marker in patients with early-stage bladder cancer. More comprehensive, prospective, and randomized controlled trials are needed.

Keywords: Biomarker, Bladder cancer, Prognosis, Proline-rich protein 11

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■ INTRODUCTION

Bladder cancer is one of the most common malignancies of the genitourinary tract [1,2]. Recently, immune checkpoint inhibitors have started to find a place in the treatment, especially in advanced-stage bladder cancer patients. Tolerance of ICI is better compared to chemotherapy, especially in elderly patients with comorbidities. Although ICI is a good treatment alternative, overall response rates are 15-20% [3]. At the same time, chemotherapy response rates also vary [4]. At this point, new biomarkers are needed to select treatment, predict treatment response, and assess prognosis.

Proline-rich 11 (PRR11) is a gene on chromosome 17q22-23 encoding a proline-rich protein [5,6]. PRR11 expression is reported to be increased in different types of cancer, such as ovarian carcinoma [7], breast cancer [8], non-small cell lung cancer [9,10], colorectal cancer [11], esophageal cancer [12], and pancreatic cancer [13].

PRR11 expression has a role in the cell cycle and may contribute to the oncogenic process [6]. Zhang et al. demonstrated increased PRR11 expression in the late S phase of the cell cycle, which remained high until just before mitotic telophase. Suppression of PRR11 resulted in cell cycle arrest

in the late S phase. In addition, suppression of PRR11 caused a significant delay in G2/M progression and induced apoptosis [14].

We aimed to investigate PRR11 transcription levels and their prognostic effect in early-stage (non-metastatic) bladder cancer.

MATERIALS AND METHODS

Study design

Thirty-one early-stage (non-metastatic) muscle-invasive bladder cancer patients followed up in our center between December 2014 and June 2021 were evaluated retrospectively. The transcription levels of PRR11 expression in the tumor tissues of patients at diagnosis were analyzed. The values derived from the analysis were also compared with each other, and a median fold change value was calculated for each patient. These values were subsequently recorded.

The demographic data, including gender, age, smoking history, comorbidities, and clinical variables such as treatment methods and survival outcomes for disease-free survival (DFS) and overall survival (OS) of all the patients were documented. Disease-free survival was defined as the duration between diagnosis and the date of recurrence or death. Overall survival is defined as the duration between diagnosis and the date of death or the last known date of being alive.

RNA extraction, cDNA synthesis, and qRT-PCR

Total RNA was obtained from tissues using the DiaRex® Total RNA Extraction kit (Cat No: TR-0877, Diagen, Turkey). In summary, 5-30 mg of tissue was homogenized in a 1.5 mL tube, followed by extraction in accordance with the manufacturer's protocol, resulting in the acquisition of 30-50 µL of Total RNA. Total RNAs were preserved at -80°C until the study was conducted.

Preserved samples were thawed on ice, and RNA measurements (Colibri Titertek Berthold, Germany) were performed to stabilize RNA concentrations before cDNA processing. Then, cDNA synthesis was started using SOLIScript® RT cDNA synthesis KIT (SolisBIODYNE, Estonia). After all the content was prepared, it was loaded into a conventional PCR device (ThermoFisher Veriti, America). As for the PCR protocol, reverse transcription was performed at 50°C for 5 minutes. At the end of the reaction, the enzyme was inactivated at 85 °C for 5 minutes. After inactivation, cDNA products were stored at -20 °C.

SolisFAST® SolisGreen® qPCR Mix (no ROX), 5X (SolisBIODYNE, Estonia) was used to determine gene expression levels. For the 1X PCR reaction, the total volume consisted of 4 µL master mix, 5 µL mixB (containing 0.3mM forward and reverse primers), 6 µL dH₂O, and 5 µL cDNA, making the total volume 20 µL. The reaction was carried out on a real-time PCR device (BioRAD CFX-96, Germany), first denaturation 95 oC 5 min, 45 repetitions 95 oC 5 sec, 55 oC(mir-34a/mir-146a/mir-181) 57 oC(U6/mir-148a) was applied as

30 seconds (reading). Relative mRNA expression levels obtained for specific genes via the device were determined using the 2-ΔΔCt method with the R package (qpcrtools 1.0.1, ggpubr 0.6.0, dplyr 1.1.4, tidyverse 2.0.0, car 3.1-2).

Statistical analysis

Descriptive statistics were used to examine the demographic and clinicopathological characteristics of the patients. Categorical data was analyzed using the chi-square test.

The median follow-up time was determined utilizing the reverse Kaplan-Meier method. Survival analyses of median DFS (mDFS) and median OS (mOS) were performed using the Kaplan-Meier method, and possible prognostic factors were compared using the log-rank test. A p-value below 0.05 was deemed statistically significant. All statistical analyses were conducted via the IBM SPSS Version 21.0 (Armonk, NY: IBM Corp.).

RESULTS

Patients' demographic and Clinicopathological characteristics

The study included 31 patients with early-stage (non-metastatic) bladder cancer. Of the patients, 28 (90.3%) were male and 3 (9.7%) were female. The mean age of the patients was 71.9 (±10.04). Nineteen (61.2%) of the patients were active smokers, 6 (19.3%) were ex-smokers, and 6 (19.5%) of the patients had no smoking history (Table 1). Four (2.9%) of the patients were initially diagnosed with non-muscle invasive bladder cancer and were subsequently diagnosed with muscle-invasive bladder cancer. The remaining 27 (97.1%) patients were initially diagnosed with muscle-invasive bladder cancer.

Table 1. Patients' baseline demographic and clinicopathologic characteristics.

	Total (n=31)
Age (years), (±SD)	71.9 (±10.04)
Sex M/F (n)	28/3
Comorbidities, n (%)	
Hypertension	6 (19.3)
Diabetes Mellitus	6 (19.3)
Lung Disease	4 (12.9)
Treatment modality, n (%)	
Neoadjuvant Therapy	8 (25.8)
Adjuvant Therapy	7 (22.5)
Definitive CRT	16 (51.7)
Smoking History, n (%)	
Active smoker	19 (61.4)
Ex-smoker	6 (19.3)
Non-smoker	6 (19.3)
Stage, n (%)	
Stage 1	0
Stage 2	21 (67.7)
Stage 3A	8 (25.8)
Stage 3B	2 (6.5)

CRT: Chemoradiotherapy.

Table 2. Patients' survival outcomes according to PRR11 transcription levels.

	All patients (n=31)	PRR11 transcription level ≤ 1.381 (n=16)	PRR11 transcription level > 1.381 (n=15)	p value
DFS, months, median 95% CI	14 3.4-24.5	19 2.1-48.4	11 7.5-14.4	0.486
OS, months, median 95% CI	27 4.1-60.07	27 4.1-58.3	14 8.1-19.8	0.514

DFS: Disease-free survival, OS: Overall survival, CI: Confidence interval.

Twenty-one (67.7%) patients were stage II, 8 (25.8%) patients were stage IIIA, and 2 (6.5%) patients were stage IIIB. Six of the patients had positive lymph nodes at the time of diagnosis. When the treatment modalities were examined, 7 (22.5%) patients received adjuvant chemotherapy after radical cystectomy and pelvic lymph node dissection. Eight (25.8%) patients received neoadjuvant chemotherapy followed by radical cystectomy and pelvic lymph node dissection. Sixteen (51.7%) patients received definitive chemoradiotherapy (Table 1). In some of the patients who received definitive chemoradiotherapy, this treatment was chosen because the patients did not accept surgery.

PRR11 transcription levels

PRR11 transcription levels were analyzed in 31 patients with early-stage (non-metastatic) bladder cancer tumor tissues. All transcription levels were analyzed within themselves, and median fold change values were obtained. These values ranged between 0.135 and 2.016 (Figure 1). The median PRR11 transcription level value in the entire patient group was 1.381. Patients were examined in 2 groups according to the median value of 1.381. There were 16 patients with a PRR11 transcription level of ≤ 1.381 and 15 with a level of > 1.381 . The two groups were similar in terms of age, gender, smoking history, stage at diagnosis, and treatment modalities.

Survival analysis

The median follow-up time was 25 months (min: 3-max: 84). mDFS was 14 months (95% CI: 3.4-24.5 months), and mOS

was 27 months (95% CI: 4.1-60.07 months) for all patients. In the patient group with a median PRR11 transcription level value ≤ 1.381 (n=16), mDFS was 19 months (95% CI: 2.1-48.4 months); in the group with > 1.381 (n=15), mDFS was 11 months (95% CI: 7.5-14.4 months) (Figure 2a). In the group with ≤ 1.381 , mOS was 27 months (95% CI: 4.1-58.3 months), and in the group with > 1.381 , mOS was 14 months (95% CI: 8.1-19.8 months) (Figure 2b) (Table 2).

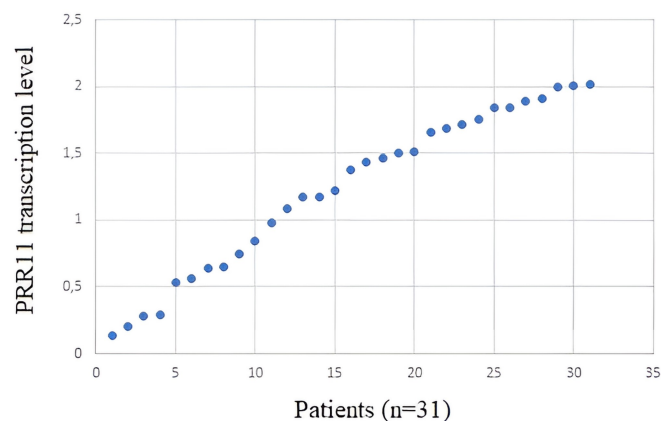
DISCUSSION

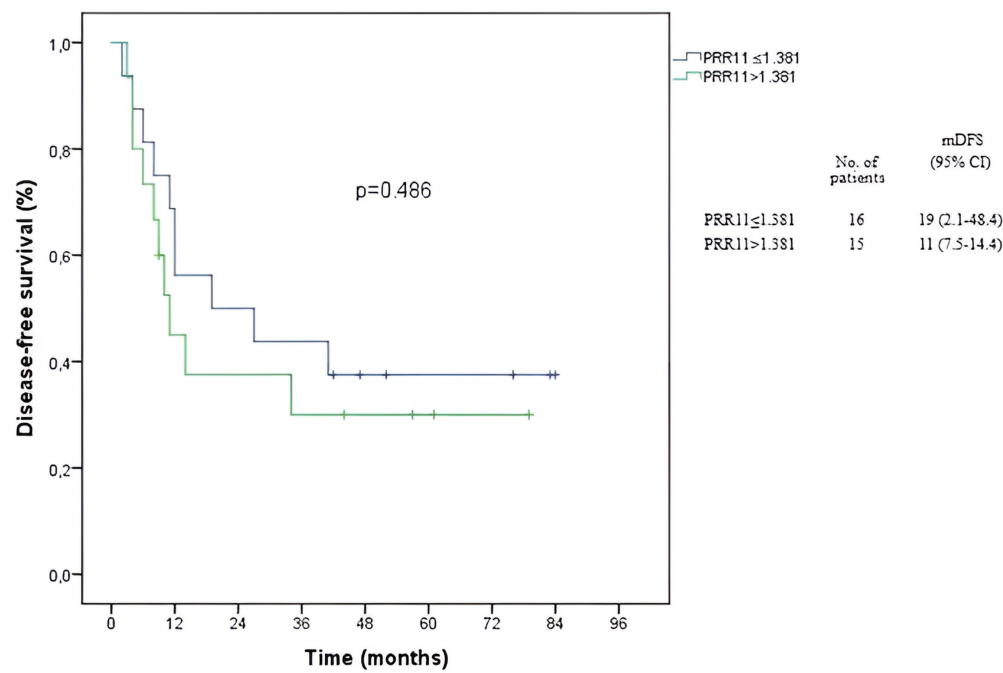
Bladder cancer is a heterogeneous condition characterized by a high recurrence rate; nevertheless, there is no reliable predictor for directing therapy. Recent studies have established models for bladder cancer related to DNA methylation-dependent genes or those involving immune genes, and these models may provide prognostic insights [15,16].

PRR11 expression is being investigated as a possible prognostic and/or therapeutic target in different types of cancer. However, the studies are insufficient to reach a definitive conclusion on this issue. Studies showing the role of PRR11 in the cell cycle, particularly in the late S phase, indicate that the amount of PRR11 increases and that silencing PRR11 delays G2-M progression and stimulates apoptosis [14], suggesting that PRR11 may have an oncogenic effect.

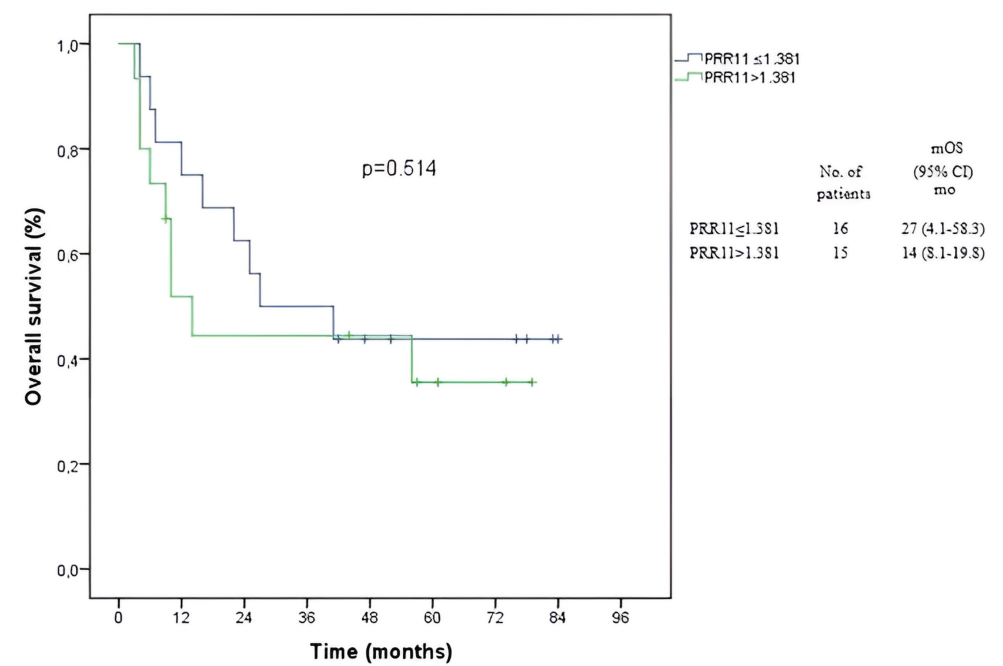
In our study, PRR11 transcription levels were analyzed in patients diagnosed with early-stage bladder cancer, and their effect on prognosis was investigated. Our study showed a negative correlation between PRR11 transcription levels and survival outcomes. However, p-values did not reach statistical significance, probably due to the small number of patients; a numerical difference was detected between the two groups in both DFS and OS. When the literature was reviewed, some studies investigated PRR11 expression in bladder cancer, and these studies have similar findings to our research.

A study based on online databases investigated the possible oncogenic and prognostic role of PRR11 expression in bladder cancer. This study showed that PRR11 was significantly expressed in bladder cancer patients, and patients with high expression had the worst prognosis. Tumor mutation burden (TMB) and immune cell infiltration were also examined in these patients. It was determined that PRR11 expression was positively correlated with TMB and levels of immune cell infiltration [17]. In a study conducted using data from The Cancer Genome Atlas (TCGA), which analyzed non-small

**Figure 1.** Distribution of PRR11 transcription levels of patients.



(a) Kaplan Meier curve for mDFS according to PRR11 transcription levels.



(b) Kaplan Meier curve for mOS according to PRR11 transcription levels.

Figure 2. Distribution of PRR11 transcription levels of patients.

cell lung cancer (NSCLC) and bladder cancer patient tissues, smoking-related genes and the PRR11 gene were evaluated as potential immunotherapeutic targets. As a result of the study, it was suggested that PRR11 could be a potential prognostic gene in both non-small cell lung cancer (NSCLC) and bladder cancer. Additionally, it was demonstrated that PRR11 plays a crucial role in regulating programmed death ligand 1 (PD-L1) by interacting with spindle apparatus coiled-coil protein 1 (SPDL1) [18]. Jiaxing Lin et al. investigated prognostic genes

in bladder cancer patients using four cohorts from TCGA and Gene Expression Omnibus databases. They detected 8 risk-increasing genes and 3 protective genes. One of the 8 genes that increase risk is PRR11. According to the risk scale created by these genes, patients with high-risk scores have the worst prognosis [19]. Bladder cancer is a heterogeneous disease, and new biomarkers that may be useful in predicting treatment selection, treatment response, and/or prognosis are needed. Various genes,

such as PRR11 and other biomarkers, are still being investigated. Due to the heterogeneous structure of the tumor, response rates to ICIs and chemotherapies vary, making it challenging to predict treatment selection and prognosis. PRR11 gene expression is being investigated as a possible biomarker in bladder cancer, as in many different types of cancer, especially since it varies in different phases of the cell cycle and is considered potentially oncogenic. Although there is no precise data with current information, it can be used as a targetable biomarker in the future. Alternatively, when evaluated as a poor prognostic factor, it can guide approaches such as more aggressive treatment options or closer follow-up.

■ CONCLUSION

The PRR11 transcription level may serve as a prognostic marker in patients with early-stage bladder cancer. Our study found a negative correlation between PRR11 transcription level and survival outcomes. However, the number of patients was insufficient to generalize the results. In addition, the analysis performed showed PRR11 expression indirectly through transcription levels. PRR11 may be a useful marker pending validation in larger cohorts and multivariate modeling. More comprehensive, prospective, and randomized controlled trials are needed.

Ethics Committee Approval: The research received approval from the hospital's ethics committee (Dr. Abdurrahman Yurtaslan Oncology Health Application and Research Center Clinical Research Ethics Committee, Decision no: 2020-05/631).

Informed Consent: No new tissue samples were taken; archival tissue was used.

Peer-review: Externally peer-reviewed.

Conflict of Interest: The author(s) disclosed no potential conflicts of interest about this article's research, authorship, or publication.

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Examining the relationship between sustainability consciousness and physical activity in healthy young adults

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■ MAIN POINTS

- Sustainable consciousness and physical activity levels of individuals studying in the field of health and physical activity in higher education are important.
- There is no relationship between sustainable consciousness and physical activity level in healthy young people.
- Sustainable consciousness sub-parameters knowledge, attitude and behavior (economic, social, environment) are significantly related to each other.

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■ ABSTRACT

Aim: Sustainability consciousness (SC) refers to the awareness and lived experience of sustainability phenomena, which includes personal insights and viewpoints. The objective of this study is to assess the correlation between SC and physical activity among young, healthy volunteers.

Materials and Methods: We assessed sustainability consciousness (SC) using the Sustainability Consciousness Questionnaire (SCQ) and physical activity levels with the International Physical Activity Short Form (IPAQ-sf).

Results: We included 235 participants in the study, with ages ranging from 18 to 33 years and an average BMI of 23.01. The study found no statistically significant association between overall physical activity levels (IPAQ-SF) and overall sustainability consciousness (SCQ) ($p > .05$). Furthermore, none of the IPAQ-SF sub-parameters showed a significant correlation with the SCQ's total scores for knowledge ($r = -.014$, $p = .835$), attitude ($r = -.007$, $p = .912$), or behavior ($r = .070$, $p = .287$). When examining the SCQ sub-parameters, we found no significant association between knowledge (economic) and attitude (environment) ($r = -.040$, $p = .539$), or between knowledge (economic) and behavior (social) ($r = -.047$, $p = .472$). However, all other SCQ sub-parameters showed significant intercorrelations ($p < .001$). Specifically, knowledge (social) and behavior (social) sub-parameters were not significantly related ($r = .026$, $p = .689$), but all other pairings within the SCQ sub-parameters were significantly correlated ($p < .001$).

Conclusion: This study found no association between sustainability consciousness (SC) and physical activity in healthy young individuals. However, we did observe significant interrelationships among the knowledge, attitude, and behavior sub-parameters of the Sustainability Consciousness Questionnaire (SCQ), across economic, social, and environmental dimensions.

Keywords: Consciousness, Sustainability development, Healthy volunteers, Higher education, Sustainability knowledge

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■ INTRODUCTION

Sustainability is a multifaceted approach aiming to preserve natural resources for future generations [1]. It encompasses environmental, economic, and social dimensions, advocating for eco-friendly practices and striving for a fair standard of living that enhances social welfare. In our rapidly developing world, sustainability has become paramount, making the effective use of resources a fundamental necessity [2,3].

Sustainability consciousness (SC) is defined as an individual's experience and awareness of sustainability phenomena, including their personal perspectives [4]. This concept is often

linked to an individual's knowledge, attitudes, and behaviors across environmental, social, and economic contexts [5]. SC highlights sensitivity to environmental factors, problems, and themes. Individuals with a strong SC are expected to significantly influence the development of future societies and contribute to social progress [6].

It's crucial for individuals to align their lives with contemporary demands while remaining aware of age-specific requirements to ensure access to suitable education [7]. Active participation in social life, driven by SC, fosters social development within the sustainability framework [8]. Moreover, in-

dividuals engaged in social life with SC tend to develop heightened environmental sensitivity by being aware of their surroundings. This underscores the importance of individuals being conscious of and sensitive to environmental factors within the context of sustainability and quality education. Ultimately, environmentally aware and conscious societies are vital for achieving a sustainable understanding, aligning with the broader Sustainable Development Goals.

One key objective of the World Health Assembly Global Physical Activity (PA) Action Plan 2018-30 is to reduce physical inactivity by 10% by 2025 and by 15% by 2030 [9]. The World Health Assembly Guidelines on Physical Activity and Sedentary Behaviour recommend a weekly minimum of 150–300 minutes of moderate-intensity PA, 75–150 minutes of high-intensity PA, or an equivalent combination [10]. Lack of regular and adequate physical activity is a widespread global issue. Consequently, promoting lifestyles that incorporate regular exercise is a national and international public health recommendation. Positive health-related lifestyle changes adopted early in life are effective in reducing the incidence of lifestyle-related disorders, necessitating a comprehensive investigation into health behaviors among young individuals [11]. In Türkiye, healthy young people represent a dynamic and crucial demographic. This population is relatively homogeneous and accessible, and their physical activity levels are important for reducing the incidence of diseases that may cause problems later in life [12].

Many studies grounded in the theory of planned behavior have empirically demonstrated relationships between attitudes, perceived norms, intention, consciousness, and behavior. When adapted to information-sharing behavior, this theory links sharing behavior with subjective norms, personal attitudes, consciousness, and perceived behavioral control through the intention to share information. Building on this, our study specifically examines the relationship between SC and PA levels.

Currently, there are very few significant studies investigating PA levels within the Turkish population, and no existing research has explored the direct relationship between SC and PA levels. However, approaches to this topic suggest the importance of physical activity levels among individuals pursuing academic studies related to health and physical activity, particularly in higher education. Against this backdrop, the present study aims to evaluate the interaction between SC and PA in young, healthy participants.

■ MATERIALS AND METHODS

Study design

This study used a descriptive methodological approach with a cross-sectional design. Ethical approval was obtained from the Necmettin Erbakan University Health Sciences Ethics Committee (2025/972, 12/2/2025). We also secured permissions from the Necmettin Erbakan University's Kamil

Akkanat Faculty of Health Sciences and Ahmet Cengiz Faculty of Engineering. All participants received both verbal and written information about the research and provided informed consent prior to data collection [13].

Participants

We calculated the sample size using a power analysis in G*Power 3.1.9.7. The study's treatment effect was defined as the difference between two treatments. Based on t-test calculations in G*Power 3.1.9.2, with an effect size of 0.25, a standard error of 0.05, and 95% power, a point biserial correlation required 197 participants [14]. To account for potential missing data and enhance study power, we included 235 volunteers.

Methods

Participants and Data collection

We identified participants who met the study's inclusion criteria as volunteers. Data were voluntarily collected through face-to-face interviews, adhering to the Declaration of Helsinki [13]. All participants provided written informed consent in accordance with human ethics regulations before data collection began.

Our eligibility criteria were based on previous studies. Inclusion criteria included:

- No health issues that would prevent physical activity.
- Willingness to participate in the research project.
- Literacy [13].

Exclusion criteria comprised:

- Musculoskeletal problems that could alter physical activity habits.
- Cardiac and respiratory problems.
- Diabetes mellitus.
- Chronic drug use.
- A body mass index (BMI) of 35 kg/m² or higher.
- Any other condition that might prevent physical activity [15].

Outcome measures

We recorded participants' physical information (age, height, gender, BMI) and sociodemographic data (chronic diseases, medication use). Sustainability consciousness (SC) was assessed using the Sustainability Consciousness Questionnaire (SCQ). Physical activity levels were measured using the International Physical Activity Questionnaire–Short Form (IPAQ-SF). Participants completed these assessment scales on photocopied sheets.

Sustainability Consciousness Questionnaire (SCQ)

The SCQ was developed by researchers, with contributions from Michalos et al. (2012) [16], and adapted into Turkish by Yüksek et al. (2019) [17]. It consists of 50 items across 3 subscales: Knowledge, Attitude, and Behavior. Each subscale integrates economic, social, and environmental factors. The questionnaire uses a five-point Likert scale ranging from "strongly agree" to "strongly disagree." The "don't know" option from the original scale was omitted to avoid confusion for the students [17].

The SCQ demonstrated strong psychometric properties: item-total correlations ranged from .300 to .819, and t-values from 2.237 to 18.812, indicating sufficient discrimination power for all items ($p < .05$). The overall Cronbach's alpha coefficient for the scale was .860 [17].

International Physical Activity Questionnaire–Short Form (IPAQ-SF)

The IPAQ-SF is a self-report questionnaire designed to assess an individual's physical activity level. Its validity and reliability have been established in 12 different countries [18]. The IPAQ-SF comprises seven questions that gather information on the duration and frequency of walking, moderate-intensity activities, and vigorous-intensity activities over the previous week.

Total physical activity scores are derived by calculating the mean duration (in minutes) and frequency of walking, moderate-to-vigorous activity, and vigorous activity. Energy expenditure is quantified using MET-minute scores, with standardized MET values assigned to activities (e.g., walking = 3.3 METs, moderate activity = 4.0 METs, vigorous exercise = 8.0 METs). These MET values are multiplied by the frequency in minutes and days to determine the overall physical activity score [18]. In addition to continuous scoring, the numerical data obtained are also classified into categories of physical activity. The processing of IPAQ-SF data follows an automated report and scoring methodology guidance. For the Turkish validity and reliability study, Cronbach's alpha values for the subscales ranged from .73 to .76 [19].

Statistical analysis

We performed all statistical analyses using IBM SPSS Statistics for Windows Version 29.00 (Armonk, NY: IBM Corp.). Data accuracy and normality were rigorously verified. We used the Kolmogorov-Smirnov test, along with skewness and kurtosis tests, to assess data conformity to a normal distribution [20]. Descriptive statistics for measured values are presented as mean $\pm$ standard deviation ($X \pm SD$), while unmeasured values are reported as percentages (%) and numbers (n). Pearson correlation analysis was conducted to determine the relationship between IPAQ-SF and SCQ scores. Results were evaluated with a 95% confidence interval and a significance level set at $p < 0.05$, as previously outlined [21].

Table 1. Physical and sociodemographic characteristics of the participants (n=235).

Physical characteristics	M $\pm$ SD	Min-Max
Age (Year)	21.32 $\pm$ 3.32	18.00-33.00
Height (cm)	170.55 $\pm$ 9.21	153.00-190.00
Weight (kg)	66.89 $\pm$ 10.73	50.00-103.00
BMI (kg/m ²)	23.01 $\pm$ 3.41	15.86-39.25
Sociodemographic characteristics		n (%)
Chronic Disorders	Yes	22 (9.4)
	No	213 (90.6)
Drugs Used	Yes	21 (8.9)
	No	214 (91.1)

n: The number of participants. M: Mean. SD: Standard Deviation. Min: Minimum. Max: Maximum. BMI: Body Mass Index.

RESULTS

Our study included 235 participants aged between 18 and 33 years, with an average Body Mass Index (BMI) of 23.01. Most participants reported no long-term health problems (90.6%) and were not taking any medication (91.1%) (Table 1).

The overall mean score for the Sustainability Consciousness Questionnaire (SCQ) was 198.00 ± 18.80 . Sub-parameter mean scores were: Knowledge, 77.31 ± 10.37 ; Attitude, 56.20 ± 7.22 ; and Behavior, 64.18 ± 10.39 . We found no statistically significant association between an individual's physical activity level (IPAQ-SF) and their overall sustainability consciousness (SCQ) ($p > .05$) (Table 2).

As shown in Table 3, the total scores for knowledge, attitude, and behavior (across all SCQ sub-parameters) exhibited no significant correlation with each other ($r = -.014$, $p = .835$; $r = -.007$, $p = .912$; $r = .070$, $p = .287$, respectively). When examining specific SCQ sub-parameters (Table 4), we found no significant relationship between knowledge (economic) and attitude (environment) ($r = -.040$, $p = .539$), nor between knowledge (economic) and behavior (social) ($r = -.047$, $p = .472$). Additionally, there was no significant relationship between knowledge (social) and behavior (social) ($r = .026$, $p = .689$). However, all other SCQ sub-parameters showed significant inter-correlations ($p < .001$).

Our multiple regression analysis (Model 1) confirmed no significant relationship between the total scores of knowledge, attitude, behavior, and IPAQ-SF ($F = 0.381$, $p = 0.767$). This model had a multiple correlation coefficient of 0.07 (Table 5).

DISCUSSION

This study represents a novel contribution to the existing literature, as it's the first to explore the direct relationship between sustainability consciousness (SC) and physical activity (PA) in healthy young individuals. Our findings indicate no statistically significant association between overall SC and PA levels in this demographic. However, we did observe significant interrelationships among the knowledge, attitude, and behavior sub-parameters of the Sustainability Consciousness

Table 2. Participants' Sustainability Consciousness Scale and International Physical Activity Questionnaire Short Form scores (n=235).

SUS CONS sub-parameters		M±SD	Min	Max	Skewness		Kurtosis	
					Statistic	Std.Error	Statistic	Std.Error
Knowledge	ECO	20.88±3.42	2.00	25.00	-1.07	0.16	3.08	0.32
	SOC	37.02±6.20	18.00	55.00	-0.90	0.16	1.35	0.32
	ENV	19.41±3.50	2.00	35.00	-0.25	0.16	3.27	0.32
	Total	77.31±10.37	42.00	95.00	-0.69	0.16	0.78	0.32
Attitude	ECO	17.51±2.89	12.00	40.00	1.90	0.16	14.79	0.32
	SOC	24.65±4.74	12.0	32.00	-0.59	0.16	-0.55	0.32
	ENV	14.05±3.15	8.00	30.00	1.33	0.16	3.10	0.32
	Total	56.20±7.22	38.00	86.00	0.26	0.16	0.57	0.32
Behavior	ECO	14.51±3.15	7.00	24.00	-0.01	0.16	-0.27	0.32
	SOC	22.61±4.10	1.00	30.00	4.10	0.16	3.11	0.32
	ENV	27.00±5.85	11.00	36.00	-0.14	0.16	-0.79	0.32
	Total	64.18±10.39	38.00	85.00	-0.19	0.16	-0.60	0.32
SUS CONS General Total		198.00±18.80	142.00	306.00	0.82	0.16	4.49	0.32
IPAQ-SF		3999.19±1003	1500	6000	0.02	0.16	-0.78	0.32

n: The number of participants. M: Mean. SD: Standard Deviation. Min: Minimum. Max: Maximum, SUS CONS: Sustainability Consciousness, ECO: Economic, SOC: Social; ENV: Environmental, IPAQ-SF: International Physical Activity Questionnaire Short Form.

Table 3. Determining the relationship between the participants' Sustainability Consciousness Scale and International Physical Activity Questionnaire Short Form scores using Pearson correlation

SUS CONS sub-parameters		International Physical Activity Questionnaire Short Form			
		r	p	95% Confidence Intervals	
				Lower	Upper
Knowledge	ECO	-0.004	0.950	0.950	0.124
	SOC	-0.010	0.873	0.873	0.118
	ENV	-0.018	0.785	0.785	0.110
	Total	-0.014	0.835	0.835	0.115
Attitude	ECO	-0.045	0.496	0.496	0.084
	SOC	-0.053	0.416	0.416	0.075
	ENV	0.105	0.110	0.110	0.229
	Total	-0.007	0.912	0.912	0.121
Behavior	ECO	0.108	0.099	0.099	0.233
	SOC	-0.023	0.725	0.725	0.105
	ENV	0.082	0.211	0.211	0.207
	Total	0.070	0.287	0.287	0.196
SUS CONS General Total		0.007	0.921	0.921	0.134

n: The number of participants. SUS CONS: Sustainability Consciousness, ECO: Economic, SOC: Social; ENV: Environmental, p <0.05. r: Pearson correlation coefficient. **= Correlation is significant at the 0.001 level. *= Correlation is significant at the 0.05 level.

Questionnaire (SCQ), across economic, social, and environmental dimensions.

While our study found no direct link between overall SC and PA, it's important to compare this with the closest related research. Polat et al. (2019) reported that individuals engaged in PA, whether licensed or recreational, exhibited more positive sustainable consumption behaviors than inactive individuals [22]. Similarly, Niu et al. (2024) demonstrated that leisure time and physical activity significantly influence the intention to make green/sustainable purchases, showing a positive correlation between participation in leisure-time PA and the purchase of environmentally friendly and sustainable products

[23]. Furthermore, Erarslan et al. (2024) identified a moderate positive relationship between SC and environmental behaviors [24], and Opdenacker et al. (2008) noted a positive psychological effect of sustainability lifestyle physical activity interventions on rural women [25]. Pan et al. (2024) even showed that teachers' lesson management can enhance students' metacognition, contributing to the development of SC [26].

The absence of a direct relationship between SC and PA in our study might be attributed to our participant demographic, specifically healthy young adults. We hypothesize that results could differ across other age groups. Despite this, physical ac-

Table 4. Determining the relationship between the participants' Sustainability Consciousness Scale scores using Pearson correlation.

SUS CONS sub-parameters		Knowledge							
		ECO		SOC		ENV		Total	
		r	p	r	p	r	p	r	p
Knowledge	ECO	1							
	SOC	0.530**	<0.001	1					
	ENV	0.252**	<0.001	0.375**	<0.001	1			
	Total	0.733**	<0.001	0.901**	<0.001	0.646**	<0.001	1	
Attitude	ECO	0.323**	<0.001	0.253**	<0.001	0.120	0.067	0.298**	<0.001
	SOC	0.522**	<0.001	0.447**	<0.001	0.243**	<0.001	0.523**	<0.001
	ENV	-0.040	0.539	-0.105**	<0.001	0.025	0.708	-0.068	0.300
	Total	0.454**	<0.001	0.349**	<0.001	0.218**	<0.001	0.433**	<0.001
Behavior	ECO	-0.135*	0.039	-0.166**	0.011	-0.066	0.316	-0.166*	0.011
	SOC	-0.047	0.472	0.026	0.689	0.163*	0.012	0.055	0.399
	ENV	-0.235**	<0.001	-0.189**	0.004	0.054	0.408	-0.173**	0.008
	Total	-0.192**	0.003	-0.146**	0.025	0.075	0.252	-0.126	0.054
SUS CONS Genberal Total		0.490**	<0.001	0.557**	<0.001	0.433**	<0.001	0.646**	<0.001

n: The number of participants. SUS CONS: Sustainability Consciousness, ECO: Economic, SOC: Social, ENV: Environmental, p <0.05. r: Pearson correlation coefficient. **= Correlation is significant at the 0.001 level, *= Correlation is significant at the 0.05 level.

Table 5. Determining the effects of sustainability awareness (Economic, Social, Environmental) on the International Physical Activity Questionnaire Short Form using multiple regression analysis.

		Multiple Regression Analysis Model Summary				ANOVA	
		R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson	F
N=235							p
Model 1							
SUS CONS (ECO, SOC, ENV)- IPAQ-Sf)		0.070	0.005	-0.008	1007.69	1.352	0.381

N: The number of participants, SUS CONS: Sustainability Consciousness, ECO: Economic, SOC: Social, ENV: Environmental, IPAQ-Sf: International Physical Activity Questionnaire Short Form.

tivity plays a crucial role in reducing carbon footprint, promoting healthy living and healthcare systems, and enhancing nature interaction and awareness. We believe that SC is vital for active participation in such sustainability-focused endeavors.

Consistency in SCQ Scores

Our study's overall mean SCQ score was 198.00 ± 18.80 . The mean scores for SCQ sub-parameters were: Knowledge (77.31 ± 10.37), Attitude (56.20 ± 7.22), and Behavior (64.18 ± 10.39). These scores are comparable to those reported by Eraslan et al. (2024), who found overall mean SCQ scores of 194.52 ± 27.22 for females and 183.52 ± 30.56 for males. Their sub-parameter means were: Knowledge (77.64 ± 10.37 for females, 74.08 ± 14.90 for males), Attitude (56.62 ± 8.82 for females, 53.79 ± 9.65 for males), and Behavior (60.25 ± 10.23 for females, 55.63 ± 10.73 for males) [24]. Similarly, Tural et al. (2023) reported a general mean SCQ score of 189.65 ± 21.01 , with sub-parameter means of Knowledge (73.59 ± 7.47), Attitude (58.47 ± 5.85), and Behavior (57.59 ± 7.69) [2]. The consistency of our SCQ sub-parameters and overall mean scores with these prior studies (Eraslan et al. and Tural et al.) reinforces the reliability of our measurements [2,24].

Our findings confirm a significant relationship among the SCQ sub-parameters of knowledge, attitude, and behavior across economic, social, and environmental contexts. This aligns with Tural et al.'s (2023) research, which also found a significant connection between different components of SC ($p < .05$) [2]. Likewise, Salem et al. (2021) and Ovais et al. (2023) reported significant relationships between the various parts of SCQ and students' SC in their respective studies ($p < .05$) [27,28]. The consistency of our results with these studies further supports the interconnected nature of SC's sub-parameters [2, 27, 28].

Limitations

To minimize bias in outcome measurements, we implemented blinding during data coding and reporting. The study utilized data collection tools with established validity and reliability. Data were meticulously collected by an expert, an Assistant Professor, and clear criteria were defined for participant exclusion and withdrawal. Appropriate statistical methods were employed for data analysis, including calculations of effect sizes and confidence intervals.

However, our study has several limitations. It was single-center research, involving students solely from a single univer-

sity in Konya province and specifically from certain departments, not an equal number from each. The evaluation of physical activity level was general rather than detailed. Furthermore, the reliance on self-report scales means that participants' accurate understanding of questions and attentive completion were crucial. One of the most important limitations of our study was the lack of data from the patient files evaluating long-term upper extremity motor functions. We believe that there is a need for new prospective randomized controlled studies on long-term upper extremity motor functions of patients who have undergone shoulder surgery and who have undergone ISBPB for postoperative pain control.

■ CONCLUSION

This study determined that there is no relationship between sustainability consciousness (SC) and physical activity levels in healthy young individuals. However, we confirmed that the knowledge, attitude, and behavior sub-parameters of the Sustainability Consciousness Questionnaire (SCQ) demonstrate significant interrelationships across economic, social, and environmental dimensions.

Ethics Committee Approval: Ethical permission was obtained from Necmettin Erbakan University Health Sciences Scientific Research Ethics Committee (Decision No: 2025/972, 12/2/2025).

Informed Consent: Informed consent was obtained from the participants.

Peer-review: Externally peer-reviewed.

Conflict of Interest: All authors have disclosed no conflicts of interest.

Author Contributions: F.N.T: Conception, Design, Supervision, Materials; M.Ç: Data Collection and/or Processing, Analysis and/or Interpretation, Literature Review, Writing, Critical Review.

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Comparison of patients undergoing general anesthesia or ultrasonography-guided interscalene block in shoulder surgery in terms of postoperative analgesia: A retrospective study

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■ MAIN POINTS

- This study demonstrated that when performed by experienced anesthesiologists using ultrasound guidance to minimize widespread postoperative pain during the first 24 hours after arthroscopic shoulder surgery; SBPB results in lower complication rates,
- Increased patient and surgeon satisfaction,
- Earlier mobilization, and a more comfortable surgical experience,
- Low analgesic consumption,
- Low VAS scores. Furthermore, patients undergoing ISBPB experienced shorter operative times. These positive results are contributing to the growing popularity of ISBPB among orthopedic shoulder surgeons.

■ ABSTRACT

Aim: We aimed to evaluate the pain scores with visual analog scale and compare opioid consumption in the early postoperative period in cases where single-shot interscalene brachial plexus block and general anesthesia or general anesthesia alone have been applied for arthroscopic shoulder surgery.

Materials and Methods: Seventy-one patients, aged 18-65, who had undergone elective arthroscopic shoulder surgery were included in this study. Participants were allocated to one of two groups: the General Anesthesia (GA) group (n=36) or the Interscalene Block and General Anesthesia (ISBPB+GA) group (n=35). The severity of postoperative pain was evaluated using Visual Analog Scale (VAS) scores.

Results: The VAS scores and analgesic requirements of patients in the ISBPB+GA group were significantly lower than GA group. Although the duration of operation was shorter in the ISBPB+GA group (87.37±17.65 min), it did not reach statistical significance ($p>0.05$). Surgeon and patient satisfaction scores were higher in the ISBPB+GA group compared to patients who underwent GA alone.

Conclusion: The cases that underwent ISBPB+GA had notably lower pain scores and decreased additional analgesic consumption in the postoperative period. We believe that this anesthesia technique provides a more comfortable recovery process in patients undergoing shoulder surgery and can be safely utilized by experienced anesthesiologists.

Keywords: Interscalene block, Shoulder surgery, Postoperative analgesia

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■ INTRODUCTION

A significant challenge for patients undergoing shoulder surgery is postoperative pain. Approximately 45% of adult patients experience severe acute pain, which can complicate early mobilization and rehabilitation, negatively affecting their overall recovery and functional outcomes. Consequently, many methods have been developed to control this pain. If not adequately managed, this acute pain can also

progress to chronic pain, driven by peripheral and central nervous system sensitization [1-4]. Regional techniques, such as the interscalene brachial plexus nerve block (ISBPB), are frequently employed in shoulder surgeries. They are valued both for their role as regional anesthesia and as a valuable component of postoperative multimodal analgesia. The adoption of these techniques is associated with a decrease in perioperative opioid consumption and a reduced frequency of opioid-

related adverse effects, including urinary retention, respiratory dysfunction, pruritus, hypotension, dyspeptic complaints, and ileus [5]. ISBPB is usually indicated for procedures involving the proximal upper extremity, such as the shoulder. It can also be used in the differential diagnosis of central and peripheral pain syndromes of the region. It can be safely performed to block sympathetic nerves in cases where stellate ganglion block is not possible [6]. In recent years, ultrasonography (USG)-guided peripheral nerve blocks have become popular. Ultrasonography (USG) facilitates improved sonoanatomical visualization of muscle, vascular, and nerve structures, thereby increasing the success rate of regional blocks and mitigating the risk of complications associated with blocks performed near nerve plexuses. The interscalene brachial plexus nerve block (ISBPB) is recognized for its efficacy in postoperative pain treatment and its ability to provide effective muscle relaxation [7,8]. The present study aimed to retrospectively analyze the postoperative pain scores and opioid analgesic requirements of our patients who underwent USG-guided ISBPB and general anesthesia in comparison to only general anesthesia alone during shoulder surgery.

MATERIALS AND METHODS

This retrospective study analyzed recorded pain and patient follow-up forms from patients who underwent shoulder surgery at the Orthopedics Clinic of Elazığ Fethi Sekin City Hospital between January and June 2019. The study received approval from the institutional review board (10.01.2019/01-03) and was conducted in accordance with the Declaration of Helsinki.

Patient selection

The study included 71 patients, aged 18-65 years, who underwent elective unilateral shoulder surgery for various clinical diagnoses. All included patients were categorized as American Society of Anesthesiologists (ASA) Physical Status I or II, received either general anesthesia alone or general anesthesia combined with an interscalene block, and had complete follow-up forms.

Patients receiving general anesthesia alone were assigned to Group GA (n=36), while those receiving general anesthesia with an interscalene block were assigned to Group ISBPB+GA (n=35). This sample size was determined based on a G*Power 3.10 analysis, which recommended at least 65 individuals with an alpha error of 0.05 and a beta error of 0.10 (power=0.90).

Patients were excluded if they had incomplete pain or patient follow-up forms, were outside the 18-65 age range, were in ASA Physical Status III-V risk groups, received upper extremity block solely for analgesia, received different peripheral nerve blocks, had neurological diseases or inflammatory joint diseases, a history of opioid use for other reasons.

Anesthesia and Block procedure

In the preoperative preparation area, all patients received intravenous access via an 18-gauge venous needle in the forearm, followed by 10 mL of balanced electrolyte solution. Sedation was achieved with 0.05 mg kg⁻¹ intravenous midazolam. Non-invasive blood pressure, peripheral oxygen saturation (SpO₂), and cardiac monitoring via electrocardiogram (ECG) were performed for all cases.

Interscalene brachial plexus nerve blocks (ISBPBs) were administered by experienced anesthesiologists. Patients in the ISBPB group were positioned supine with their head turned away from the operative side. The skin in the ISBPB application area was sterilized with 10% povidone-iodine solution.

Under ultrasound guidance (USG), a high-frequency (8-12 MHz) linear probe (Philips-Healthcare, L22-2, probe, Cambridge, US) was placed vertically along the line of the cricoid cartilage and external jugular vein. The carotid artery and internal jugular vein were visualized anteromedially. The sternocleidomastoid (SCM) muscle was observed superficial to the brachial plexus, which was identified between the anterior and middle scalene muscles, lateral to the carotid artery. After identifying the C5-C7 nerve tract, the probe was rotated to visualize the round, hypoechoic images of the C5-7 nerve roots. Local anesthesia of the skin was performed using 1% lidocaine.

In addition to USG guidance, a peripheral nerve stimulator (Stimuplex, Braun, Melsungen, Germany) was used. To avoid intraneural injection, a 21-gauge 50 mm needle (Stimuplex® D16, B. Braun, Melsungen, Germany) was advanced using the in-plane technique. If motor movement in the distal deltoid muscle was observed at currents below 0.5 mA, and the response disappeared at currents below 0.2-0.3 mA, 15 mL of 0.5% bupivacaine (Bustesin® 0.5% VEM İlaç AS, Ankara, Turkey) was administered into the brachial plexus nerve sheath. The spread of the local anesthetic between the plexus and middle scalene fascia was confirmed by USG. Following local anesthetic injection, sensory changes and motor function (inability to extend the arm) were assessed every 5 minutes for the first 20 minutes. Successful block was defined as complete loss of motor function and positive pinprick sensory testing at the block onset.

General anesthesia was administered to all patients. Induction included 2-3 mg kg⁻¹ propofol, 0.5 mg kg⁻¹ vecuronium, and 2 µg kg⁻¹ fentanyl. Anesthesia was maintained with sevoflurane in 50% O₂ + 50% air and 0.5 µg kg min⁻¹ remifentanyl. At the end of the surgical procedure, spontaneous breathing was achieved by antagonizing with 4 mg kg⁻¹ sugammadex, followed by extubation. Patients were then transferred to the Post Anesthesia Care Unit (PACU).

Postoperative assessment and Pain management

Upon arrival in the postoperative recovery room, patients' Visual Analog Scale (VAS) scores (0: no pain, 10: unbearable

Table 1. Demographic data and surgical procedures of the study groups.

	GA (N=36)	ISBPB+GA (N=35)	P value $\int$
Gender (F/M) (%)	20(55.54)/16(44.46)	19(54.28)/16(45.72)	0.217*
Age (years)	52.2 $\pm$ 13.7	51.7 $\pm$ 15.2	0.367 $\ddagger$
Weight (kg)	73.3 $\pm$ 15.4	71.5 $\pm$ 16.7	0.355 $\ddagger$
Height (cm)	171 $\pm$ 9.7	169 $\pm$ 10.8	0.426 $\ddagger$
BMI (kg/m ²)	25.9 $\pm$ 4.6	26.1 $\pm$ 5.4	0.379 $\ddagger$
ASA I/II*(%)	14(38.88)/22(61.22)	15(42.86)/20(57.14)	0.141*
Surgical procedure	16/18/2	14/17/4	
(Subacromialprocedure/ rotator cuff repair/glenohumeral repair) (%)	(44.4/50.0/5.6)	(40.0/48.57/11.43)	0.673*

Data are presented as number (n) or mean $\pm$ SD, Qualitative variables were performed by Pearson chi-square and Fisher's Exact test-chi-square analysis. Quantitative data were presented as mean, and standard deviation. P-value of less than 0.05 was considered significant. (Chi-square-Fisher's Exact test, $\ddagger$ Independent Sample t-test. GA: General anesthesia, ISBPB: Interscalene Brachial Plexus Block, F: Female, M: Male, BMI: Body Mass Index, ASA: American Society of Anesthesiologists, SD: Standard Deviation, cm: centimeter, kg: kilogram).

Table 2. Data are presented as mean $\pm$ SD. (VAS: Visual Analog Scale, GA: General Anesthesia, ISBPB: Interscalene Brachial Plexus Block), $\int$ P<0.05 is statistically significant.

	GA (N=36)	ISBPB+GA (N=35)	P value $\int$
Recovery	6.41 $\pm$ 1.25	3.45 $\pm$ 1.13	<0.001
2 nd hour	5.61 $\pm$ 1.47	3.26 $\pm$ 1.17	<0.001
4 th hour	4.98 $\pm$ 1.16	3.01 $\pm$ 1.57	<0.001
12 th hour	4.41 $\pm$ 1.07	3.02 $\pm$ 0.97	<0.001
24 th hour	3.96 $\pm$ 1.27	2.83 $\pm$ 0.91	<0.001

Data are presented as mean $\pm$ SD. (VAS: Visual Analog Scale, GA: General Anesthesia, ISBPB: Interscalene Brachial Plexus Block), $\int$ P<0.05 is statistically significant.

Table 3. Additional analgesic consumption in the study groups.

	GA (N=36)	ISBPB+GA (N=35)	P value $\int$
Step 0	5 (13%)	19 (52.7%)	<0.001
Step 1	7 (19.44%)	6 (17.14%)	>0.05
Step 2	4 (11.11%)	5 (14.28%)	>0.05
Step 3	17 (47.22%)	6 (17.14%)	<0.001

Data are presented as N (%). (GA: General anesthesia, ISBPB: Interscalene Brachial Plexus Block), $\int$ P<0.05 is statistically significant.

able pain), mean arterial pressure (MAP), and heart rate (HR) were recorded at 2, 4, 12, and 24 hours postoperatively.

Postoperative pain management followed a step-wise protocol. Patients experiencing pain despite baseline treatment routinely received 500 mg paracetamol tablets three times a day (08:30, 12:30, and 20:30) and 75 mg diclofenac tablets twice a day (08:30 and 20:30). Intravenous analgesics were administered as needed based on pain severity, according to an 11-point Numerical Rating Scale (NRS) where 0 indicates no pain and 10 represents the worst imaginable pain:

- Step 0 (NRS 0–2): No additional analgesic.
- Step 1 (NRS 3–4): 1000 mg paracetamol.
- Step 2 (NRS 5–6): 30 mg ketorolac and 1000 mg paracetamol.
- Step 3 (NRS 7–10): 30 mg ketorolac, 1000 mg paracetamol, and 100 mg tramadol.

Additional analgesic consumption was recorded. Patient and surgeon satisfaction scores at discharge were assessed using a Likert scale (0: dissatisfied, 7: very satisfied)

Statistical analysis

Statistical analysis for this study was performed using SPSS 26 (International Business Machines Corporation, USA). Data are presented as the number of cases (N) or mean $\pm$ standard deviation (SD).

The Shapiro-Wilk test was used to assess the normality of data distribution between groups. For continuous variables with a normal distribution, Student's t-test was applied. The Mann-Whitney U test was used for comparisons between paired groups that did not conform to a normal distribution. Chi-square test or Fisher's exact test was utilized for the analysis of categorical variables. A p-value of <0.05 was considered statistically significant for all analyses.

RESULTS

The 71 patients who underwent various shoulder surgeries were included in the analysis of our study. Here's a revised version of your results section, focusing on clarity, conciseness, and impact. A total of 71 patients were included in the study: 36 received general anesthesia (GA) alone, and 35 received general anesthesia combined with an interscalene brachial plexus block (GA + ISBPB). There were no statistically significant differences in the demographic characteristics or surgical procedures between the two groups (p>0.05, Table 1).

The primary outcome of our study was the comparison of Visual Analog Scale (VAS) scores between the ISBPB+GA and GA groups on the day of surgery and at specific intervals during the first 24 postoperative hours. Secondary outcomes included additional analgesic consumption, surgical duration, anesthesia induction times, hemodynamic findings, length of hospital stay, and patient and surgeon satisfaction scores. When comparing VAS scores, patients in the ISBPB+GA group reported statistically significantly lower pain scores upon admission to the postoperative recovery room and at 2, 4, 12, and 24 hours postoperatively compared to the

Table 4. Duration of surgery, anesthesia induction times, hemodynamic findings, length of hospital stay, and patient and surgeon satisfaction scores of the study groups.

	GA (N=36)	ISBPB+GA (N=35)	P value [†]
Duration of surgery (min)	99.18±25.13	87.37±17.65	<0.001 [‡]
Anesthesia induction time (min)	7.5±4.47	11.6±5.9	<0.001 [†]
Heart rate (beat min ⁻¹)	75.32±9.76	64.85±7.87	<0.001**
Systolic arterial blood pressure (mm/Hg)	102.56±14.51	97.81±11.78	0.017**
Postoperative hospital length of stay (day)	2.15±0.73	2.11±0.71	0.81**
Patient satisfaction score	7±0.54	9±0.35	0.023**
Surgeon satisfaction score	7±0.87	9±0.63	0.018**

Data are presented as mean ± SD **. †Mann Whitney U test, ‡ Independent Sample t-test, †P<0.05 is statistically significant. (GA: General anesthesia, ISBPB: Interscalene Brachial Plexus Block, min: minutes).

GA group ($p=0.001$, Table 2). Furthermore, the ISBPB+GA group required significantly less additional analgesic in the early postoperative period ($p<0.001$, Table 3).

The mean intraoperative mean arterial pressure (MAP), mean heart rate (HR), and mean duration of surgery were significantly lower in the ISBPB+GA group compared to the GA group ($p<0.05$). Additionally, patient and surgeon satisfaction scores were higher in the ISBPB+GA group ($p=0.023$, $p=0.018$, respectively). However, there was no statistically significant difference in the duration of hospital stay between the groups ($p>0.05$, Table 4).

No life-threatening complications occurred in either group. Only one patient in the ISBPB+GA group developed recurrent laryngeal nerve paresis, which fully resolved within 24 hours after surgery. No local anesthetic toxicity was observed in the ISBPB+GA group.

■ DISCUSSION

The increasing frequency of arthroscopic shoulder surgery necessitates an anesthetic technique that is safe, effective, and provides both long-term analgesia and enables early mobilization. Postoperative pain is a significant challenge in these patients, leading to the use of various analgesic methods. While techniques like subacromial bursa block, intra-articular local anesthetic injection, oral analgesics, single-shot or continuous interscalene brachial plexus blocks (ISBPs), suprascapular blocks, and axillary blocks have been employed for pain control [9,10], ISBPs are widely considered the most effective [11].

The PROSPECT study, a comprehensive review of 59 randomized controlled studies on pain control in shoulder surgery, recommended single-shot ISBPB as a component of multimodal analgesia [12]. Similarly, a meta-analysis of randomized controlled trials (RCTs) evaluating single-shot ISBPB for shoulder surgeries, including rotator cuff repair, found it more effective than systemic analgesics or placebo [13]. However, this review also noted a short duration of analgesia (6 hours with movement and rest) and the occurrence of rebound pain at 24 hours [13].

Consistent with these findings, our study revealed statistically significantly lower VAS scores in the ISBPB+GA group across

all measured time points. Notably, 91% of patients in the GA group required opioid analgesics upon admission to the recovery room, whereas none in the ISBPB+GA group required additional opioid intervention. Similarly, VAS scores and additional analgesic consumption at 2, 6, 12, and 24 hours were significantly lower in the ISBPB+GA group compared to the GA group. This reduction in opioid consumption is crucial, as opioid agonists can induce nausea and vomiting in the late postoperative period. Consequently, patient satisfaction in the ISBPB+GA group was high due to decreased opioid use.

While Fredrickson et al. reported that continuous ISBPB provides superior analgesia, faster recovery, and lower pain scores, particularly within the first 24 hours of movement, it carries a risk of complications. These include infection, local anesthetic toxicity, central neuraxial block, nerve damage, Horner's syndrome, phrenic nerve palsy, and a catheter dislodgement rate as high as 22% [14]. Given these potential complications, we opted for a single-shot ISBPB in our patients. Oh et al. also suggested that a single-shot interscalene block combined with continuous intrabursal local anesthetic infusion offers comparable analgesic efficacy to continuous interscalene catheters, presenting a safer alternative with fewer motor and sensory deficits [15]. Some studies, however, argue that continuous interscalene blocks are superior to single-shot blocks in reducing postoperative opioid consumption and pain, attributing this to a later onset of rebound pain after the maximum 12-hour effect of a single dose [16,17]. Despite this, our study demonstrated a statistically significant decrease in VAS scores at 24 hours postoperatively in the single-shot ISBPB group compared to the GA-only group. The most significant findings of our study were the remarkably lower pain levels in the ISBPB+GA group on the day of surgery, coupled with reduced additional analgesic consumption and higher patient and surgeon satisfaction.

ISBPB is generally considered superior to intra-articular injection or subacromial bursa block, techniques linked to serious complications such as chondrolysis [18-20]. Nevertheless, ISBPB itself can lead to acute and chronic complications, including pneumothorax, neurotoxicity, complex regional pain syndrome, and plexus injury [21]. During ISBPB, accidental spread of the local anesthetic or misdirection of the nee-

dle tip can block the vagus, recurrent laryngeal, and sympathetic nerves [6]. Using ultrasound guidance (USG) with a nerve stimulator (Stimuplex needle) to elicit contractions in the pectoral, deltoid, arm, forearm, and hand muscles at 0.2–0.5 mA indicates a successful block. Conversely, contractions in the neck, trapezius, scapular, or pectoral muscles suggest the need for needle repositioning [6,8]. In line with Lehmann et al. [8], our approach of performing local anesthetic injection under USG guidance with a stimplex device improved block success and significantly reduced potential complications. While Lenters et al. [22] reported transient complications like brachial plexus injuries, respiratory, central nervous system, and cardiovascular issues associated with interscalene brachial plexus block, we encountered no chronic or life-threatening complications. Only one patient in the ISBPB group experienced recurrent laryngeal nerve paresis, which resolved completely within 24 hours. We believe that combining the Stimplex device with USG in ISBPB procedures significantly mitigates the risk of plexus damage and local anesthetic toxicity.

Despite the literature supporting ISBPB for shoulder surgeries, it has reported disadvantages, including the necessity for high practitioner experience, procedural time investment, increased cost, and the possibility of serious and long-term neurological complications [23,24]. In our study, ISBPB was performed by the most experienced anesthesiologists. However, the retrospective nature of our review and the exclusion of incomplete patient files limited our sample size for accurately evaluating complications. Additionally, patient file data were insufficient to assess long-term neurological complications.

Examination of intraoperative hemodynamic parameters revealed lower heart rate and systolic blood pressure in the ISBPB+GA group compared to the GA group. Controlled hypotension during shoulder surgery contributes to a more comfortable procedure and reduces bleeding risk. Studies indicate that effective analgesia, by reducing bleeding and enhancing arthroscopic visualization, yields positive outcomes in shoulder arthroscopy performed with ISBPB+GA [13–15,25]. In our research, we observed shorter operating times in the ISBPB+GA group, which contributes to reduced complication rates and costs.

Liu et al. [25] assessed pain scales in 62 patients undergoing rotator cuff repair, comparing those receiving general anesthesia alone with those receiving general anesthesia and a single dose of interscalene block. They found lower VAS scores during the first 12 hours and reduced opioid use in the first 6 hours in the ISBPB+GA group. Additionally, in the ISBPB group, rescue analgesics were not needed during the first 24 hours, although opioid requirements were similar on days 2 and 3 [25]. Our study similarly showed a significantly lower rate of rescue analgesic use in the ISBPB+GA group during the first 24 hours compared to the GA group. Wong et al. [26] explored different ropivacaine doses for ISBP, finding lower VAS scores and opioid consumption at 72 hours with 2% ropi-

vacaine compared to 1%. Conversely, another study comparing 5 mL and 10 mL single-dose ropivacaine for ISBPB found no difference in pain scores or opioid consumption [27]. In our study, we aimed for standardization by including patients who received a single-shot ISBPB with 15 mL of 0.5% bupivacaine.

A meta-analysis involving 746 patients undergoing arthroscopic shoulder surgery indicated that ISBPB+GA, compared to GA alone, resulted in a lower heart rate, lower pain scores on the day of surgery and the following day, lower intraoperative systolic blood pressure, shorter extubation time, and a lower incidence of side effects [28]. Postoperative pain control is crucial for facilitating early mobilization in shoulder surgery patients [25,28]. In our study, all patients in the ISBPB+GA group experienced a decrease in the need for additional analgesics over a 24-hour period and achieved earlier mobilization compared to the GA group, aligning our findings with previous studies [25–28]. Although satisfaction rates were higher in the ISBPB+GA group, no significant difference in hospital stay duration was observed.

Limitations

This study has several limitations. First, the relatively small sample size, resulting from including only patients who received shoulder surgery with 15 mL of 0.5% bupivacaine for their blocks and excluding cases with incomplete file information, may impact the robustness of our findings. Second, preoperative pain intensity and analgesic use could influence rescue analgesic consumption and pain scores, but our patient files contained limited information regarding analgesic history. One of the most significant limitations is the lack of data from patient files to evaluate long-term upper extremity motor functions. We recommend future prospective randomized controlled studies to further investigate the long-term upper extremity motor functions of patients undergoing ISBPB for postoperative pain control after shoulder surgery.

CONCLUSION

The findings of this study indicate that ISBPB, when performed by an experienced team, is associated with low complication rates, a shortened duration of operation, and effective postoperative analgesia. These favorable outcomes contribute to the growing popularity of ISBPB among orthopedic surgeons for shoulder joint surgeries.

A part of this study was presented in the 58th Turkish Anesthesiology and Reanimation Congress with National and International Participation dated; Nov 28-Dec 1, 2024.

Ethics Committee Approval: The study was conducted by retrospectively examining the pain and patient follow-up forms recorded in the files of patients who underwent shoulder surgery between January 2019 and June 2019, at Elazığ Fethi Sekin City Hospital Orthopedics clinic, after receiving approval from the Ethics Committee of Firat University Faculty

of Medicine (10.01.2019/01-03). The research was carried out in accordance with the Declaration of Helsinki.

Informed Consent: Not necessary for this manuscript.

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The effect of music to sleep quality on liver transplanted patients

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■ MAIN POINTS

- Listening to music significantly improved sleep quality among liver transplant recipients.
- The intervention led to notable improvements across all five dimensions of the Richards-Campbell Sleep Questionnaire (RCSQ).
- Music listening was particularly effective in reducing the frequency of awakenings and enhancing perceived sleep depth.
- The study highlights music listening as a safe, cost-effective, and non-pharmacological approach to support postoperative recovery.
- Integrating music listening into routine nursing care may enhance patient comfort and sleep outcomes after liver transplantation.

■ ABSTRACT

Aim: This study aimed to evaluate the effect of music listening on sleep quality in adult liver transplant recipients. Given the limited research in this specific patient population, the study contributes to the growing body of evidence supporting non-pharmacological strategies in post-operative nursing care.

Materials and Methods: A quasi-experimental pre-test/post-test control group design was employed. A total of 88 patients were included, with 44 assigned to the experimental group and 44 to the control group. Sleep quality was assessed using the Richards-Campbell Sleep Questionnaire (RCSQ) before and after the intervention. The experimental group listened to 30 minutes of culturally familiar music each night for four consecutive days, while the control group received standard care only.

Results: Baseline RCSQ scores indicated poor sleep quality in both groups. Following the intervention, the experimental group showed a statistically significant improvement in total RCSQ scores (from 24.0 to 50.0, $p < 0.001$). Subscale analysis revealed significant improvements in all five RCSQ dimensions—sleep depth, sleep latency, frequency of nighttime awakenings, wake time, and overall sleep quality ($p < 0.001$). In contrast, the control group showed no meaningful change except for a slight improvement in the frequency of awakenings subscale ($p = 0.035$).

Conclusion: These findings suggest that music listening can significantly enhance sleep quality in liver transplant recipients. As a safe, inexpensive, and easy-to-apply method, music listening holds promise for integration into routine postoperative nursing care to promote patient comfort and recovery.

Keywords: Liver transplantation, Music, Sleep quality, Postoperative care, Nursing intervention, Richards-Campbell Sleep Questionnaire

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■ INTRODUCTION

Liver transplantation (LT) remains the most effective treatment for patients with end-stage liver failure, chronic viral hepatitis (HBV/HCV), or inherited metabolic disorders such as Wilson's disease. Other than these indications that cause chronic liver disease, LT is indicated in hepatocellular carcinoma, a primary liver tumor [1,2]. In addition to reducing liver-related mortality, transplantation allows patients to reintegrate into daily life and contributes to improvements in physical and psychological well-being [3].

However, complications during the post-transplant period have significant impact quality of life. Among these, sleep disturbances are frequently reported. Previous studies suggest

that a considerable proportion of liver transplant recipients experience poor sleep quality, often linked to anxiety, depression, and limited social support [4–6]. Environmental stressors in the intensive care unit (ICU), such as sensory overload and isolation, can further worsen these disturbances [7].

In recent years, non-pharmacological and non-invasive strategies have gained prominence in addressing sleep-related problems. In particular, Music-based approaches have demonstrated benefits for post-transplant patients [8–10]. Music has been shown to influence the autonomic nervous system, lower stress levels, and facilitate the onset of sleep. In liver transplant populations, music applications have proven effective in alleviating environmental stress and improving subject-

tive sleep quality [7, 8].

The underlying mechanisms through which music exerts these effects have also been explored. Studies suggest that these outcomes are linked to physiological changes, such as increased parasympathetic activity and reduced cortisol levels—both indicators of a relaxation response that may support sleep regulation. For instance, Ginsberg et al. reported a shift toward parasympathetic dominance, while Thoma et al. observed decreased cortisol concentrations following music listening [9, 10].

Despite these promising findings, there is still a limited number of comprehensive studies that specifically investigate the impact of music on sleep quality in adult liver transplant recipients. This gap in the literature hinders a deeper understanding of how music might be implemented in clinical practice for this patient group.

Considering these gaps, the present study investigates the impact of music on sleep quality in liver transplant patients. The findings are expected to fill a gap in the information regarding the clinical nursing practices by supporting the integration of culturally sensitive music applications into postoperative care. Clinically, the results highlight the potential of music as a safe, low-cost, and feasible approach to improve sleep regulation in immunosuppressed patients. Theoretically, this study underscores the interplay between environmental stimuli and physiological recovery, offering a multidimensional perspective on post-transplant care within the biopsychosocial framework.

■ MATERIALS AND METHODS

This study received ethical approval from the Non-Interventional Clinical Research Ethics Committee of Inonu University (Approval No: 2018/7-5). Institutional permission was obtained, and informed consent was secured from all participants in accordance with the principles outlined in the Declaration of Helsinki.

Study design

This study employed a quasi-experimental, pre-test/post-test control group design to examine the effects of structured music listening as a nursing intervention on sleep quality among liver transplant recipients. Random allocation was not feasible due to logistical constraints. Specifically, the researcher responsible for patient recruitment and data collection was only present in the liver transplant clinic on specific days of the week. As a result, the continuous presence required for randomization and daily monitoring could not be ensured. To maintain methodological consistency while minimizing ethical concerns and avoiding disruption of clinical routines, a quasi-experimental design with pre-scheduled intervention and control days was adopted.

Participants were assigned to either the intervention or control group using a sequential and convenience-based allocation method. Patients who met the inclusion criteria and were

admitted to the hospital on days designated for the intervention were assigned to the experimental group, while those admitted on control-designated days were placed in the control group. This method ensured feasibility under real-world clinical constraints while allowing for consistency in timing and implementation.

Setting and duration

The study was conducted from May 2017 to January 2018 at a liver transplant institute in Eastern Turkey. This facility features inpatient rooms, intensive care units, and operating theaters. All inpatient rooms are single-occupancy and equipped with both acoustic and thermal insulation. Standard evening medication rounds were performed at 18:00 and 22:00. Accordingly, the music intervention was scheduled between 22:00 and 24:00 to ensure its implementation after the final medication administration, thereby facilitating a calm and uninterrupted rest period conducive to sleep.

Study population and sampling

The study population included adult patients who had undergone liver transplantation. Using a confidence interval of 95% and a 5% margin of error, the required sample size was determined to be 88 patients, with 44 in the experimental group and 44 in the control group. Participants were selected using a non-probability random sampling method. Inclusion criteria were:

- Patients without any hearing impairment and who are able to communicate verbally,
- Patients who have been hospitalized for at least one week following liver transplantation,
- Patients who are not using any medications for diagnosed sleep disorders, such as obstructive sleep apnea syndrome, insomnia, or parasomnia.

Data collection tools

Data were collected using the Patient Information Form and the Richards-Campbell Sleep Questionnaire (RCSQ).

The Patient Information Form was developed by the researchers based on literature and expert input and includes sociodemographic and clinical variables such as age, sex, marital status, education level, place of residence, transplantation reason, sleep habits, and length of hospital stay [11–13].

The RCSQ is a self-reported visual analog scale comprising five items that assess sleep depth, latency, number of awakenings, return to sleep, and overall sleep quality. The internal consistency of the original scale was high (Cronbach's $\alpha = 0.82$) [14], and the Turkish version, validated by Karaman Ozlu and Yucel (2011), reported a Cronbach's $\alpha = 0.91$ [15]. In the present study, the internal consistency of the RCSQ based on pre-test data was calculated as Cronbach's $\alpha = 0.973$.

Data collection procedure

Data were collected through face-to-face interviews. All interviews were conducted by the same researcher, who was familiar with the study protocol, to minimize interviewer bias and ensure consistency in data collection. In the experimental group, baseline RCSQ data were recorded prior to the intervention. A 30-minute music listening session was then administered each night for four consecutive days between 22:00 and 24:00. Post-intervention RCSQ scores were recorded 24 hours after the final session. The control group did not receive any intervention; however, RCSQ assessments were conducted at equivalent time points.

Intervention protocol

The music selection was carried out in collaboration with academic experts from the Department of Music Education at a university located in Eastern Anatolia, Turkey, and TÜ-MATA (The Group for the Research and Promotion of Turkish Music), a renowned organization dedicated to preserving and applying traditional Turkish music in therapeutic and cultural contexts. The selected compositions reflect authentic maqam structures and performance practices consistent with culturally informed music interventions.

The intervention consisted of a 30-minute pre-recorded instrumental playlist specifically designed to promote relaxation and improve sleep quality. All compositions were performed in the Zîrgüleli Hicaz maqam, which is known for its emotionally calming and soothing melodic characteristics.

This maqam was selected based not only on its cultural familiarity for the regional patient population, but also on prior research demonstrating its positive effects on sleep quality and fatigue. For instance, a systematic analysis of Turkish doctoral theses found that the Zîrgüleli Hicaz maqam has been associated with improved sleep quality and emotional regulation (16).

The playlist included the following pieces:

- *Hicaz Peşrev* by Tanburi Büyük Osman Bey
- *Hicaz Peşrev (Zîrgüleli version)* by Neyzen Osman Dede
- *Improvisational Taksim in Zîrgüleli Hicaz* (instrumental, ney-based).

The pieces were performed using traditional Turkish instruments such as the ney, tanbur, and kanun. Music was selected based on established criteria for sleep-inducing compositions, including a slow and steady tempo (approximately 70–75 bpm), minimal rhythmic variation, and monotonous melodic development. These features are aligned with research by Shum et al. (2014) on the benefits of sedative, wordless music for sleep, as well as recommendations outlined by Öztürk (2020) for music intended to facilitate sleep onset [17,18].

To reduce the risk of opportunistic infections among immunosuppressed liver transplant recipients, headphones were intentionally avoided. Instead, the music was played through in-room speakers at a moderate and comfortable volume. The intervention was implemented once per evening, for four consecutive nights, using the same playlist each time to ensure consistency and control across sessions.

No healthcare personnel were present in the patient's rooms during the music sessions in order to maintain a private and natural sleep environment. Although no formal feedback instrument was used, informal verbal responses from participants were consistently positive. None of the patients reported any discomfort or adverse reactions. Several participants spontaneously stated that the music made it easier for them to fall asleep. The lack of structured qualitative feedback is acknowledged as a limitation and discussed in the relevant section of the manuscript.

Statistical analysis

Data analysis was performed using IBM SPSS Statistics Standard Concurrent User V 30 (IBM Corp., Armonk, New York, USA). Descriptive statistics were presented as frequencies (n), percentages (%), median, and interquartile range (IQR). The normality of age and pre-test–post-test score differences was assessed using the Shapiro-Wilk normality test. Group comparisons for age were conducted using the Mann-Whitney U test. Wilcoxon signed-rank test was used for comparisons of pre-test and post-test scores. Pearson chi-square, Fisher-Freeman-Halton exact test, and Yates chi-square test were employed for the comparison of categorical variables between groups. A p-value of less than 0.05 was considered statistically significant.

■ RESULTS

Table 1 compares the sociodemographic and clinical characteristics of the experimental and control groups. No statistically significant differences were found between the groups regarding age, gender, marital status, education level, place of residence, transplant type, cause of transplant, sleep medication use, or hospitalization duration (all $p > 0.05$). These results demonstrate that the groups were comparable at baseline.

Impact of music intervention on sleep quality

As presented in Table 2, the pre-test and post-test median RCSQ scores for the experimental and control groups are. In the experimental group, post-test scores increased significantly compared to pre-test scores ($p < 0.001$). No significant difference was observed between pre-test and post-test scores in the control group ($p = 0.431$).

Subscale analysis of RCSQ scores

As presented in Table 3, statistically significant improvements were observed in all RCSQ subscale scores from pre-test to

Table 1. Comparison of sociodemographic and clinical characteristics between experimental and control groups.

Age, (years)	53.0 (19.7)	56.5 (19.5)	0.564	0.573 ^{&}
Gender, n (%)				
Male	17 (38.6)	16 (36.4)	0.000	1.000 ^Φ
Female	27 (61.4)	28 (63.6)		
Marital Status, n (%)				
Married	37 (84.1)	39 (88.6)	0.096	0.756 ^Φ
Single	7 (15.9)	5 (11.4)		
Education, n (%)				
Literate only	13 (29.5)	11 (25.0)		
Primary	17 (38.6)	23 (52.3)	2.844	0.415 [¥]
Secondary	10 (22.7)	5 (11.4)		
Higher	4 (9.1)	5 (11.4)		
Place of Residence, n (%)				
Village	4 (9.1)	4 (9.1)		
Town / District	21 (47.7)	21 (47.7)	-	-
City Center	19 (43.2)	19 (43.2)		
Transplant Type, n (%)				
Living	38 (86.4)	42 (95.5)	-	0.266 [‡]
Deceased	6 (13.6)	2 (4.5)		
Cause of Transplant, n (%)				
Acute liver failure	2 (4.5)	0 (0.0)		
Chronic liver failure	30 (68.2)	33 (75.0)	3.041	0.591 [¥]
Metabolic diseases	2 (4.5)	1 (2.3)		
Malignancy	5 (11.4)	7 (15.9)		
Other	5 (11.4)	3 (6.8)		
Sleep Medication Use, n (%)				
Nothing	37 (84.1)	30 (68.2)		
Resting	2 (4.5)	6 (13.6)	5.277	0.130 [¥]
Painkiller	0 (0.0)	3 (6.8)		
Music/TV	5 (11.4)	5 (11.4)		
Hospitalization Duration, n (%)				
1-2 weeks	11 (25.0)	14 (31.8)		
3-4 weeks	30 (68.2)	21 (47.7)	4.498	0.084 [‡]
5-6 weeks	3 (6.8)	9 (20.5)		

n: Number of patients, %: Column percentage, Age summarized as median (interquartile range). &: Mann-Whitney U test, ‡: Pearson chi-square test, ¥: Fisher-Freeman-Halton exact test, Φ: Yates chi-square test.

post-test in the experimental group ($p < 0.001$ for all subscale areas).

Visual representation of RCSQ subscale scores

According to the findings displayed in Table 4, among the RCSQ subscales in the control group, only the “Awakening Frequency” subscale showed a statistically significant difference between pre-test and post-test scores ($p = 0.035$), while no significant changes were noted in the other subscales ($p > 0.05$).

Figure 1 presents a comparative boxplot of the total and subscale RCSQ scores for both control and experimental groups at pre-test and post-test measurements. As illustrated, the experimental group showed notable improvements across all sleep quality dimensions compared to the control group.

Table 2. Group-wise comparison of Pre-test and Post-test total RCSQ scores.

Group	Pre-test M (IQR)	Post-test M (IQR)	z	p
Experimental	24.0 (30.0)	50.0 (31.0)	-5.276	<0.001
Control	41.5 (35.0)	41.0 (35.0)	-0.788	0.431

M: Median, IQR: Interquartile range, z: Standardized test statistic for Wilcoxon signed rank test.

DISCUSSION

This study demonstrated that the music intervention significantly improved sleep quality in liver transplant recipients. Statistically significant improvements were observed across all subscales of the Richards-Campbell Sleep Questionnaire

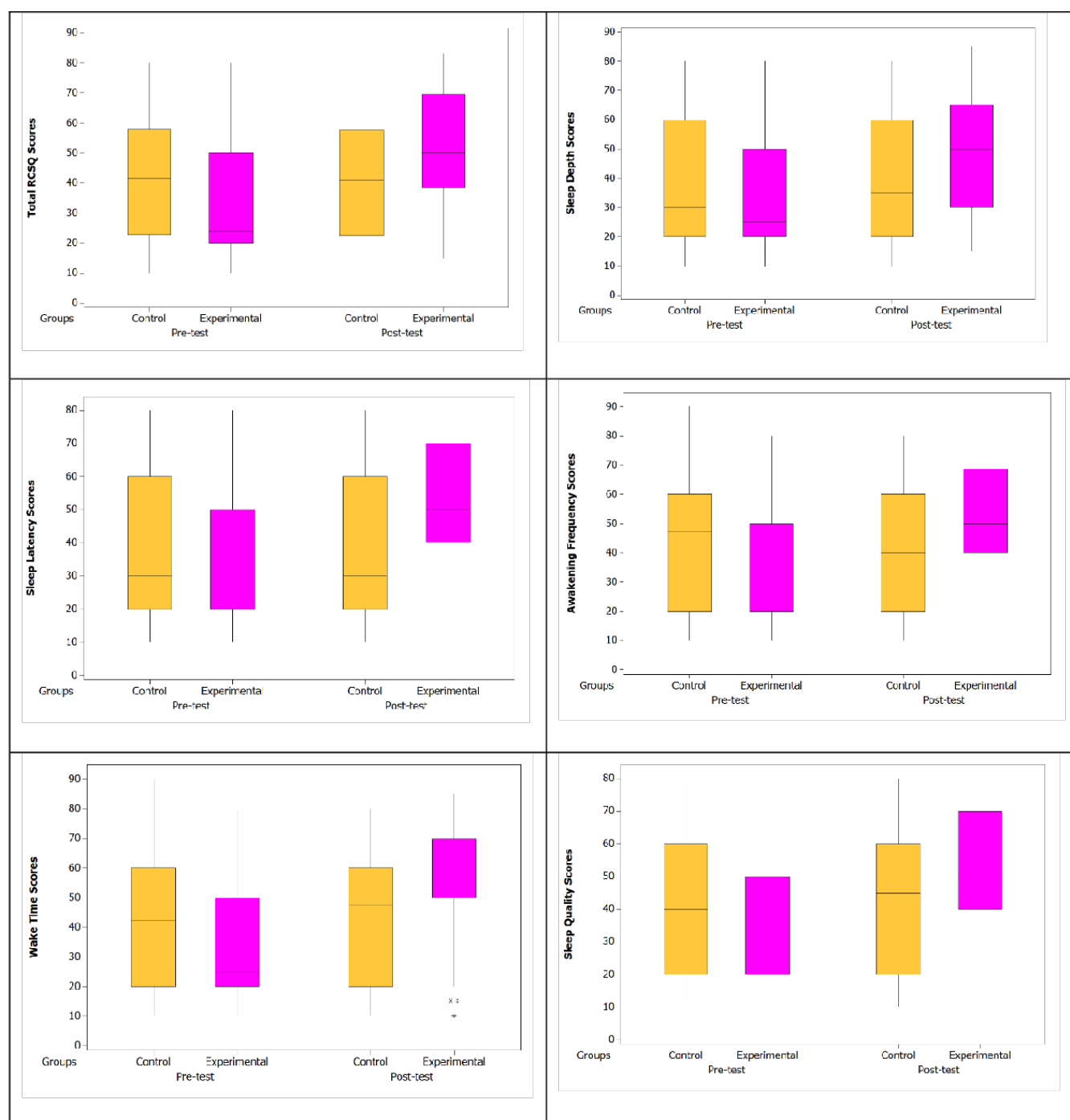


Figure 1. Boxplot comparison of RCSQ total and subscale scores between control and experimental groups at pre-test and post-test.

(RCSQ), with the most notable gains in “sleep depth” and “nighttime awakening frequency.” In the intervention group, the total RCSQ score increased from a pre-test median of 24.0 (IQR 30.0) to a post-test median of 50.0 (IQR 31.0), and this difference was found to be statistically significant ($p < 0.001$). No similar improvement was observed in the control group. These findings suggest that culturally adapted, non-pharmacological interventions—such as Turkish makam music—can be an effective strategy to enhance postoperative sleep quality.

Sleep disturbances are widely prevalent among liver transplant

recipients. For instance, Bhat et al. reported that approximately 60% of liver transplant survivors experience significant sleep problems, such as difficulty falling asleep and frequent awakenings [2]. In a multicenter study conducted in Japan, Akahoshi et al. found that more than 50% of post-transplant patients experienced clinically relevant sleep disturbances that negatively affected their quality of life [6]. Similarly, Zhu et al. in a Chinese outpatient sample, noted a high prevalence of insomnia, nocturia, and sleep fragmentation among liver transplant recipients [3].

These sleep disturbances have been linked to factors such as

Table 3. Comparison of RCSQ Subscale scores -- Experimental group

Subscale	Pre-test M (IQR)	Post-test M (IQR)	z	p
Sleep Depth	25.0 (30.0)	50.0 (35.0)	-5.212	<0.001
Sleep Latency	20.0 (30.0)	50.0 (30.0)	-5.046	<0.001
Awakening Frequency	22.5 (30.0)	50.0 (28.8)	-5.172	<0.001
Wake Time	25.0 (30.0)	50.0 (20.0)	-5.143	<0.001
Sleep Quality	27.5 (30.0)	50.0 (30.0)	-5.172	<0.001

M: Median, IQR: Interquartile range, z: Standardized test statistic for Wilcoxon signed rank test.

Table 4. Comparison of RCSQ Subscale scores -- Control group.

Subscale	Pre-test M (IQR)	Post-test M (IQR)	z	p
Sleep Depth	30.0 (40.0)	35.0 (40.0)	-0.179	0.858
Sleep Latency	30.0 (40.0)	30.0 (40.0)	-0.324	0.746
Awakening Frequency	47.5 (40.0)	40.0 (40.0)	-2.113	0.035
Wake Time	42.5 (40.0)	47.5 (40.0)	-0.733	0.463
Sleep Quality	40.0 (40.0)	45.0 (40.0)	-0.424	0.672

M: Median, IQR: Interquartile range, z: Standardized test statistic for Wilcoxon signed rank test.

pain, immunosuppressive therapy, environmental stress in intensive care settings, and disruptions in melatonin secretion [19-21]. Moreover, decreased melatonin levels and altered circadian rhythms are common in patients with liver cirrhosis and may persist even after transplantation, contributing to ongoing sleep difficulties [22,23].

The low pre-test sleep scores observed in our study reflect the negative impact of postoperative ICU conditions, environmental noise, psychological stress, and physiological instability on sleep quality [21]. The statistically significant pre-test difference between the intervention and control groups ($p < 0.05$) may be attributed to individual stress levels or psychological variability [24].

The significant increase in sleep scores following the music intervention supports the hypothesis that music facilitates both physiological and mental relaxation. Music has been shown to regulate the autonomic nervous system and reduce cortisol levels, thereby alleviating stress responses [25,26]. Furthermore, music may ease mental tension by diverting attention from external stimuli. Compositions with slow tempo and stable melodic structures can help synchronize biological rhythms through a phenomenon known as “entrainment.” Culturally familiar music can also elicit positive emotional responses that support sleep onset. As noted by Öztürk, personal beliefs and expectations regarding the therapeutic role of music may enhance its perceived effectiveness [18]. Kim et al. [22] demonstrated that music therapy not only improved RCSQ scores but also increased melatonin levels. Likewise, Herscher et al. [27] reported that nighttime music significantly improved sleep hygiene in hospitalized patients.

As shown in Table 3, significant improvements were observed in RCSQ subdimensions such as sleep latency, sleep depth,

and frequency of nighttime awakenings [20,22,24]. Similar outcomes were reported by Nurhayati et al. [20], who applied a combined intervention of natural music and foot massage. Baransel and Uçar [28] also found that music positively influenced all dimensions of sleep quality in high-risk pregnancies. Additionally, Kakar et al. reported that music therapy improved subjective sleep quality by approximately 27% in surgical patients [29].

As demonstrated in Table 4, no significant difference was found between pre-test and post-test RCSQ subscale scores in the control group. This suggests that without supportive interventions, sleep quality does not improve spontaneously [27,29]. Similarly, Vinayak et al. [30] showed that both active and receptive music therapy significantly enhanced sleep quality among cancer patients undergoing chemotherapy or radiotherapy. Patchaiappan and Kripa [31] also reported that music not only improved sleep quality but also reduced anxiety and fatigue in both inpatient and outpatient oncology settings.

Limitations

This study has several limitations. First, the use of a quasi-experimental design without random assignment may have introduced selection bias, even though group comparability was statistically confirmed. Second, the sample was limited to a single transplant center in Eastern Turkey, which may restrict the generalizability of the findings. Third, although participants’ verbal feedback on the music intervention was consistently positive, no formal qualitative or satisfaction data were collected. Finally, the study measured only short-term effects on sleep quality; longer-term outcomes were not assessed.

CONCLUSION

In conclusion, the findings of this study indicate that the music intervention has a positive impact on postoperative sleep quality in liver transplant recipients. Given its low cost, ease of application, and lack of side effects, music listening may represent a promising complementary strategy in nursing care for surgical patients. However, due to the limitations of this quasi-experimental, single-center study with a relatively small sample size, further randomized and multicenter trials are necessary before this intervention can be routinely recommended in clinical nursing practice.

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Informed Consent: Written informed consent was obtained from the legal guardians of all participating patients.

Peer-review: Externally peer-reviewed.

Conflict of Interest: The authors declare no conflict of interest.

Author Contributions: Concept: H.S.; Design: H.S.; Supervision: H.S.; Materials: H.S.; Data Collection and/or Processing: H.S.; Analysis and/or Interpretation: M.Ö.; Literature Review: M.Ö.; Writing: H.S.; Critical Review: M.Ö.

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Intersphincteric anal abscess, a rare cause of axial low back pain: A case report

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■ ABSTRACT

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A 60-year-old male patient presented with axial lower back pain. He had suffered from pain for one month. Within a week, the patient's pain had increased, and he experienced additional symptoms of fever, malaise, and weight loss. Lumbar MRI revealed an intersphincteric anal abscess extending to the level of the lower lumbar vertebrae. The patient was then referred to a general surgeon. After drainage of the abscess and administration of broad-spectrum antibiotics, the patient's pain resolved within one week. This case report describes a rare presentation of lower back pain, in which a normal physical examination led to an initial delay in considering an anal abscess. The diagnosis of an advanced intersphincteric abscess was ultimately established by a lumbar MRI, which had been ordered to investigate for possible malignant metastasis.

Keywords: Anal abscess, Low back pain, Analgesia

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■ INTRODUCTION

Majority of lower back pain has a mechanical origin and develops as a result of overuse, strain or trauma to the spine and surrounding structures [1–3]. This type of pain is primarily caused by degeneration of the disc and facet joints as well as strains and sprains in the paraspinal muscles and connective tissues [2]. To define low back pain as mechanical, it is necessary to exclude inflammatory, neoplastic, metabolic, and infectious pathologies, as well as all other causes such as fractures and referred pain from internal organs [2,4].

At this stage, identifying symptoms such as advanced age, trauma, history of cancer, immunosuppression, fever, weight loss, fatigue, and abnormal physical and neurological examination findings is the most important step in the evaluation. These symptoms are known as 'red flags' in lower back pain [4,5]. Although these patients constitute a very small percentage of all patients with low back pain, failure to recognize them leads to increased morbidity and mortality rates.

Anorectal infections may manifest as either acute abscesses or persistent anal fistulas. They are more common in men aged between 30 and 50 years [6]. Perianal abscesses are characterized by increased pain when sitting or defecating as well as a tender, reddened mass in the area. However, intersphincteric

and supralelevator abscesses typically do not exhibit any signs or symptoms. In progressive cases, pelvic and rectal pain may extend to the lumbar region and be accompanied by fever and malaise [6,7].

Our case report presents a patient with an intersphincteric anal abscess that extended to the lumbar region and who presented with low back pain.

■ CASE REPORT

A 60-year-old male patient presented with axial low back pain that had been localized in the lower lumbar region for one month. The pain increased with coughing and straining and was particularly worse when sitting or lying down. There were no accompanying systemic symptoms or signs, such as leg pain, numbness, urinary or fecal incontinence, fever, or weight loss, at the initial presentation. The patient had undergone right upper lobectomy for early-stage lung adenocarcinoma three years ago, with no evidence of distant metastasis. There were no abnormal findings on physical or neurological examination, except for tenderness of the lower lumbar paravertebral muscles. Since the patient was over 50 years of age, had recently experienced low back pain, and had a history of cancer, a contrast-enhanced lumbar MRI was planned, with

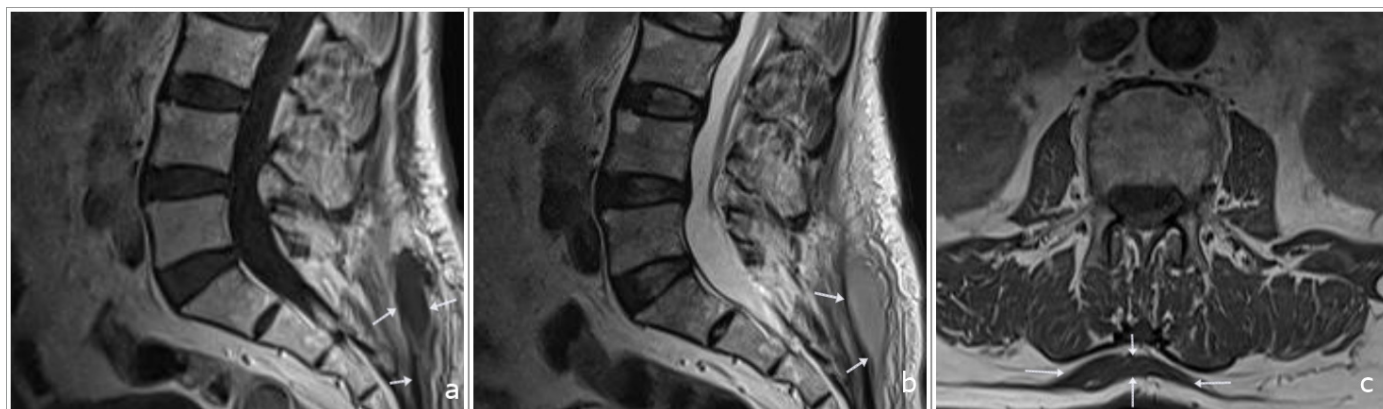


Figure 1. Images of the abscess collection areas on different MRI sections: a) T1-weighted sagittal, b) T2-weighted sagittal, and c) T1-weighted axial.

suspicion of possible metastasis, and pain treatment, including nonsteroidal anti-inflammatory drugs and myorelaxants, was prescribed.

One week later, the patient's pain had increased and was accompanied by fever, malaise, and weight loss. A contrast-enhanced lumbar MRI scan showed no evidence of metastasis but revealed an intersphincteric abscess extending from the anal region to the lower lumbar vertebrae (Figure 1). Blood tests confirmed a leukocyte count of 16,800/ μ L and C-reactive protein level of 231 mg/L. The patient was referred to department of surgery. Following abscess drainage and broad-spectrum antibiotic treatment, the patient's clinical condition improved within one week following surgical drainage. Informed written consent was obtained from the patient on 25.03.2025.

■ DISCUSSION

Perianal abscess is a common colorectal disease that typically affects people aged 30–40 years, with an incidence rate of 0.5–1% [6–8]. Perianal infections are often cryptoglandular in origin, and manifest as acute abscesses or chronic anal fistulas. The causative agents of the infection are microorganisms of fecal (*Escherichia coli* and anaerobes) and cutaneous (*Staphylococcus aureus*) origin, which originate in the anal crypts and often progress to the anal glands, subsequently settling in the intersphincteric space [9,10]. The risk of development increases in cases of Crohn's disease and immunodeficiency, including malignancy and AIDS [11].

Patients primarily complain of severe anal pain when walking, which is aggravated by strain or sneezing. In the later stages, symptoms such as fever, urinary retention or sepsis may also be seen [6]. Although diagnosing a perianal abscess is usually simple, there are typically no visible signs of intersphincteric or supralelevator abscess [6,7]. As in our case, the initial presentation may only be backpain, with a delay in diagnosis.

Symptoms that are considered “red flags” in patients with low back pain are those that are less frequently detected, such as neoplastic, infectious and traumatic conditions. However, if these symptoms are not identified, morbidity and mortal-

ity can significantly increase [12,13]. Important signs to look for in the medical records of the patients include resting pain, which was present in our case, and constitutional symptoms, such as fever and weight loss. Pain at rest suggests neoplastic and infectious pathologies, whereas symptoms such as fever and malaise suggest infectious or inflammatory conditions [12]. Therefore, it is crucial to evaluate risk factors for red flags and perform further investigations for differential diagnosis when necessary. In our case, the patient's history of lung adenocarcinoma, accompanied by resting pain, fever, and weight loss, necessitated further investigation to rule out infectious and malignant processes.

Our patient had the characteristics of a “red flag” at the first presentation due to new-onset low back pain at the age of 50 years and a history of cancer. Fever, malaise, and weight loss should also be considered in patients presenting with low back pain during follow-up examinations. In addition, elevated white blood cell counts and CRP levels support an infectious process. Lumbar spinal imaging (contrast-enhanced magnetic resonance imaging) revealed an intersphincteric abscess extending to the lumbar region. Although there were no findings suggestive of an abscess on physical examination, it presented as a rare cause of low back pain.

■ CONCLUSION

Our case is a challenging, unexpected, and instructive case in which anorectal pathologies should be considered in patients presenting with lower lumbar region pain that increases at rest, accompanied by fever, malaise, and weight loss unresponsive to medical treatment. Furthermore, regardless of the stage and presence of cure, cancer patients are prone to spread of infections with an insidious onset.

Informed Consent: Informed written consent was obtained from the patient and was attached as a document.

Peer-review: Externally peer-reviewed.

Conflict of Interest: The author has no conflict of interest to declare.

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