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RESEARCH ARTICLE

Fatigue and Associated Factors in Patients with Knee Osteoarthritis: A Cross-Sectional Study

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ABSTRACT

Objective: Fatigue is a common but underrecognized symptom in knee osteoarthritis (OA), which significantly impacts patients' quality of life. This study aimed to investigate the associations between fatigue severity and clinical variables in individuals with knee OA.

Materials and Methods: This cross-sectional study included 92 patients (mean age 64.09 ± 9.68 years; 62.0% female) clinically diagnosed with knee OA. Fatigue severity was assessed using the Fatigue Severity Scale. Additional assessments included pain intensity via the Visual Analog Scale, functional status using the Knee Injury and Osteoarthritis Outcome Score - Physical Function Shortform (KOOS-PS), and anxiety and depression levels as measured by the Hospital Anxiety and Depression Scale. Body mass index (BMI) was calculated for each participant, and radiographic severity of knee OA was determined using the Kellgren-Lawrence Classification. Spearman's rank correlation was employed for statistical analyses to determine associations between the variables.

Results: Significant positive correlations were observed between fatigue severity and BMI (r=0.335, p=0.001), pain intensity (r=0.386, p<0.001), anxiety levels (r=0.323, p=0.002), depression levels (r=0.318, p=0.002), and radiographic severity (r=0.464, p<0.001). Additionally, a significant negative correlation was found between fatigue severity and the KOOS-PS score (r=-0.356, p<0.001).

Conclusion: Fatigue in knee OA is significantly associated with radiographic severity, pain, mood disorders, functional impairment, and BMI. These findings highlight the importance of considering fatigue as a core component of OA assessment and treatment. Multidisciplinary approaches targeting these factors are recommended to improve patient outcomes.

Keywords: Anxiety, depression, fatigue, knee, osteoarthritis

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INTRODUCTION

Osteoarthritis (OA) is the most common chronic joint disorder and a major contributor to disability among the elderly.[1] Knee OA, the most prevalent subtype worldwide, is characterized by progressive cartilage degeneration, osteophyte formation, joint space narrowing, and pain, all of which collectively impair functional mobility and quality of life.[2]

The term fatigue is defined as a persistent feeling of physical and/or mental exhaustion that is not proportional to recent activity and is not relieved by rest.[3] In musculoskeletal conditions, fatigue has been conceptualized as a multifactorial symptom influenced by both peripheral and central mechanisms.[4] Although pain and physical limitations are the primary clinical concerns in OA, many patients report fatigue as a significant symptom that is often neglected in routine assessment and treatment algorithms.[5]

Most existing studies have primarily focused on inflammatory rheumatic diseases, such as rheumatoid arthritis and lupus, while fatigue in OA—particularly in its non-inflammatory degenerative forms—remains insufficiently understood.[6]

Recent biomarker studies have demonstrated that central sensitization and neuroinflammation play a significant role

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in chronic pain and fatigue. However, fatigue has been found to be metabolically distinct from widespread chronic pain.[7–9] Additionally, it has been observed that central sensitization in knee OA is particularly pronounced in patients reporting high levels of clinical pain despite the absence of radiographic evidence.[10]

Psychological factors have a significant impact on functional independence in older individuals with knee OA.[11] OA pain increases fatigue and disability, leading to a depressive mood; the depressive mood, in turn, worsens fatigue and pain, further reducing functionality and creating a vicious cycle between pain and depression.[12]

Due to functional impairment, decreased muscle conditioning and physical capacity limit mobility and social participation, contributing to chronic fatigue.[3] Therefore, we consider fatigue not as an isolated symptom but as part of the complex symptomatology of knee osteoarthritis.

The aim of this study is to investigate the associations between fatigue severity and clinical variables such as pain intensity, functional status, anxiety, and depression in individuals with clinically diagnosed knee OA.

MATERIALS and METHODS

The present study was conducted as a single-centre, cross-sectional, observational study. It was performed between 15.12.2024 and 15.01.2025 at the Physical Medicine and Rehabilitation Outpatient Clinic. Ethical approval was obtained from the local ethics committee prior to the initiation of the study (approval number: 2024-77). All participants provided written informed consent prior to enrollment, and the study procedures were conducted in full accordance with the ethical principles outlined in the Declaration of Helsinki. Inclusion and exclusion criteria were established to minimize potential confounders affecting fatigue perception and to ensure homogeneity within the sample.

Inclusion Criteria

- Age between 40 and 80 years,
- Diagnosis of knee OA according to ACR clinical guidelines,
- Ability to comprehend and complete the study questionnaires independently.

Exclusion Criteria

- Prior history of knee arthroplasty or major knee surgery,
- Diagnosed fibromyalgia or chronic fatigue syndrome,
- Presence of active rheumatologic, neurological, or psychiatric disorders,
- Current use of medications that significantly alter fatigue perception (e.g., corticosteroids, antidepressants, psychostimulants),
- Decompensated cardiac, hepatic, or renal insufficiency.

Data Collection and Clinical Evaluation

Demographic and clinical characteristics were gathered using a standardized data collection form. The following variables were collated: age, gender, weight, height, and body mass index (BMI). The variables marital status, smoking history, educational attainment, and occupational status were also included. Pain duration (in months) and range of motion (ROM) of the affected knee joint were also noted. ROM was categorized as either full or restricted, based on clinical examination by a board-certified physiatrist.

Outcome Measures and Assessment Tools

All participants underwent comprehensive evaluation using validated, patient-reported outcome measures, each with established Turkish adaptations and psychometric properties.

Fatigue Severity Scale

The Turkish version of the Fatigue Severity Scale (FSS), which has been validated for both reliability and the assessment of chronic fatigue levels, was used in this study.[13] The FSS is a self-administered tool consisting of nine items, each rated on a 7-point Likert scale ("1 = strongly disagree" to "7 = strongly agree"). The average score is calculated, and according to the cutoff value established for the FSS, scores of 4 or higher indicate the presence of fatigue, with higher values reflecting more severe fatigue.[14]

Knee Injury and Osteoarthritis Outcome Score – Physical Function Shortform

The Knee Injury and Osteoarthritis Outcome Score – Physical Function Shortform (KOOS-PS) is a disease-specific instrument utilised for the evaluation of physical functional limitations associated with knee osteoarthritis (OA). The instrument comprises seven items, which are scored on a 5-point Likert scale. Scores are transformed to a 0–100 scale, with higher scores denoting better physical function. The Turkish validation study, conducted by Gul et al.[15] in 2013, established the reliability and validity of the scale.

Visual Analog Scale

The intensity of pain experienced over the preceding week was measured using a Visual Analog Scale (VAS) with a length of 10 centimeters (cm).[16] This scale was employed to ensure accurate measurement of pain intensity. The endpoints of the scale were defined as "0 = no pain" and "10 = worst imaginable pain."

Hospital Anxiety and Depression Scale

The Hospital Anxiety and Depression Scale (HADS) is a screening tool that is employed extensively in medical populations for the identification of anxiety and depression. The tool is composed of 14 items, which are divided into two subscales: an anxiety subscale (HADS-A) and a depression subscale (HADS-D). Each item is evaluated using a 4-point Likert scale, with subscale scores ranging from 0 to 21. The Turkish validation study, conducted by Aydemir et al.[17] in 1997, established the reliability and validity of the scale.

Radiological Assessment

Radiographic severity of OA was assessed using the Kellgren-Lawrence Classification, based on standard weight-bearing anteroposterior knee radiographs.[18] The Kellgren-Lawrence grades range from 0 (no radiographic features) to 4 (severe joint space narrowing, large osteophytes, and deformity). Radiographs were interpreted by an experienced physiatrist who was blinded to the clinical data.

Sample Size Calculation

The necessary sample size was determined by using the G*Power 3.1 program. Based on a medium correlation effect size (r=0.3), an alpha error probability of 0.05, and a statistical power of 0.90, the minimum number of participants required was determined to be 92.

Statistical Analysis

The statistical analyses were conducted using PASW Statistics for Windows, Version 18.0 (SPSS Inc., Armonk, NY). Data normality was assessed using the Lilliefors-corrected Kolmogorov-Smirnov test. Continuous variables were represented as mean±standard deviation (SD) or median with interquartile range (IQR), as indicated. Categorical data were summarized as frequencies (percentage).

Spearman's rank correlation test was used to evaluate the relationships between FSS scores and clinical parameters (VAS, KOOS-PS, HADS-A, HADS-D, BMI, pain duration, and Kellgren-Lawrence Classification grade), due to the non-normal distribution of the data. The strength of correlations was interpreted according to standard guidelines, and a p-value of <0.05 was considered statistically significant.

RESULTS

Ninety-two patients with a diagnosis of knee OA were eligible for the study. The mean age of the participants was 64.09±9.68 years, and 62% of them were female. The mean height and weight of the participants were recorded as 163.84±9.59 cm and 81.83±12.28 kg, respectively. The mean BMI of the participants was calculated to be 30.71±5.67 kg/m². Most participants were married (78.3%) and had completed only primary education (55.4%) (Table 1). In this study, 58 patients (63%) had FSS scores of 4 or higher.

Table 1. Demographic characteristics of the patients

	n	%	Mean±SD
Age (years)			64.09±9.68
Height (cm)			163.84±9.59
Weight (kg)			81.83±12.28
BMI (kg/m²)			30.71±5.67
Gender			
Female	57	62.0	
Male	35	38.0	
Marital status			
Married	72	78.3	
Single	20	21.7	
Educational level			
Primary school	51	55.4	
Secondary school	15	16.3	
High school	17	18.5	
University college	9	9.8	
Occupational status			
Employed	7	7.6	
Retired	38	41.3	
Housewife	47	51.1	
Smoking history			
Yes	76	82.6	
No	16	17.4	

The data were presented as mean±standard deviation or frequencies. SD: Standard deviation; BMI: Body mass index

Clinical assessments revealed that the scores for FSS, VAS, KOOS-PS, and HADS are summarized in Table 2. According to the Kellgren-Lawrence Classification, most participants (51.1%) had grade 2 OA, and 62% of the patients exhibited a full ROM (Table 2).

Fatigue severity showed a statistically significant positive correlation with BMI, VAS pain score, HADS-A, and HADS-D (r=0.335, p=0.001; r=0.386, p<0.001; r=0.323, p=0.002; r=0.318, p=0.002, respectively). Additionally, a statistically significant positive correlation was observed with radiographic severity based on the Kellgren–Lawrence grade (r=0.464, p<0.001). In

Table 2. Clinical features and functional assessments of the patients

	n	%	Min	Max	Median (IQR)
FSS			0.55	7.00	4.44 (3.22–5.67)
VAS			3.00	10.00	6.00 (5.00–8.00)
KOOS-PS			0.00	85.20	56.00 (51.50–66.40)
HADS anxiety			2.00	14.00	7.00 (6.00–10.00)
HADS depression			1.00	15.00	6.00 (4.00–9.00)
Duration of pain (months)			3.00	24.00	6.00 (4.00–10.00)
ROM					
Full	57	62.0			
Resricted	35	38.0			
Kellgren-Lawrence Classification					
Grade 2	47	51.1			
Grade 3	36	39.1			
Grade 4	9	9.8			

The data were presented as median (interquartile range) or frequencies. IQR: interquartile range; SD: Standard deviation; FSS: Fatigue severity scale VAS: Visual analog scale; HADS: Hospital anxiety and depression scale; ROM: Range of motion; KOOS-PS: Knee disability and osteoarthritis outcome score-physical function shortform

contrast, fatigue severity exhibited a statistically significant negative correlation with the KOOS-PS functional score (r=-0.356, p<0.001). However, no significant relationships were observed between FSS scores and patients' age, weight, or duration of pain (Table 3).

DISCUSSION

This study provides a comprehensive and clinically nuanced understanding of the multifactorial nature of fatigue in patients with knee OA. The results show that fatigue in OA is not an isolated complaint, but a multifaceted symptom closely associated with radiographic severity, pain intensity, functional activity level, mood, and BMI. This indicates that the observed statistical relationships correspond to tangible clinical differences; for instance, higher fatigue levels are associated with increased anxiety and depression that can affect daily mood and interactions, as well as a decline in physical function that impairs activities of daily living. It emphasizes the importance of recognizing fatigue as a core component of the OA symptom complex for clinical assessment and intervention.

Table 3. Correlation between fatigue severity and clinical parameters

	FSS score	
	rho	p
Age (years)	-0.139	0.186
Weight (kg)	0.023	0.831
BMI (kg/m^2)	0.335	**0.001**
Pain duration (months)	-0.014	0.897
Kellgren-Lawrence Classification	0.464	**0.000**
VAS	0.386	**0.000**
KOOS-PS	-0.356	**0.000**
HADS anxiety	0.323	**0.002**
HADS depression	0.318	**0.002**

Spearman's rank correlation. BMI: Body mass index; FSS: Fatigue severity scale; VAS: Visual analog scale; KOOS-PS: Knee disability and osteoarthritis outcome score-physical function shortform; HADS: Hospital anxiety and depression scale

One of the most striking findings in our study was the close relationship between fatigue and radiographic disease severity. Patients with more advanced structural degeneration on imaging tended to report significantly higher fatigue load. Joint degeneration not only causes nociceptive pain but also a decrease in joint function, leading to compensatory gait patterns that result in an increase in energy expenditure during locomotion.[19] We propose that this heightened energy demand contributes to fatigue.

A review of the literature reveals that pain and fatigue are often characterized as mutually reinforcing symptoms.[20, 21] Pain exacerbates fatigue through the disruption of sleep patterns, its negative impact on mood, and its limitation of physical activity. This further corroborates that fatigue is significantly shaped by the patients' pain experience. Our results show that individuals with more intense pain complaints exhibited higher levels of fatigue.

Katz et al.[22] investigated factors associated with fatigue in rheumatoid arthritis patients, using the FSS to assess fatigue severity. Their findings indicate that fatigue in rheumatoid arthritis is influenced by both disease-specific and non-specific factors, with poor sleep, depression, and obesity identified as primary predictors beyond disease activity.

The interaction between mood disorders and fatigue may be bidirectional, with factors such as pain severity, role functioning, depressive mood, self-efficacy on fatigue, worrying, helplessness, and non-restorative sleep exacerbating fatigue, while the severity of fatigue also worsens these psychosocial factors, creating a self-reinforcing cycle that diminishes coping capacity and functional engagement.[23]

The results of our study in terms of physical functionality have shown that low functional capacity is consistently associated with increasing fatigue. This finding correlates with the well-known clinical course in musculoskeletal disorders, where patients experience fatigue following physical limitations.[24]

Schepens et al.[25] investigated the effects of standardized lab-based physical tasks on fatigue in older adults, both with and without OA. The study found that older adults with OA reported higher levels of fatigue following physical activity compared to their peers without the condition.

Our study highlights a significant correlation between fatigue and BMI, emphasizing the dual burden of mechanical overload in OA and systemic metabolic dysregulation. Excess weight can increase joint stress, contributing to cartilage wear and low-grade systemic inflammation, which in turn may exacerbate pain and, consequently, fatigue.[26,27] Therefore, weight management may alleviate both mechanical strain and inflammatory pathways, potentially improving pain and fatigue in OA patients.

Fatigue in OA, particularly in knee OA, has often been overlooked or underexplored in clinical research. This study distinguishes itself by evaluating fatigue through a multidimensional approach that incorporates radiographic severity, validated functional and psychological scales, and body composition metrics. Unlike previous studies that focused mainly on pain or function in isolation, we investigated the interconnected roles of somatic and psychosocial factors in determining fatigue severity. Additionally, by using face-to-face structured interviews and culturally validated Turkish versions of standardized tools, we offer a high-fidelity snapshot of real-world patient experiences. These contributions fill a critical gap in OA fatigue literature and have the potential to guide individualized, multidisciplinary treatment plans that target fatigue as a primary therapeutic concern rather than a secondary symptom.

However, several limitations should be noted. First, its cross-sectional design precludes any conclusions about causality. Second, as a single-center study, the generalizability of the findings to broader populations may be limited. Third, fatigue, being a subjective experience, may have been influenced by unmeasured confounding factors such as sleep quality, nutritional status, and social support, which were not specifically assessed. Additionally, the use of the unidimensional FSS as the sole instrument may have limited the ability to capture the multifaceted nature of fatigue, including its physical, mental, and motivational dimensions. Moreover, because ROM was evaluated categorically (as either "full" or "restricted"), and socioeconomic variables such as educational level, occupational status, and marital status were collected as categorical variables, this prevented detailed correlation analyses with fatigue.

CONCLUSION

In conclusion, fatigue in knee OA is a complex and clinically significant symptom that is intricately linked to joint pathology, pain, mood disturbances, physical impairment, and excess weight. The findings of this study highlight the importance of considering fatigue as a core domain in the evaluation and treatment of OA. Therefore, multidisciplinary treatment strategies targeting these factors are recommended; for instance, physiatrists can manage pain and improve function, psychiatrists or psychologists can address mood disorders, and dietitians can provide guidance on weight management. Future research should include longitudinal, multi-center designs to establish causal relationships, and incorporate additional potential contributors to fatigue such as sleep quality, nutritional status, and social support networks. Such comprehensive approaches would further enhance our understanding of fatigue in knee OA and refine targeted intervention strategies.

Disclosures

Ethics Committee Approval: The study was approved by the Scientific Research Ethics Committee of Istanbul Physical Therapy Rehabilitation Training and Research Hospital Ethics Committee (No: 2024-77, Date: 05/12/2024).

Informed Consent: All participants provided written informed consent prior to enrollment, and the study procedures were conducted in full accordance with the ethical principles outlined in the Declaration of Helsinki

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