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The Effect of Autonomic Dysfunction on Sleep Quality in Fibromyalgia Syndrome

Fibromiyalji Sendromunda Otonom Disfonksiyonun Uyku Kalitesi Üzerine Etkisi

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ABSTRACT

Objective: Fibromyalgia Syndrome (FMS) is characterized by widespread pain, fatigue, and non-restorative sleep. Dysregulation of the autonomic nervous system may play a role in the severity of these symptoms, particularly sleep impairment. This study aimed to investigate the effect of autonomic dysfunction on sleep quality in individuals with FMS.

Methods: The study is a cross-sectional study conducted between January and May 2025, including 40 female patients diagnosed with FMS according to the ACR 2016 criteria, and a control group of 40 healthy individuals matched for age and gender. Participants were administered the Pittsburgh Sleep Quality Index (PSQI), the Composite Autonomic Symptom Score-31 (COMPASS-31), and the Fibromyalgia Impact Questionnaire (FIQ).

Results: The FMS group had significantly higher PSQI, COMPASS-31, and FIQ scores compared to the control group ($p<0.001$). Regression analysis revealed that the COMPASS-31 score was a significant predictor of PSQI score ($B=0.278$, $p<0.001$). Additionally, a significant positive correlation was found between COMPASS-31 and PSQI scores in the FMS group ($r=0.448$, $p<0.05$).

Conclusion: This study revealed that FMS exhibit significantly increased levels of autonomic dysfunction and impaired sleep quality compared to healthy individuals. As the level of autonomic dysfunction increases, a significant decline in sleep quality is observed. This finding supports the notion that autonomic nervous system disorders may play a central role in the development and exacerbation of FMS symptoms.

Keywords: Autonomic Dysfunction, Fibromyalgia Syndrome, Sleep Quality

ÖZET

Amaç: Fibromiyalji Sendromu (FMS), yaygın ağrı, yorgunluk ve dinlendirici olmayan uyku ile karakterizedir. Otonom sinir sistemi düzensizliği, özellikle uyku bozukluğu olmak üzere bu semptomların şiddetinde rol oynayabilir. Bu çalışmanın amacı, FMS'li bireylerde otonom disfonksiyonun uyku kalitesi üzerine etkisini araştırmaktır

Yöntem: Bu çalışma Ocak–Mayıs 2025 tarihleri arasında yürütülmüş kesitsel bir araştırmadır. Çalışmaya, ACR 2016 kriterlerine göre FMS tanısı almış 40 kadın hasta ile yaş ve cinsiyet açısından eşleştirilmiş 40 sağlıklı bireyden oluşan kontrol grubu dahil edilmiştir. Katılımcılara Pittsburgh Uyku Kalitesi İndeksi (PUKİ), Kompozit Otonom Semptom Skoru-31 (COMPASS-31) ve Fibromiyalji Etki Anketi (FIQ) uygulanmıştır.

Bulgular: FMS grubunun PUKİ, COMPASS-31 ve FIQ puanları kontrol grubuna kıyasla anlamlı derecede yüksek bulunmuştur ($p<0,001$). Regresyon analizinde COMPASS-31 puanının PUKİ puanının anlamlı bir yordayıcısı olduğu saptanmıştır ($B=0,278$, $p<0,001$). Ayrıca FMS grubunda COMPASS-31 ile PUKİ puanları arasında anlamlı pozitif korelasyon bulunmuştur ($r=0,448$, $p<0,05$).

Sonuç: Bu çalışma, FMS'li bireylerin sağlıklı bireylere kıyasla anlamlı düzeyde artmış otonom disfonksiyon ve bozulmuş uyku kalitesine sahip olduğunu ortaya koymuştur. Otonom disfonksiyon düzeyi arttıkça uyku kalitesinde belirgin bir düşüş gözlenmektedir. Bu bulgu, otonom sinir sistemi bozukluklarının FMS semptomlarının gelişiminde ve şiddetlenmesinde merkezi bir rol oynayabileceğini desteklemektedir.

Anahtar kelimler: Fibromiyalji Sendromu, Otonom Disfonksiyon, Uyku Kalitesi

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INTRODUCTION

Fibromyalgia syndrome (FMS) is a multifaceted, long-term condition marked by widespread muscle and skeletal pain, along with fatigue, sleep problems, and various other systemic complaints. Dysautonomias, regional pain syndromes, and various neurovegetative symptoms frequently accompany this condition (1). The prevalence of FMS ranges from 0.5% to 12%, depending on the study population and assessment methods, and it is approximately three times more common in women than in men (2). In the pathogenesis of FMS, pathophysiological mechanisms such as autonomic nervous system dysregulation, central sensitization, and in some cases peripheral small fiber neuropathy play a role (3). The widespread pain associated with autonomic changes may result from abnormal pain processing at both peripheral and central nervous system levels (4). Recent studies identifying small fiber sensory and autonomic neuropathy in FMS patients support the coexistence of dysautonomic and neuropathic features. Although the mechanisms of sensory neuron dysfunction in the dorsal root ganglia and autonomic ganglia are still being studied, genetic factors, trauma, or infection-induced abnormal neuroplasticity have been associated with this condition (5).

Patients with FMS frequently report sleep disturbances such as insomnia, early morning awakening, and poor sleep quality (6). Sleep and wakefulness states are also modulated by the autonomic nervous system (7). In this context, autonomic nervous system dysfunction is thought to be one of the underlying causes of the sleep disturbances commonly seen in FMS. Particularly, frequent awakenings and increased wake time support the potential role of the autonomic nervous system in disrupting sleep regulation (8).

This study aims to evaluate the impact of autonomic dysfunction on sleep quality in patients with fibromyalgia syndrome. Given the role of the autonomic nervous system in regulating sleep, its dysfunction may contribute to the sleep disturbances commonly seen in these patients. A better understanding of this relationship may inform strategies for improving symptom management and overall quality of life in FMS.

MATERIALS AND METHODS

Study Design

This cross-sectional study was carried out between January and May 2025 in the Department of Physical Medicine and Rehabilitation at Tokat Gaziosmanpaşa University Hospital. The study included female patients who presented with widespread pain and were

diagnosed with FMS according to the 2016 revised diagnostic criteria of the American College of Rheumatology (ACR), as well as healthy individuals matched for age and gender.

Sample Size and Participants

The sample size was calculated using the G*Power 3.1.7 software based on an effect size of 0.78 obtained from a previous similar study (9). With 95% power, a significance level of 0.05, and an estimated 10% non-response rate, a total of 80 individuals were included in the study. The sample consisted of 40 female patients diagnosed with FMS and 40 healthy female matched to the patients. Although the control group was composed of individuals without known chronic or systemic diseases, two participants were identified as having psoriasis and one as having non-medication-requiring asthma; these conditions were recorded but did not necessitate exclusion from the study as they were not expected to affect sleep or autonomic functions.

Inclusion and Exclusion Criteria

The study included women aged 20 to 64 years who met the 2016 revised ACR diagnostic criteria for FMS. Participants who had used antidepressant medications, such as pregabalin, amitriptyline, or duloxetine, in the past month were excluded. Additionally, participants were excluded if they had a history of neurological disorders, a diagnosis of inflammatory rheumatic disease, current pregnancy, obstructive sleep apnea, psychiatric disorders (such as major depression and anxiety disorders), or other sleep-related breathing disorders, a diagnosis of malignancy, or uncontrolled endocrine disorders such as thyroid, parathyroid, or diabetes-related conditions. Participants working night shifts or in occupations known to disrupt circadian rhythm were not included in the study, based on information obtained during the initial clinical interview.

Assessment Tools

Sociodemographic information of the participants—including age, weight, height, Body Mass Index (BMI), marital status, education level, socioeconomic status, occupation, smoking habits, and duration of diagnosis—was collected using a standardized data collection form.

Sleep quality was assessed using the Pittsburgh Sleep Quality Index (PSQI)

The PSQI, a self-report questionnaire developed by Buysse et al. (10), comprises 24 items across 7 subcomponents. Scores range from 0 to 21, with higher scores reflecting poorer sleep quality. A total PSQI score above 5 can differentiate good sleepers from poor sleepers, demonstrating a sensitivity of 89.6% and a specificity of 86.5%. The PSQI questionnaire was adapted to the Turkish language by Agargun et al. (11).

Fibromyalgia Impact Questionnaire (FIQ)

Functional status was evaluated using the FIQ which covers 10 subcomponents such as physical functioning, work absenteeism, pain, fatigue, stiffness, anxiety, and depression (12). The total score ranges from 0 to 100, with higher values reflecting a greater severity of impact. The Turkish version of the FIQ was validited by Sarmer et al (13)**.**

Composite Autonomic Symptom Score–31 (COMPASS-31)

Autonomic symptoms were assessed with the COMPASS-31 a self-report questionnaire consisting of 31 multiple-choice items. It evaluates six domains of autonomic function: gastrointestinal, bladder, pupillomotor, vasomotor, secretomotor, and orthostatic intolerance. Total scores range from 0 to 100, with higher scores indicating more severe autonomic dysfunction. Scoring was performed following the criteria established by Sletten et al. (14). The Turkish version of the COMPASS-31 was validited by Is et al (15).

Ethical Considerations of the Study

The study was carried out in accordance with the Declaration of Helsinki and received approval from the Ethical Board of Tokat Gaziosmanpaşa University (24-MOBAEK-069). Informed consent was obtained from all participants.

Statistical Analysis

The data were analyzed using the SPSS software package (Version 25.0, SPSS Inc., Chicago, IL, USA). Descriptive statistics were presented as mean and standard deviation for continuous variables, and frequency distributions (number and percentage) for categorical variables. The normality of data distribution was assessed using the Kolmogorov-Smirnov test. For comparisons of means between two independent groups, the Independent Samples t-test was used. Categorical variables were analyzed using Pearson’s Chi-Square Test or Fisher’s

Exact Test. Regression analysis was performed to assess relationships between variables. A p-value of <0.05 was considered statistically significant.

RESULTS

In this study, the sociodemographic characteristics, levels of autonomic dysfunction, sleep quality, and functional status of individuals with FMS were compared with those of the control group.

Table 1. Distribution of Descriptive Characteristics of the Study Population and Comparison Between Groups

Descriptive Characteristics		Control % (n)	FMS % (n)	Test
Marital Status	Single	45.5 (5)	54.5 (6)	x^2: 0.105 p: 0.745
	Married	50.7 (35)	49.3 (34)	
Education Level	Primary school	44.8 (13)	55.2 (16)	x^2: 1.446 p: 0.143
	High School	54.1 (20)	45.9 (17)	
	University	57.1 (8)	42.9 (6)	
Income Level	Income < Expenses	37.9 (11)	62.1 (18)	x^2: 2.771 p: 0.250
	Income = Expenses	55.8 (24)	44.2 (19)	
	Income > Expenses	62.5 (5)	37.5 (3)	
Occupation	Housewife	45.1 (23)	54.9 (28)	p: 0.219*
	Teacher	88.9 (8)	11.1 (1)	
	Factory worker	0 (0)	100 (1)	
	Civil servant	45.5 (5)	54.5 (6)	
	Day-shift nurse	50 (1)	50 (1)	
	Day-shift cleaning staff	50 (3)	50 (3)	
Place of Residence	City center	56.0 (28)	44.0 (22)	x^2: 2.268 p: 0.322
	District center	35.3 (6)	64.7 (11)	
	Village/Town	46.2 (6)	53.8 (7)	
Smoking Status	No	53.1 (34)	46.9 (30)	x^2: 1.250 p: 0.264
	Yes	37.5 (6)	62.5 (10)	
Presence of Chronic Disease	No	4.4 (37)	45.6 (31)	p: 0.060*
	Yes	25.0 (3)	75.0 (9)	
Body Mass Index	Normal	74.2 (23)	25.8 (8)	x^2: 13.186 **p<0.001**
	Overweight	26.1 (6)	73.9 (17)	
	Obese	41.7 (10)	58.3 (14)	
Sleep Quality	Poor	10.0 (4)	72.5 (29)	**p< 0.001***
	Good	90.0 (36)	27.5 (11)	

Chi-square test was used; *Fisher's Exact Test applied.

Evaluation of the participants' sociodemographic characteristics revealed no statistically significant differences between the FMS and control groups regarding marital status, education level, income level, smoking status, place of residence, or presence of chronic disease (p > 0.05). However, significant differences were observed between the groups in terms of body mass index (BMI) and sleep quality. The proportion of overweight and obese individuals was

higher in the FMS group (p< 0.001). In addition, the majority of individuals in the FMS group had poor sleep quality (72.5%), compared to only 10% in the control group, and this difference was statistically significant (p<0.001) (Table 1).

Table 2. Comparison of PSQI, COMPASS-31, and FIQ Scores Between FMS and Control Groups

Score	Control (n=40)	FMS (n=40)	Test
PSQI Total score	4.62±2.43	9.17±2.96	t:-7.493 **p<0.001**
COMPASS-31 total score	8.40±4.22	20.95±7.15	t:-9.551 **p<0.001**
FIQ score	27.73±14.24	69.67±14.92	t:-12.858 **p<0.001**

Student's t-test was used for group comparisons.

Additionally, when PSQI, COMPASS-31, and FIQ scores were compared, the scores in the FMS group were significantly higher than those in the control group in all tests (p< 0.001). The mean PSQI score in the FMS group was 9.17 ± 2.96, compared to 4.62 ± 2.43 in the control group. Similarly, COMPASS-31 scores averaged 20.95 ± 7.15 in the FMS group and 8.40 ± 4.22 in the control group (Table 2).

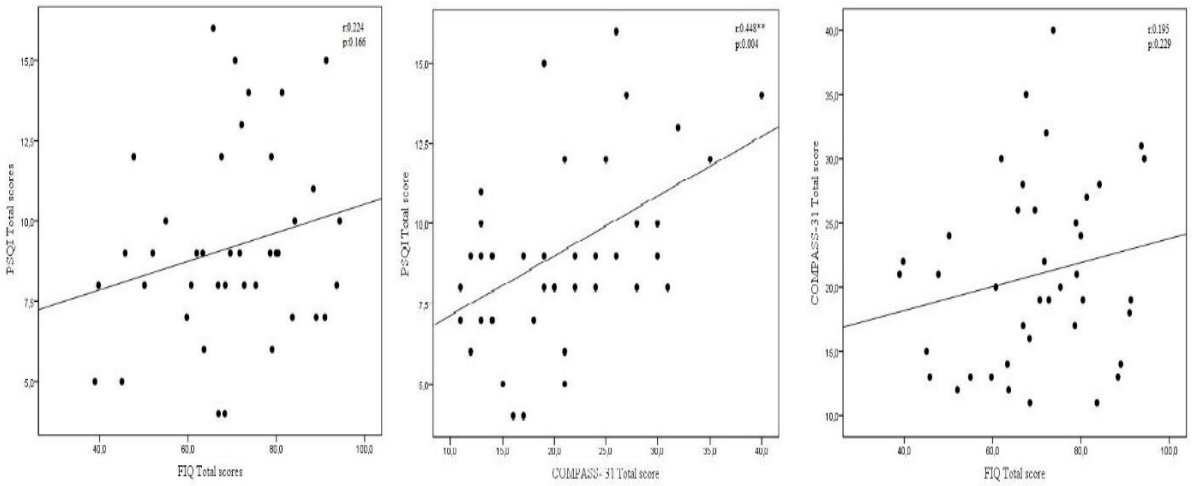
Table 3. Results of Regression Analysis for Factors Affecting PSQI Score

Model	Non-standardized		Standardized	t	p	Confidence interval (95%)		VIF
	B	SE	Beta			Lower limit	Upper limit	
Constant	2.826	0.584		4.840	0.001	1.663	3.369	
COMPASS-31 total score	0.278	0.034	0.675	8.706	0.001	0.209	0.346	1

Notes: Dependent variable: PUKİ, R=0.675 R^2=0.455, Durbin-Watson=1.947, F=65.214; p<0.05, B: non-standardized coefficients; SE: standard error; ß: standardized coefficient (SC); VIF: Variance Inflation Factor; p < 0.05

When examining the variables that predict the PSQI score in the FMS group, the COMPASS-31 score was found to be a significant predictor (B = 0.278, p < 0.001). It was observed that each one-point increase in the COMPASS-31 score led to a 0.278-point increase in the PSQI score. The overall model was statistically significant (F = 65.214, p < 0.001) and demonstrated a high level of explanatory power (R^2 = 0.455) (Table 3).

Figure1. Correlations Among Quantitative Variables in the FMS Group



Pearson correlation coefficient was used. ** Correlation is significant at the 0.01 level (2-tailed). **PSQI:** Pittsburgh Sleep Quality Index, **COMPASS-31:** Composite Autonomic Symptom Score-31, **FIQ:** Fibromyalgia Impact Questionnaire

According to the correlation analysis conducted within the FMS group, a positive and statistically significant correlation was found between COMPASS-31 and PSQI scores ($r = 0.448$, $p < 0.05$). However, the correlations between COMPASS-31 and FIQ, as well as between PSQI and FIQ, were not statistically significant (Figure 1).

DISCUSSION

FMS is a complex clinical condition characterized by widespread pain, often accompanied by autonomic nervous system dysfunction. The literature consistently reports a strong association between dysautonomia and FMS (16). The COMPASS-31 scale, a widely used tool for assessing autonomic dysfunction, generally yields scores between 8.6 and 11.1 in healthy individuals (17,18). In our study, however, the mean score was significantly higher (20.95±7.1), indicating increased autonomic symptoms in individuals with FMS. Although these findings support the presence of autonomic dysfunction in FMS, previous studies have reported conflicting results.Similar to our findings, Solano et al. (19) reported that FMS patients scored high across all assessed autonomic dysfunction domains and that various non-pain symptoms were associated with autonomic dysfunction. Their study found a significant

correlation between FIQ and COMPASS-31 scores, suggesting that autonomic dysfunction may be an intrinsic component of FMS (19). Martínez-Martínez et al. (20) evaluated sympathetic-parasympathetic balance and responses to orthostatic stress using short-term heart rate variability measures, showing impaired sympathetic response to orthostatic stress in FMS patients compared to healthy controls. Conversely, Kulshreshtha et al. conducted a comprehensive autonomic function test battery and concluded that sympathetic and parasympathetic functions were preserved in FMS patients. However, they observed significantly higher systolic and diastolic blood pressure in the FMS group, which they attributed to deconditioning and physical inactivity related to chronic pain, leading to secondary autonomic symptoms (21). In another study from India, Hazra et al. found no significant difference in overall autonomic activity between FMS patients and controls. Nonetheless, the FMS group showed altered sympathetic activity and a diminished stress response, potentially due to central sensitization mechanisms often implicated in FMS pathophysiology (22). In our study did not identify a significant correlation between COMPASS-31 and FIQ scores in the FMS group. In contrast, Vincent et al. demonstrated that FMS patients reported prominent symptoms across various autonomic subdomains, which were significantly associated with total FIQ scores (23). Overall, our findings indicate that individuals with FMS have markedly elevated autonomic symptoms compared to healthy controls. However, the relationship between autonomic dysfunction and FMS symptom severity remains inconsistent. The lack of a significant correlation between COMPASS-31 and FIQ scores in our study, in contrast to previous findings, may reflect the heterogeneous nature of FMS and varying underlying pathophysiological processes. These discrepancies underscore the need for more standardized and in-depth investigations into the role of autonomic dysfunction in FMS.

More than 90% of patients with FMS report sleep disturbances, with non-restorative sleep being one of the most commonly cited complaints (24). This supports the clinical relevance and high prevalence of sleep disorders in FMS. Consistently, in our study, 72.5% of participants in the FMS group had poor sleep quality, and the group's PSQI scores were significantly worse than those of the control group. These results align with a prior study conducted in Turkey by Celepkolu et al., which also found significantly poorer PSQI scores in FMS patients compared to controls (25). The literature suggests that FMS patients often experience shortened sleep duration, leading to reduced sleep quality, impaired sleep efficiency, and overall insufficient rest (26). Sleep plays a crucial role in regulating autonomic nervous system function. Increased sympathetic activity during the night may either result from poor sleep or reflect autonomic dysregulation caused by altered sleep physiology (27). These

findings underscore the central role of sleep disturbances in the clinical profile of FMS and suggest that impaired sleep quality may not only be a prominent symptom but also a contributing factor to the underlying autonomic dysregulation observed in this condition.

In our study, a one-point increase in COMPASS-31 score was associated with a 0.278-point increase in PSQI score, and a moderate, statistically significant positive correlation was found between these scores. This supports the hypothesis that autonomic dysfunction plays a potential role in the deterioration of sleep quality. Poor sleep quality and insufficient sleep duration are recognized risk factors for chronic pain development (28). Additionally, short or fragmented sleep has been linked to hyperalgesia and spontaneous pain symptoms such as muscle aches (29). Studies have shown a significant relationship between increased autonomic activity following sleep restriction and decreased pain thresholds. This finding has biological relevance, as nociceptive and autonomic regulatory regions in the central nervous system respond to the same somatic or visceral stimuli. These regions integrate nociceptive and visceral sensory information and contain neuronal groups that initiate autonomic, antinociceptive, and behavioral responses to painful stimuli. This may explain the observed correlation between pain perception and autonomic responses, particularly after sleep deprivation (30). While sleep architecture directly affects autonomic regulation, autonomic dysfunction may also contribute to the development of sleep disturbances. Sleep disorders are often considered symptoms of autonomic nervous system disruption, and autonomic factors are known to influence sleep physiology. The bidirectional relationship between sleep and autonomic dysfunction suggests the possibility of a shared pathological basis. Chronic sleep interruptions during different stages of sleep can impair autonomic nervous system functions, while disturbances in autonomic coordination can adversely affect sleep initiation and maintenance (31). Rizzi et al. (32) found that sleep in FMS patients mimics the effects of stress. It has been shown that pain during sleep elevates sympathetic cardiovascular activity, reducing sleep efficiency, resulting in lighter sleep, more frequent awakenings, increased periodic limb movements, altered cardiovascular neural regulation, and heightened pain sensitivity. This further supports abnormal autonomic nervous system responses as one of the biological markers of FMS (33). Ultimately, reduced autonomic nervous system activity and neuroendocrine dysregulation may contribute to both chronic pain and non-rheumatic symptoms such as orthostatic intolerance in FMS, or they may themselves be a consequence of chronic pain (27). These findings emphasize the importance of the bidirectional relationship between sleep quality and autonomic dysfunction in FMS and suggest that both sleep regulation and autonomic nervous system stabilization should be considered in treatment approaches.

This study has several limitations. First, both sleep quality and autonomic symptoms were assessed solely through self-report questionnaires, which may introduce response bias and limit measurement precision. Objective assessments such as polysomnography, actigraphy, heart rate variability, or cardiovascular reflex tests could strengthen future research. Second, the cross-sectional design precludes any causal inference, and the findings should be interpreted as associations rather than cause-effect relationships. Third, although groups were compared on several sociodemographic variables, potential confounders such as psychological symptoms, physical activity levels, and BMI differences could not be fully controlled.

In conclusion, our study highlights that both autonomic dysfunction and poor sleep quality are significantly elevated in individuals with FMS. These two conditions are not independent but likely interact in a complex, bidirectional manner. The reciprocal relationship between autonomic nervous system regulation and sleep architecture may play a central role in exacerbating FMS symptoms. Therefore, comprehensive evaluation and management strategies for FMS should extend beyond pain management to include interventions targeting sleep quality and autonomic nervous system regulation. Future research incorporating objective measures and longitudinal designs will be essential to further elucidate the underlying pathophysiology of FMS and inform individualized treatment approaches.

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Conflict of Interest: The author declares that she has no conflict of interest.

Data Availability: The data that support the fndings of this study are available from the corresponding author upon reasonable request.

Author's Contribution: Conceptualization, Methodology, Formal analysis and investigation, Writing – original draft preparation, Writing – review and editing, Resources, Supervision: S.O.

Compliance with Ethical Standards: The study was conducted according to the Declaration of Helsinki and was approved by the Ethical Board of Tokat Gaziosmanpaşa University (24-MOBAEK-069).

Consent to participate: Informed consent was obtained from all individual participants included in the study.

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