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The Relationship Between Cardiorespiratory Function and Disease Severity, Pain and Fatigue Parameters in Fibromyalgia Syndrome

Fibromiyalji Sendromunda Kardiyorespiratuvar Fonksiyonun Hastalık Şiddeti, Ağrı ve Yorgunluk Parametreleri ile İlişkisi

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ABSTRACT

Aim: The objective of the present study is to examine the effects of fibromyalgia on cardiorespiratory and autonomic nervous system functions, as well as quality of life, in fibromyalgia patients.

Materials and Methods: The study included 39 women aged 25-50 years with fibromyalgia syndrome and 39 women without fibromyalgia as a control group. Fibromyalgia impact questionnaire, pain score with visual analogue scale, widespread pain index, symptom severity scale, fibromyalgia severity scale, Beck depression inventory, fatigue severity scale, 6-minute walk test and 24-hour blood pressure monitoring with Holter device were applied to all participants.

Results: The comparative analysis revealed that patients suffering from fibromyalgia exhibited a diminished 6-minute walking distance, with values recorded at 492.26±53.95 meters, significantly lower than the control group's mean of 550.13±44.56 meters ($p<0.05$). While heart rate recovery index was comparable, fibromyalgia patients had a higher prevalence of non-dipper blood pressure patterns (26.9% vs. 11.5%, $p<0.05$). Higher fibromyalgia severity scale scores were associated with greater fatigue severity scale ($r=0.619$, $p<0.001$) and Beck depression inventory scores ($r=0.457$, $p<0.001$), and inversely correlated with 6-minute walking distance ($r=-0.444$, $p<0.001$). The fibromyalgia impact questionnaire scores were correlated with fatigue severity scale scores ($r=0.717$, $p<0.001$) and Beck depression inventory scores ($r=0.541$, $p<0.001$), but not with 6-minute walking distance ($r=-0.069$, $p=0.675$).

Conclusion: The study found that women with fibromyalgia have impaired physical capacity and autonomic nervous system function compared to those without the condition. This highlights the importance of periodically assessing circadian blood pressure rhythms in people with fibromyalgia. Furthermore, the study suggests that fatigue and depressed mood are more impactful for individuals with fibromyalgia than physical limitations.

Keywords: Fibromyalgia syndrome, cardiorespiratory, ambulatory blood pressure, 6-minute walk test, autonomic dysfunction, non-dipping blood pressure

ÖZ

Amaç: Bu çalışmanın amacı, fibromiyaljinin kardiyorespiratuvar ve otonom sinir sistemi fonksiyonları ile yaşam kalitesi üzerindeki etkilerini incelemektir.

Gereç ve Yöntem: Çalışmaya 25-50 yaş arası fibromiyalji sendromu tanısı almış 39 kadın ve kontrol grubu olarak 39 fibromiyaljisi olmayan kadın dahil edildi. Tüm katılımcılara fibromiyalji etki anketi, görsel analog skala ile ağrı skoru, yaygın ağrı indeksi, semptom şiddet skalası, fibromiyalji şiddet skalası, Beck depresyon envanteri, yorgunluk şiddet skalası, 6 dakikalık yürüme testi ve Holter cihazı ile 24 saatlik kan basıncı takibi uygulandı.

Bulgular: Karşılaştırmalı analiz, fibromiyalji hastalarının 6 dakikalık yürüme mesafesinde azalma olduğunu ve 492,26±53,95 metre olarak kaydedilen ortalama mesafenin, kontrol grubunun 550,13±44,56 metrelik ortalamasından önemli ölçüde düşük olduğunu ortaya koymuştur ($p<0,005$). Kalp hızı

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toparlanma indeksi benzer olsa da, fibromiyalji hastalarında non-dipper kan basıncı paterninin görülme sıklığı daha yüksekti (%26,9'a karşı %11,5, p<0,05). Daha yüksek fibromiyalji şiddet skalası puanları, daha yüksek yorgunluk şiddet skalası (r=0,619, p<0,001) ve Beck depresyon envanteri puanları (r=0,457, p<0,001) ile ilişkiliyken, daha düşük şiddet daha iyi 6 dakikalık yürüme mesafesi (r=-0,444, p<0,001) ile ilişkiliydi. Fibromiyalji etki anketi puanları, yorgunluk şiddet skalası (r=0,717, p<0,001) ve Beck depresyon envanteri puanları (r=0,541, p<0,001) ile ilişkiliydi, ancak 6 dakikalık yürüme mesafesi (r=-0,069, p=0,675) ile ilişkili değildi.

Sonuç: Çalışma, fibromiyaljisi olan kadınların, sağlıklı olanlara kıyasla fiziksel kapasite ve otonom sinir sistemi fonksiyonlarında bozulma olduğunu ortaya koymuştur. Bu durum, fibromiyaljisi olan kişilerde sirkadiyen kan basıncı ritimlerinin periyodik olarak değerlendirilmesinin önemini vurgulamaktadır. Ayrıca çalışma, fibromiyaljisi olan bireylerde yorgunluk ve depresif ruh halinin fiziksel kısıtlılıklardan daha etkili olduğunu göstermektedir.

Anahtar Kelimeler: Fibromiyalji sendromu, kardiyorespiratuvar, ambulatuvar kan basıncı, 6 dakikalık yürüme testi, otonom disfonksiyon, kan basıncında düşüş olmaması

INTRODUCTION

Fibromyalgia syndrome (FMS), a rheumatic disorder, is characterized by widespread chronic pain, sleep disturbances, stiffness, fatigue, and various symptoms[1]. The symptoms of FMS profoundly affect daily activities and quality of life[2]. Although the exact cause of FMS, which affects a significant proportion of the general population, is not fully understood, it is thought to be related to increased sensitivity in the central nervous system and inadequate pain inhibition pathways[3]. A significant proportion of FMS patients have autonomic nervous system dysfunction, particularly in stressful situations. This imbalance is caused by a disturbance of the harmony between the sympathetic and parasympathetic nervous systems. Studies on the autonomic nervous system in individuals with FMS have reported varying results. Some studies on FMS patients report sympathetic hyperactivity and decreased parasympathetic activity, while others report autonomic system inhibition, characterized by suppression of both systems[4].

FMS patients have several cardiovascular autonomic abnormalities. These include blunted autonomic reactivity to acute stress, changes in baroreflex sensitivity, and increased arterial stiffness[5]. Studies show that FMS patients have a non-dipper blood pressure (BP) pattern, which is when the drop in BP at night is less than 10%[6]. Even if not hypertensive, this pattern is associated with target organ damage and increased risk of cardiovascular morbidity[7]. FMS has been shown to be an independent predictor of a non-dipper BP pattern, suggesting a disrupted circadian rhythm of BP[6]. The 6 minute walk test (6MWT) is a simple, safe, and low-cost test for assessing functional capacity in various conditions, including FMS[8]. Studies have shown that FMS patients walk shorter distances on the 6MWT compared to healthy individuals[9]. Furthermore, FMS patients report higher pain intensity and perceived exertion during the 6MWT, suggesting that increased pain and exertion during physical activity exacerbates functional limitations in FMS[10]. However, studies have reported conflicting results regarding the relationship between functional capacity and quality of life in FMS[8,11-14]. Autonomic dysregulation plays a central role in explaining the complex nature of symptoms and functional limitations in FMS[4]. The objective of this study is to assess cardiorespiratory function parameters, such as functional capacity (6MWT), cardiovascular autonomic function [heart rate recovery (HRR) index and dipper/non-dipper pattern characteristics according to ambulatory BP monitoring], and to investigate the relationship between functional capacity, fatigue, depression, and fibromyalgia symptom parameters in patients with FMS. This holistic approach is critical for better understanding the complex interplay between symptoms, functional limitations, and autonomic dysregulation in FMS patients. The findings may contribute to the development of new FMS diagnosis and treatment strategies.

MATERIALS AND METHODS

This study was conducted in the Department of Physical Medicine and Rehabilitation, Faculty of Medicine, Trakya University in order to investigate the relationship between cardiopulmonary function in FMS patients and the basic parameters of the disease, such as disease severity, pain, and fatigue. Participants consented to participate in the study in accordance with the Declaration of Helsinki, as evidenced by their signatures on the informed consent form. Approval of the Trakya University Faculty of Medicine Scientific Research Ethics Committee was obtained for the study (protocol no: TÜTF-BAEK 2021/248, approval number: 12/02, date: 31.05.2021). The study group was 39 female patients diagnosed with FMS, according to the 2016 American College of Rheumatology (ACR) criteria[15]. A control group of 39 individuals without FMS and not meeting the 2016 ACR criteria was also included. Exclusion criteria were as follows: age <25 years and >50 years, musculoskeletal problems that may interfere with ambulation, uncontrolled arrhythmia, unstable ischemia, severe valvular stenosis and congenital heart disease, metabolic problems (hypo/hyperkalemia, hypovolemia); severe cardiomyopathy; active pericarditis/myocarditis; recent history of thrombophlebitis/embolism; active infection; malignancy; unstable angina; or myocardial infarction in the last month. In addition, subjects with a pre-assessed resting heart rate >120 beats/min, systolic BP >180 mmHg and/or diastolic BP >100 mmHg before the 6MWT were excluded.

Evaluation of Sociodemographic Characteristics

A comprehensive documentation of the participants' demographic and health-related information was conducted, encompassing age, height, weight, body mass index (BMI), marital status, educational background, occupational status, presence of comorbidities, and the medications related to these conditions.

Pain Intensity Assessment

The intensity of their pain was evaluated using the visual analog scale, wherein patients were instructed to indicate their pain levels on a 10-centimeter line.

Symptom Severity Assessment

Widespread Pain Index

Widespread pain is characterized by the presence of pain in a minimum of four of the five areas that have been designated as relevant. It is important to note that pain in the jaw, chest, and abdomen is not considered to be confined to the widespread pain group. For each area, areas where continuous pain has been felt in the last seven days are marked. The score ranges from 0 to 19. Conversely, elevated scores are indicative of the presence of pain[15].

Symptom Severity Scale

The scale is evaluated in two groups, A and B. The total score obtained from items belonging to these groups is calculated. In group A, all items including fatigue, waking up without rest, cognitive findings, and somatic symptoms in the last week are scored between 0-3 (maximum score: 9). In group B, headache, lower abdominal pain-cramps, and depression in the last 6 months are evaluated (maximum score: 3). Consequently, the maximum attainable score for the symptom severity scale (SSS) is 12[15].

Fibromyalgia Severity Scale

The widespread pain and symptom severity scales are utilized to ascertain whether a patient has FMS. Scores falling below 12 on these scales do not suggest the presence of the condition. A widespread pain index (WPI) of ≥7 and a SSS of ≥5, or alternatively a WPI of 4-6 and a SSS of ≥9, are indicative of FMS. The severity of the disease increases in proportion to the scores obtained. The existence of concomitant painful disorders does not preclude a diagnosis of FMS[15].

Assessment of Quality of Life and Functional Status

The fibromyalgia impact questionnaire (FIQ), which has been demonstrated to be both valid and reliable in Turkish by Sarmer et al.[16], was utilized to assess the quality of life and functional status in individuals diagnosed with FMS[17]. The scale in question encompasses ten distinct features, including physical function, general well-being, incapacity to attend work, difficulties experienced at the workplace, pain, fatigue, morning fatigue, stiffness, anxiety, and depression. With the exception of the subjective experience of well-being, low scores are indicative of recovery or a lesser degree of impact from the disease. A total FIQ score of <39 is considered as mildly affected, ≥39 to <59 as moderately affected, and ≥59 as severely affected[18].

Fatigue Severity Assessment

The fatigue levels of the participants were measured using the fatigue severity scale (FSS)[19]. The validity and reliability of this scale was previously demonstrated in Turkish by Gencay-Can and Can[20]. The scale comprises nine questions. Each question is scored on a scale ranging from 1 to 7, with 1 representing "strongly disagree" and 7 representing "strongly agree". The scores from each question are then aggregated to obtain a total score, which is subsequently calculated as the mean of these values. The attainment of elevated scores is indicative of the presence of fatigue[19].

Depression Assessment

The beck depression inventory (BDI) was utilized to assess the severity of depression in the study participants[21]. The BDI comprises a total of 21 questions. In the scale, patients are invited to select the sentence that best reflects their experience. Each item is composed of four sentences. The severity of each condition is then assigned a point value, with the most mild condition receiving a score of 0 and the most severe condition receiving a score of 3. The maximum score that can be attained is 63. Scores of 0-13 are indicative of no depression, 14-24 points indicate moderate depression, and scores of over 25 points are suggestive of severe depression[21,22].

Assessment of Cardiorespiratory Capacity and Heart Rate Recovery Index

In the present study, the 6MWT was utilized as a means to evaluate cardiorespiratory capacity, owing to its simplicity and the minimal equipment requirements. A comprehensive evaluation encompassing BP, heart rate, and oxygen saturation was conducted prior to and following the administration of the test. The participants were requested to walk as quickly as possible for a period of six minutes along a 30-meter straight corridor, and the total distance covered was meticulously recorded in meters[23]. Furthermore, the discrepancy between the heart rate at the conclusion of the test and that recorded one minute later was documented as the HRR index[24]. Abnormal HRR was defined as a decrease of 12 beats per minute or less from peak exercise heart rate[25].

Ambulatory Blood Pressure Measurement

The 24-hour evaluation was performed with BP Holter devices. The hours between 6am and 10pm were considered daytime and 10pm and 6am were considered nighttime. The devices were programmed to measure BP at 30 min intervals during daytime and 60 min intervals at night. When evaluating the ambulatory blood pressure (ABP) measurements of the participants, it was taken into consideration that the percentage of valid measurements during the day was above 70%. Those whose mean nighttime systolic BP decreased by 10% or more compared to the mean daytime value were defined as dipper, and those who decreased less were defined as non-dipper. A 24-hour average of systolic BP ≥130 mmHg and/or diastolic BP ≥80 mmHg was considered hypertensive[26].

Sample Size Calculation

The power analysis using G*Power revealed that 80% power could be achieved with 95% confidence if the study included 78 participants (39 in each group).

Statistical Analysis

The statistical analysis of the data was conducted utilizing the SPSS 21.0 software. Continuous variables are expressed as the mean ± standard deviation, while categorical variables are presented as numbers and percentages. The chi-squared test was utilized for the purpose of comparing qualitative data, while the Student t-test and Mann-Whitney U test were employed for the purpose of comparing quantitative data. Spearman's correlation analysis was utilized to evaluate the bilateral relationships between the variables. The results were evaluated with a 95% confidence interval and a significance level of $p<0.05$.

RESULTS

In the present study, a total of 78 subjects participated, comprising 39 women diagnosed with FMS who were undergoing outpatient care at the Department of Physical Therapy and Rehabilitation, Trakya University Faculty of Medicine Hospital, and 39 female volunteers without FMS, ranging in age from 25 to 50 years. Demographic data of the study participants are shown in Table 1. When demographic characteristics were compared, no statistically significant difference was found between the two groups in terms of age and BMI averages ($p>0.05$), while statistically significant differences were found between marital status, educational status, and occupational groups ($p<0.05$). 24.4% of FMS patients used duloxetine, 6.4% used pregabalin. A comparison of the two groups in terms of reported comorbidities showed no statistically significant difference between the FMS and control groups. The distribution of comorbidities and medications for these comorbidities is shown in Table 2. The comparison of the symptom parameters of the FMS group and the control group is demonstrated in Table 3. Statistically significant differences were identified in all of the evaluated parameters ($p<0.05$). The statistical significance values of the difference between the mean 6-minute walking distance (6MWD) and HRR index of the FMS and control groups are shown in Table 4. A total of 16 subjects (41%) in the FMS group and 12 subjects (30.8%) in the control group exhibited abnormal HRR. While the mean 6MWD in the FMS group was statistically significantly lower than the control group ($p<0.05$), no statistically significant difference was found between the two groups in terms of both the mean HRR index and the number of patients with normal and abnormal HRR index ($p>0.05$). After the 24-hour ABPM, 11 people in the FMS group and 6 in the control group were found

Table 1. Demographic characteristics of participants

		FMS group (n=39)		Control group (n=39)		
		n	%	n	%	p
Age (years)	Mean ± SD (min-max)	41.74±6.00 (28-50)		38.95±6.64 (25-50)		0.055*
BMI (kg/m²)	Mean ± SD (min-max)	27.02±5.02 (18.80-40.10)		25.47±5.00 (18.00-39.10)		0.149***
Marital status	Married	35	89.7	26	66.7	**0.028****
	Single	4	10.3	13	33.3	
Educational background	Primary school	14	35.9	9	23.1	**0.002****
	Middle school	3	7.7	0	0	
	High school	12	30.8	4	10.3	
	University	10	25.6	26	66.7	
Occupational status	Housewife	18	46.2	7	17.9	**0.003****
	Employee	18	46.2	32	82.1	
	Retired	3	7.7	0	0	

*: Student's t-test, **: Chi-square test, ***: Mann-Whitney U test, level of significance set at $p<0.05$ BMI: Body mass index, FMS: Fibromyalgia syndrome, SD: Standard deviation, min: Minimum, max: Maximum,

Table 2. Distribution of comorbidities and medications of participants

		FMS group (n=39)		Control group (n=39)		
		n	%	n	%	p*
Comorbidities	Hypertension	10	25.6	3	7.7	0.068
	Diabetes mellitus	4	10.3	0	0	0.115
	Thyroid diseases	3	7.7	0	0	0.240
	Asthma	3	7.7	0	0	0.240
	Other comorbidities	6	15.4	1	2.6	0.108
Medications	Antihypertensive	10	25.6	3	7.7	0.068
	Antidiabetic	4	10.3	0	0	0.115
	Medicines for thyroid diseases	3	7.7	0	0	0.240
	Asthma medicines	1	2.6	0	0	1.000
	Antidepressants	1	2.6	0	0	1.000
	Other medications	3	7.7	2	5.1	1.000

*: Chi-square test, level of significance set at p<0.05, FMS: Fibromyalgia syndrome

Table 3. Comparison of symptom parameters between FMS and control groups

	FMS group Mean ± SD (n=39)	Control group Mean ± SD (n=39)	p*
VAS pain score (0-10)	4.49±1.89	0.97±1.06	**0.000**
Widesprain pain index (0-19)	8.44±4.33	1.97±1.61	**0.000**
Symptom severity scale (0-12)	7.08±2.39	3.28±1.26	**0.000**
Fibromyalgia severity scale (0-31)	15.51±5.31	5.25±2.24	**0.000**
Fibromyalgia impact questionnaire (0-100)	46.30±18.86	16.64±8.14	**0.000**
Fatigue severity scale (0-7)	5.37±1.44	3.16±1.31	**0.000**
Beck depression inventory (0-63)	13.77±8.41	7.46±6.20	**0.001**

*: Mann-Whitney U test, level of significance set at p<0.05, FMS: Fibromyalgia syndrome, VAS: Visual analog scale, SD: Standard deviation

Table 4. Comparison of 6-minute walking distance and HRR index between FMS and control groups

	FMS group Mean ± SD (min-max) (n=39)	Control group Mean ± SD (min-max) (n=39)	p*
6-minute walking distance (m)	492.26±53.95 (350-570)	550.13±44.56 (485-648)	**0.000**
HRR index (beat)	14.33±20.41 [(-33)-83]	18.89±20.79 [(-18)-85]	0.294

*: Mann-Whitney U test, level of significance set at p<0.05, FMS: Fibromyalgia syndrome, HRR: Heart rate recovery, SD: Standard deviation, min: Minimum, max: Maximum

to have hypertension. When these people were redistributed to their groups, 21 (26.9%) in the FMS group and 9 (11.5%) in the control group were found to have hypertension. The FMS group had a higher number of hypertensive patients than the control group (p<0.05). A comparison was made of the numbers of normal dipper and non-dipper individuals in the FMS group and the control group according to the data obtained as a result of 24-hour ABPM. The results showed that 82.1% of the individuals in the FMS group (32 patients) and 59% of the individuals in the control group (23 patients) showed a non-dipper pattern. The probability of being a non-dipper in the FMS group was higher than in the control group (p<0.05). In the 24-hour average systolic BP, a decrease in nighttime systolic BP was observed, with an average reduction of 5.29±6.30% in the FMS group and 6.82±7.3% in the control group. A statistical analysis revealed no significant difference between the groups (p>0.05). A correlation analysis was conducted on the symptom parameters of participants in the FMS group. The SSS score was correlated with the FSS score. There was a positive relationship between the fibromyalgia severity (FS) scale score and the FSS and BDI scores, as well as an inverse relationship with the 6MWD. The FIQ score was correlated with the FSS and BDI scores, but not the 6MWD score. The correlation analysis is displayed in Table 5.

DISCUSSION

The study examined the effects of fibromyalgia on cardiorespiratory and autonomic nervous system functions, as well as quality of life, in women with FMS. FMS patients exhibited a reduced 6MWD compared to the control group,

Table 5. Correlation of the symptom parameters of the participants in the FMS group, with FSS, BDI, and 6MWD

		Fatigue severity scale	Beck depression inventory	6-minute walking distance
Widesprain pain index	**r**	0.018	0.161	0.162
	p	0.912*	0.328*	0.326*
Symptom severity scale	**r**	**0.665**	0.289	-0.042
	p	**0.000***	0.074*	0.801*
Fibromyalgia severity scale	**r**	**0.619**	**0.457**	**-0.444**
	p	**0.000***	**0.000***	**0.000***
Fibromyalgia impact questionnaire	**r**	**0.717**	**0.541**	-0.069
	p	**0.000***	**0.000***	0.675*

*: Spearman correlation analysis, level of significance set at p<0.05, FMS: Fibromyalgia syndrome, FSS: Fatigue severity scale, BDI: Beck depression inventor, 6MWD: Six-minute walking distance

suggesting potential cardiovascular implications. While HRR was comparable, fibromyalgia patients had a higher prevalence of non-dipper BP patterns. Higher FS was associated with greater fatigue and depression, and lower severity with better walking distance. The correlation between symptom severity and fatigue was statistically significant. However, there was no correlation between symptom severity and depression. The investigation revealed no correlation between WPI and FSS scores, BDI, or 6MWD. The impact of fibromyalgia was associated with severity of fatigue and depression, but not 6MWD. The study found that FMS affects exercise capacity and well-being, as well as the cardiorespiratory system, particularly through effects on the autonomic nervous system, and symptom relationships are complex, emphasizing the multifaceted nature of the disease. The study demonstrated that individuals diagnosed with FMS exhibited diminished exercise capacity in comparison to individuals without FMS. This finding aligns with the findings of previous research and is associated with the severity of fibromyalgia[27-29]. The investigation further highlighted the impact of FMS on the autonomic nervous system, observing elevated arterial BP[4]. In healthy people, a decrease in BP at night, known as the "dipping pattern", is expected due to the circadian rhythm of BP. This rhythm is controlled by the autonomic nervous system, especially the sympathetic nervous system[26,30]. However, FMS patients often show a "non-dipping pattern", which is associated with cardiovascular risks[31,32]. Inal et al.[6] found an association between FMS and non-dipping BP, with a higher frequency in FMS patients than in healthy individuals, suggesting an additional risk factor. The study included both normotensive and hypertensive individuals and found that the majority had a non-dipping pattern in both groups, although the frequency was higher in the FMS group compared to the control group, consistent with previous research[6]. It is known that patients with FMS are at a higher risk for cardiovascular disease than healthy people[33,34]. Inadequate levels of moderate-to-high-intensity physical activity are blamed for this, in particular[33]. However, the non-dipper pattern may also contribute to the increased cardiovascular risk in FMS patients[7,31,35]. This pattern has been associated with cardiovascular morbidity in both normotensive and hypertensive individuals[7,31]. This association appears to be independent of traditional risk factors, such as office and 24-hour ABP levels[35]. Therefore, determining if FMS patients have a non-dipper pattern by performing ABP monitoring in addition to one-time BP checks may help reduce cardiovascular disease risk. Large-scale studies examining the relationship between cardiovascular risk and the non-dipper pattern in fibromyalgia patients would be helpful in this regard. The decline in heart rate following exercise at the anticipated rate has been demonstrated to be predominantly associated with the reactivation of the parasympathetic nervous system[5]. This phenomenon serves as an indicator of optimal autonomic nervous system regulation, thereby contributing to the maintenance of physiological balance and well-being. Abnormal HRR index, defined as a 12-beat drop or less in heart rate per minute after exercise, predicts mortality independent of workload and heart rate changes during exercise[25]. In addition to studies suggesting that FMS patients have a reduced chronotropic response to exercise and slower HRR compared to healthy individuals[36,37], there are also authors who, in parallel with our study, have found that FMS patients are similar to individuals without FMS in terms of HRR index[38]. Bardal et al.[38], who found similar results to our study, evaluated HRR index after a submaximal exercise test as in our study. It is hypothesized that the discrepancy in results between the studies is attributable to variations in the utilized test protocols. As previously indicated by Bardal et al.[38], in instances where a protocol of HRR index assessment is implemented, ensuring the maintenance of comparable absolute loading during the HRR period, FMS patients may show a narrower drop in the rate of post-exercise heart rate due to their lower aerobic capacity. Whereas in both the Bardal et al.[38] study and the current study, participants were at rest during the HRR period. The contradictory findings observed in this study reflect the intricate nature of autonomic nervous system dysfunction. While extant studies generally report sympathetic hyperactivity and decreased parasympathetic activity in FMS patients, some authors report autonomic system inhibition, characterized by suppression of both the sympathetic and parasympathetic systems[4]. This finding

suggests that the HRR index may be a misleading metric for evaluating the autonomic function of FMS patients. Numerous studies have demonstrated the negative impact of FMS on quality of life[39-41]. The FIQ is a specific questionnaire that measures all aspects of FMS. It is the most commonly used quality of life scale in studies conducted with FMS patients[42]. Our study found a moderate impact on quality of life when considering the mean score of the FMS group. FIQ scores were associated with fatigue and depression, which supports previous studies[43,44]. Conversely, the absence of correlation between the extensive distribution of pain and FSS scores, in addition to BDI scores, demonstrates the complex nature of symptom relations in FMS. As Martinez et al.[45] observed, fluctuations in pain levels during the day can complicate the discernment of relationships between FMS symptoms. Additionally, while fibromyalgia patients walked shorter distances than patients without fibromyalgia, no correlation was found between the 6MWD and the total FIQ score. The literature contains conflicting results regarding the existence of this correlation. Some studies found no association[11,12], while others reported weak to moderately significant associations[8,13,14]. These discrepancies may be due to the multifaceted nature of FMS and the sensitivity of the measurement tools. In patients with FMS, fatigue and depressed mood may have a greater impact than diminished physical capacity. Some patients may develop high willpower or adaptive strategies to perform daily activities, leading them to perceive a better quality of life even if their physical performance is low[11]. The 6MWD and FIQ provide different yet complementary information. Combining objective performance tests and subjective questionnaires is essential for understanding potential discrepancies between a patient's functional capacity and their perception of disease burden.

Study Limitations

The cross-sectional nature of our study, which examined the relationship between FMS clinical parameters and the cardiovascular system, constitutes a significant limitation. The modest size of the FMS population in the study area, in conjunction with the presence of hypertensive and normotensive individuals within the groups, serves to limit the generalizability of the results. Another limitation of the study is the heterogeneous nature of the groups. The groups included participants with comorbidities that could affect the autonomic nervous system, such as hypertension, diabetes, and thyroid disease, as well as participants who used medications such as antihypertensives and antidepressants. Similar levels of comorbidities in both groups mitigate the negative impact of this limitation on subsequent results. Subsequent studies are planned to enhance the patient population in our study by incorporating new patients and to promote greater homogeneity within the group.

CONCLUSION

This study investigated the effects of fibromyalgia on cardiorespiratory and autonomic nervous system functions, as well as quality of life, in women. The findings suggest that women with fibromyalgia have poorer physical capacity compared to unaffected women. The autonomic nervous system assessment revealed that the HRR index, which relates to the parasympathetic nervous system, was similar between the two groups. However, the "non-dipper" pattern, which relates to the sympathetic nervous system and was determined by 24-hour ABP monitoring, occurred more frequently in women with fibromyalgia. These results imply a potential cardiovascular risk in FMS patients and highlight the intricate nature of the autonomic nervous system. In consideration of the impact on quality of life and psychological factors, it has been observed that fatigue and depressive symptoms have the capacity to exacerbate the impact of fibromyalgia on patients. However, a similar relationship was not observed with functional capacity. In conclusion, it is crucial to consider circadian BP rhythms along with office BP measurements when evaluating patients with FMS. FMS is a multifaceted disorder involving physical limitations, autonomic imbalance, and psychological distress. The impact of FMS on patients' lives may not be directly related to physical performance. This is important to understand and to improve FMS patients' lives.

Ethics

Ethics Committee Approval: Approval of the Trakya University Faculty of Medicine Scientific Research Ethics Committee was obtained for the study (protocol no: TÜTF-BAEK 2021/248, approval number: 12/02, date: 31.05.2021).

Informed Consent: Participants consented to participate in the study in accordance with the Declaration of Helsinki, as evidenced by their signatures on the informed consent form.

Footnotes

Authorship Contributions

Concept: İ.K., N.T., H.Ö., D.D.K., Design: İ.K., N.T., H.Ö., D.D.K., Data Collection or Processing: İ.K., N.T., H.Ö., Analysis or Interpretation: İ.K., N.T., H.Ö., D.D.K., Literature Search: İ.K., N.T., H.Ö., D.D.K., Writing: İ.K., N.T., H.Ö.

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