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Original Article

Evaluation of the Effectiveness of an Aerobic Exercise Program and the Personality Characteristics of Patients with Fibromyalgia Syndrome: A Pilot Study

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Abstract. [Purpose] The aim of this study was to assess the effectiveness of a 6-week aerobic exercise program on pain, physical function, and psychological status, and to evaluate the personality characteristics of fibromyalgia syndrome (FMS) patients. [Subjects and Methods] Fourteen women with FMS were enrolled. They were trained for a 6-week home-based aerobic exercise program. The Fibromyalgia Impact Questionnaire, the Beck Depression Inventory, the visual analog scale of pain and sleep quality were measured at baseline and at the end of week 6. The personality profiles were evaluated using the Minnesota Multiphasic Personality Inventory (MMPI). [Results] After the exercise program, significant improvements were determined in pain, sleep quality, physical function, depression and FMS symptoms compared to baseline. In addition, the hysteria item (71.21±8.84) of the MMPI was significantly higher in FMS. [Conclusion] Our findings indicate that home-based aerobic exercise may be a useful treatment in the management of FMS. Personality characteristics should be considered during the planning process of the treatment of FMS. Personality is a filter between life events and psychological responses. It is defined to be the integration of effective and behavioral patterns. Long-term studies involving larger clinical samples are needed to define the role of personality characteristics in FMS.
Key words: Fibromyalgia syndrome, Aerobic exercise, Personality characteristics

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INTRODUCTION

Clinical diagnosis of fibromyalgia syndrome (FMS) is based on many accompanying subjective symptoms such as fatigue, sleep disorders, stiffness, irritable bowel syndrome, depression, and anxiety, in addition to chronic widespread musculoskeletal pain[1)]. According to the American College of Rheumatology (ACR) 1990 classification criteria, FMS is defined as >3 months of continuous tenderness determined by a finger pressure of around 4 kg at at least 11 out of 18 predefined sites and widespread musculoskeletal pain[2)]. Recently, new ACR diagnostic criteria including fatigue, non-restorative sleep, abdominal discomfort and cognitive symptoms have been proposed[3, 4)]. No single factor is determined to be cause of FMS. Although it is reported that a multifactorial condition with various biological and psychosocial factors may play a role in the initiation and maintenance of pain, the etiopathogenesis of pain is not yet fully understood[5, 6)]. Therefore, therapy targeting the underlying cause is not possible. Various pharmacological and non-pharmacological treatment modalities have been tried. It is reported that the available treatment modalities provide relief of symptoms in less than 50% of patients[6)]. Exercise is considered to be a part of FMS treatment[6)]. Aerobic exercise programs have been shown to improve the physical capacity of patients with FMS[1)]. Additionally, it has been suggested that aerobic exercise has modest effects on some symptoms of FMS and physical function[6, 7)]. Researchers have investigated the effectiveness of various exercises programs including bicycle ergometer, side step in the pool, jogging, walking outdoors and walking on a treadmill[6, 8)]. Some studies have reported that aerobic exercise has posi-

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tive effects on pain, disability and mood[8, 9]. In a meta-analysis, it was mentioned that the effectiveness of aerobic and strengthening exercises on general well-being in FMS is contradictory. In the assessment of functional condition, the positive effects of exercise have been reported in some studies using the Fibromyalgia Impact Questionnaire (FIQ), but the absence of a statistically significant difference has also been reported[10]. Although there might be many reasons behind these differing results, one possibility is the personality characteristics of the patients. It has been showed that the profiles of individuals with FMS include difficulties regarding physical, functional and psychological status. Additionally, it has been emphasized that odyophobia lies at the bottom of psychological and behavior responses in the subgroups comprised of individuals with FMS and a self-management approach should be included in the treatment for chronic pain[11]. According to the biopsychosocial model of health, personal beliefs and actions affect the health an individual. It has been reported that when education programs developing self-managements for individuals are supported by exercise programs, there are positive effects on physical function and FMS symptoms[12]. A previous study also reported that some personality parameters assessed by The Minnesota Multiphasic Personality Inventory (MMPI) differ with pain management[13].

Besides FMS is a disease characterized by widespread pain and tender points, therefore it is important to consider the psychological aspect of FMS[14]. It has been reported that it is necessary to focus on dysfunction in both physical and emotional aspects of treatment together[9]. Evaluation of personality characteristics and the role of personality characteristics in treatment planning are important in FMS. In this study, we aimed to evaluate the personality characteristics of patients with FMS and to assess the pain, quality of sleep, physical function, and depression parameters after a 6-week home-based aerobic exercise program.

SUBJECTS AND METHODS

Eighteen female patients admitted to the Physical Medicine and Rehabilitation Department of Bakirkoy Dr. Sadi Konuk Training and Research Hospital and diagnosed with FMS according to 1990 ACR classification criteria were included in this study. The exclusion criteria were as follows: psychotic disorder; suicidal ideation; presence of neurological disease; use of neurological and psychiatric tricyclic antidepressant, antipsychotics, selective serotonin-norepinephrine reuptake inhibitors, or medicines similar to anticonvulsants; presence of a systemic disease that would interfere with doing exercise; pregnancy or abnormality in routine tests. This study was approved by the Ethics Committee of Bakirkoy Dr. Sadi Konuk Training and Research Hospital and written informed consent was received from each subject prior to their participation. Demographic characteristics, FMS symptoms and the number of tender points of the patients were identified. Pain and quality of sleep were assessed using Visual Analog Scale (VAS). Physical function was assessed with the FIQ, depression was assessed with the Beck Depression Inventory (BDI), and personality characteristics were assessed with the MMPI. The Structured Clinical Interview for DSM-IV Axis I Disorders (SCID-I) was used to determine whether the patients had DSM-IV Axis I disorders or not. A home-based exercise program was performed three times a week for 6 weeks. Each exercise session lasted 60 minutes and consisted of a warming-up period of 10 minutes, moderate intensity aerobic exercises period of 40 minutes and a cooling down period of 10 minutes. The training program included exercises for strength, endurance, and elasticity, and stretching of both the upper and lower extremities. The intensity of exercise was performed at a heart rate (HR) of between 60% and 80% of the maximal heart rate, which was calculated by Karvonen formula (target HR= ((220-age)-Resting HR) × 0.60 + Resting HR±5). The exercise program was performed by a physiotherapist. The training program was checked by a physical therapy and rehabilitation specialist every 2 weeks.

In this study, we assessed whether there were significant differences in the pain, quality of sleep, physical function and depression parameters of the patients with FMS before and after the exercise program. Additionally, features of the psychiatric diagnosis and personality profiles of the patients were evaluated.

NCSS (Number Cruncher Statistical System) 2007 Statistical Software (Utah, USA) program was used for the statistical analysis performed in this study. The paired t-test was used for comparisons of descriptive statistics (mean, standard deviation) as well as for comparisons of data before and after treatment. McNemar's test was used for the comparison of qualitative data, and Pearson's correlation test was used for the comparison of the correlations among the variables. Significance was accepted for values of $p<0.05$.

RESULTS

Four of 18 patients included in our study dropped out of the study because they did not want to maintain the exercise program. Therefore, the data of only 14 patients with FMS used in the analysis. The mean age of the patients with FMS was 43±5.33 years (minimum: 25, maximum: 43), and their mean body mass index (BMI) was 24.21±3.3 (minimum: 17.99, maximum: 30.11) kg/m^2. The other demographic characteristics are shown in Table 1.

After exercise, the symptoms accompanying FMS (fatigue, morning stiffness, disturbance of sleep, morning fatigue, paresthesia, headache, irritable bowel syndrome and soft tissue edema) were determined to be significantly lower than before exercise ($p<0.05$) (Table 2).

The number of tender points, VAS values for pain, and quality of sleep after exercise were found to be significantly lower than their respective values before exercise ($p<0.05$) (Table 3).

In the patients with FMS, mean values of physical function, feeling good, pain, fatigue, resting, stiffness, anxiety, depression parameters and total FIQ scores after the exercise program, except the working parameter, ($p>0.05$) were determined to be significantly improved compared to before the exercise program ($p<0.05$) (Table 3).

Table 1. Demographic characteristics of the patients with fibromyalgia syndrome

Variable	Mean ± SD	Minimum	Maximum
Age (year)	35.43 ± 5.33	25	43
BMI (kg/m²)	24.21 ± 3.3	17.99	30.11
Number of children	1.5 ± 1.16	0	3
Variable		n	%
Education	Primary school	2	14.3
	Secondary school	3	21.4
	High school	5	35.7
	University	4	28.6
Marrial status	Single	2	14.3
	Married	11	78.6
	Divorced	1	7.1
Occupation	Housewives	8	57.14
	Employees	3	21.43
	Public official	1	7.14
	Private sector	2	14.9
Smoking	Yes	3	21.4
	No	11	78.6

BMI: Body Mass Index, SD: Standard Deviation

Table 2. Comparison of accompanying fibromyalgia syndrome before and after exercise

	Before exercise		After exercise	
Variable	n	%	n	%
Fatigue*	13	92.9	6	42.9
Morning stiffness*	13	92.9	5	35.7
Sleep disorder*	12	85.7	4	28.6
Morning tiredness*	13	92.9	8	57.1
Paresthesia*	11	78.6	3	21.4
Headache*	13	92.9	7	7
Raynaud's phenomenon	0	0.0	0	0
Irritable bowel syndrome*	7	50.0	1	7.1
Sicca symptoms	3	21.4	1	7.1
Female urethral syndrome	5	35.7	1	7.1
Soft tissue edema*	11	78.6	1	7.1
Dysmenorrhea	8	57.1	2	21.4

*p<0.05

Table 3. Comparison of clinical parameters before and after exercise

	Before exercise	After exercise
Variable	Mean ± SD	Mean ± SD
Number of tender points by palpation*	14.79 ± 1.37	8.36 ± 3,05
VAS pain*	7.71 ± 2.16	4.29 ± 2.43
VAS sleep*	6.14 ± 2.98	3.64 ± 2.68
FIQ physical function*	5.21 ± 1.54	4.34 ± 1.95
FIQ feeling good*	7.04 ± 2,13	4.18 ± 2.47
FIQ job loss	0 ± 0	0 ± 0
FIQ working	5.4 ± 3.44	3.8 ± 0.84
FIQ pain*	7.79 ± 2.04	4.64 ± 2.31
FIQ fatigue*	8.21 ± 1.53	6.71 ± 2.81
FSESF resting*	9 ± 1.24	6.71 ± 2.81
FIQ stiffness*	7.29 ± 2.55	5.14 ± 3.37
FIQ anxiety*	7.93 ± 2.16	5.5 ± 2.9
FIQ depression*	7.29 ± 1.98	4.57 ± 2.9
Total FIQ*	70.58 ± 14.64	50.57 ± 20.53
BDI*	17.57 ± 7.82	10.64 ± 7.52

*p<0.05, VAS: Visual Analog Scale, FIQ: Fibromyalgia Impact Questionnaire, BDI: Beck Depression Inventory, SD: Standard Deviation

Mean BDI after exercise was found to be significantly lower than mean BDI before exercise (p<0.05) (Table 3).

When SCID-I was investigated, major depression, dysthymia or depressive disorder not otherwise specified were determined in 5 patients (35.7%). Social phobia, generalized anxiety disorder, or obsessive compulsive disorder were determined in 6 patients (42.9%), and specific phobia in 3 patients (21.4%). Anxiety disorder not otherwise specified was determined in 9 patients (64.3%), and somatoform disorders in 8 patients (57.1%). Diagnosis of panic disorder, post trauma stress disorder, adjustment disorder or other DSM IV disorders were not seen in any patient. Major depression, dysthymia or depressive disorder not otherwise specified according to SCID-I lifetime values were determined in 13 patients (92.9%). Obsessive compulsive disorder was determined in 6 patients (42.9%) and anxiety disorder not otherwise specified in 9 patients (64.3%). Adjustment disorder was determined in 4 patients (28.6%), social phobia or generalized anxiety disorder in 12 patients (85.7%) and specific phobia in 7 patients (50%). Somatoform disorders were determined in 8 patients (57.1%) but post-traumatic stress disorder, panic disorder or other DSM IV disorders were not found in any patient.

According to the MMPI personality inventory, only the hysteria subscale score (71.21±8.84) was determined to be above the significance level (Table 4).

DISCUSSION

Non-pharmacological approaches to treatment of FMS have gradually gained in importance in recent years. A physical exercise program is an important treatment option either alone or combined with the other treatment components in the treatment of FMS due to its relatively ease of applicability, low risk and low cost[10, 15–17]. It has been reported that a home exercise program is effective at easing the level of pain and improving functional status[18]. In addition researchers have suggested that active individual exercise programs improve muscle function[19].

In the literature, the positive effects of aerobic exercise on pain, physical function and quality of life have been reported[9, 10, 15]. A meta-analysis reported a significant improvement in the number of tender points by palpation after

Table 4. Assessment of the personality characteristics of the patients with Fibromyalgia Syndrome by the Minnesota Multiphasic Personality Inventory

MMPI	Mean ± SD	Minimum	Maximum
Lie	55.43 ± 11.37	41	81
Frequency	50.64 ± 7.47	38	65
Correction	52 ± 10.36	37	72
Hypochondriasis	63.86 ± 6.62	50	71
Depression	58.57 ± 10.97	42	78
Hysteria	71.21 ± 8.84	52	86
Psychotic deviation	53.86 ± 9.7	35	73
Male-female	48.21 ± 10.28	34	66
Paranoia	51 ± 9.66	31	62
Psychasthenia	56.93 ± 9.47	42	73
Schizophrenia	52.86 ± 7.61	38	63
Hypomania	48.43 ± 7.6	37	64
Social introversion	58.64 ± 8.71	45	74

MMPI: The Minnesota Multiphasic Personality Inventory, SD: Standard Deviation

aerobic exercise alone or in combination with strengthening exercises, and its authors emphasized that improvement in the number of tender points through exercise supports the reduction of widespread pain and tenderness in female patients with FMS[20]. Jones et al.[21] reported positive effects of submaximal aerobic exercise on pain, fatigue and the quality of life. Häuser et al.[16] reported positive effects of aerobic and mixed exercise on physical function. In contrast, King et al.[22] concluded that aerobic exercise was ineffective in the treatment of physical function as assessed by FIQ in the patients with FMS. On the other hand, in the systematic review performed by Busch et al.[23] the positive effects of aerobic exercise on FMS symptoms are reported. Additionally, in another review, Busch et al. again emphasized the positive effects of aerobic exercise on pain, the number of tender points, physical function and FMS symptoms, albeit with the caveat that more comprehensive studies of exercise prescription and compliance of patients with the exercise program were necessary[24].

According to the results of our study, a significant improvement was seen in the symptoms accompanying FMS, the number of tender points by palpation, VAS score of pain and quality of sleep in the patients with FMS after the home-based aerobic exercise program. According to the assessment of physical function by the FIQ, a significant improvement was found in all items except that of working. The symptoms of the patients with FMS, and the type and levels of physical exercise affect the response to FMS treatment[9]. Most authors have recommended gradually increasing the intensity of exercise and the "start low and go slow" approach and moderate intensity exercise programs are especially recommended. A reduction in post-exercise pain and fatigue complaints with these approaches suggest that this type of approach is most suitable[9, 25]. The authors of a previous study tried to develop a formula to calculate target heart rate for aerobic exercise program using a mathematical model. According to this model, the recommended exercise intensity for patients with FMS is within the range of 52–60% of heart rate reserve or 75–85% of HR at the anaerobic threshold[26]. In our present study, the intensity of exercise was a HR of 60–80% of maximal HR reserve.

In addition to FMS symptoms, and characteristics of physical exercise, the importance of psychological characteristics has also been mentioned in relation to FMS treatment[9]. The correlation between chronic pain and emotional, physical and social function was shown in two studies[10, 27]. In a meta-analysis, it was reported that aerobic exercise interventions had positive effects on depression[16]. Mannerkorpi et al.[12] used the Hospital Depression Scale to assess the psychological status before and after exercise and reported that there was a mild improvement in the scale. In our study, post-exercise mean BDI was significantly lower than the pre-exercise mean BDI.

Some studies have reported poor patient compliance with exercise regimes and high dropout rates[28, 29]. In our study, 4 patients dropped out because they did not want to continue the exercise program. Although it was reported that the personality characteristics of patients with FMS were heterogeneous in a review, studies performed on this subject have been very few. Assessment tools and the characteristics of the patients included in studies might have contributed to these differences[30]. In our study, we evaluated the personality characteristics of the patients with FMS using the MMPI. According to the MMPI personality inventory, a significant decrease was found only in the hysteria item. The hysteria scale of the MMPI is a subset of individuals with higher scores who mainly use denial, who are childishly egoistic, and have anxiety-related somatic complaints. It is known that personality plays a major role in the etiology of psychosomatic disorders[31]. Taking account of this, multidisciplinary approaches should be planned to increase the participation of patients in an exercise program by evaluation of personality characteristics and psychological status of the patients before the exercise program.

A home-based exercise program is a training program for the patient[32–34]. Some studies have reported the effectiveness of home-based programs including exercise program. For example, in a controlled study, it was reported that targeted individual training increases the effectiveness of exercise in the treatment of FMS[34]. Another study mentioned that frequent visits during a training program had significant effects on the psychosocial status of patients with FMS[35]. In our study, the 6-week home-based aerobic exercise programs of the patients with FMS were checked by a physical therapy and rehabilitation specialist every two weeks.

In a meta-analysis performed by Häuser et al.[36], results were assessed over a period of 1–15 months. Moreover, the assessment was performed according to whether the total exercise period was shorter or longer than 30 hours. Häuser et al. emphasized that short-term and long-term aerobic exercise program had positive effects on physical function and depression but that multicomponent treatment programs are necessary to increase compliance with an exercise program during long-term home care. With the development of individually focused psychological strategies for patients with

FMS, it is generally accepted that maintaining compliance with an aerobic exercise program increases the success of the treatment. FMS is a highly complicated syndrome and its etiopathogenesis is not yet well understood. However, many studies indicate that it is a neurobiological disease and emphasize its association with central sensitization, endocrine factors, sleep disorders, psychosocial, physical stress and physical trauma[37]. It has also been reported that physical function, anxiety, pain, stiffness, general fatigue and morning tiredness of FMS patients are significantly improved by psychosocial training[33].

Psychosocial training programs for personality profiles and the psychological status of the patients with FMS can be included in aerobic exercise programs. In this study, we investigated the personality characteristics of the patients with FMS while assessing the effectiveness of aerobic exercise. We wanted to confirm that aerobic exercise is effective in the treatment of FMS, and that emotional status and personality characteristics should be considered during the planning process of the treatment for FMS. We think that many more studies with a larger number of patients are required on this subject.

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