

ORIGINAL ARTICLE

Effect of Pilates Training on People With Fibromyalgia Syndrome: A Pilot Study

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ABSTRACT. Altan L, Korkmaz N, Bingol Ü, Gunay B. Effect of Pilates training on people with fibromyalgia syndrome: a pilot study. *Arch Phys Med Rehabil* 2009;90:1983-8.

Objective: To investigate the effects of Pilates on pain, functional status, and quality of life in fibromyalgia, which is known to be a chronic musculoskeletal disorder.

Design: Randomized, prospective, controlled, and single-blind trial.

Setting: Physical medicine and rehabilitation department.

Participants: Women (N=50) who had a diagnosis of fibromyalgia syndrome (FMS) according to the American College of Rheumatology criteria.

Intervention: The participants were randomly assigned into 2 groups. In group 1, a Pilates exercise program of 1 hour was given by a certified trainer to 25 participants 3 times a week for 12 weeks. In group 2, which was designed as the control group, 25 participants were given a home exercise (relaxation/stretching) program. In both groups, pre- (week 0) and posttreatment (week 12 and week 24) evaluation was performed by one of the authors, who was blind to the group allocation.

Main Outcome Measures: Primary outcome measures were pain (visual analog scale) and Fibromyalgia Impact Questionnaire (FIQ). Exploratory outcome measures were number of tender points, algometric score, chair test, and Nottingham Health Profile.

Results: Twenty-five Pilates exercise and 24 relaxation/stretching exercise participants completed the study. In group 1, significant improvement was observed in both pain and FIQ at week 12 but only in FIQ at 24 weeks. In group 2, no significant improvement was obtained in pain and FIQ at week 12 and week 24. Comparison of the 2 groups showed significantly superior improvement in pain and FIQ in group 1 at week 12 but no difference between the 2 groups at week 24.

Conclusions: We suggest Pilates as an effective and safe method for people with FMS. Our study is the first clinical study designed to investigate the role of the Pilates method in FMS treatment. We believe that further research with more participants and longer follow-up periods could help assess the therapeutic value of this popular physical exercise method.

Key Words: Exercise; Fibromyalgia; Rehabilitation.

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FIBROMYALGIA SYNDROME is characterized by chronic widespread pain, reduced pain threshold, hyperalgesia, and allodynia. This common rheumatologic condition has a wide clinical array of symptoms such as fatigue, depression, anxiety, sleep disturbance, headache, migraine, variable bowel habits, diffuse abdominal pain, and urinary frequency.¹ The precise pathogenesis of FMS remains unknown; however, several mechanisms such as peripheral and central hyperexcitability at spinal or brainstem level, altered pain perception, and somatosensation have been hypothesized and indeed demonstrated in some patients.² Treatment of FMS is usually symptomatic because of the lack of understanding of its etiology and pathophysiology, and several treatment modalities ranging from antidepressant therapy to biofeedback and electroacupuncture have been suggested.^{1,3} A range of pharmacologic and non-pharmacologic management options have also been examined in evidence-based guidelines and reviews.^{1,4} A stepwise program emphasizing education, certain medications, exercise, cognitive therapy, or a combination of all these modalities has been recommended in the light of current evidence.¹

Exercise programs were reported to be helpful in FMS patients in several studies, and the programs including stretching, strength maintenance, and aerobic conditioning were accepted as a standard treatment protocol.⁵⁻¹⁰ A recent review has suggested the beneficial effect of supervised aerobic exercise training and strength training on physical capacity and clinical symptoms in FMS patients.¹¹ However, the standardization of the type, intensity, and duration of exercise has not yet been delineated, and authors have emphasized the necessity of further research for the long-term benefit of exercise in FMS.^{11,12}

Pilates is a particular exercise approach that was founded on the teachings of Joseph Pilates (1880–1967) and was initially practiced almost exclusively by athletes and dancers. Pilates has become a fast-growing, popular trend in rehabilitation and fitness programs in recent years.¹³ Pilates can be described as a method combining Oriental and Western philosophies including yoga, dance, durability-strength training, and gymnastics. The goal of Pilates training is improvement of general body flexibility and health, emphasizing core (truncal) strength, posture, and coordination of breathing with movement.¹⁴ Based on anecdotal evidence, the Pilates method has been suggested to help attain the natural flexibility of the spine and limbs by increasing core strength. Additionally, there is little scientific research on the effectiveness of the Pilates method, and most of the studies performed to date have been interpreted as lacking control groups.¹⁵

Although Pilates exercise is generally adopted in training programs for healthy people as part of general fitness programs, it has been suggested as a therapeutic modality for

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List of Abbreviations

FIQ	Fibromyalgia Impact Questionnaire
FMS	fibromyalgia syndrome
NHP	Nottingham Health Profile

several musculoskeletal disorders.^{16,17} In a number of studies^{18,19} positive results have been reported in chronic low back pain patients who enrolled in Pilates training programs. The positive results were attributed to the specific training applied to the core (abdomen and back) musculature and the resultant increase in spinal resilience and improved mobility in the joints. Improvement in a participant with scoliosis has been reported in a case report.¹⁷ La Touche et al¹⁹ have reported in a recent review that there were only 2 randomized controlled trials and 1 clinical controlled trial studying the effects of Pilates on low back pain. All researchers studying the clinical effects of Pilates agreed that additional research on Pilates is necessary.

Most FMS patients feel tired and unrefreshed as a result of interruption of deep sleep by bursts of brain activity similar to wakefulness due to electroencephalographically-documented alpha-delta wave intrusions. Therefore these patients may have difficulty complying with the standard aerobic exercises.²⁰ Pilates in particular can be suggested for people with FMS, because it focuses on isometric contractions and causes less fatigue than aerobic exercises.

People with FMS have muscular asymmetry and antalgic postural problems.²¹ Jones et al²² have shown that FMS may affect peripheral and/or central mechanisms of postural control, leading to significantly impaired balance. Johnson et al²³ have reported improvement of dynamic balance compared with the control group after 10 Pilates-based exercise sessions. Pilates exercises may improve impaired posture and balance in FMS patients, because Pilates techniques aim to correct body posture by training the muscular system as a whole. More specifically, the Pilates concept locates the body center in deep muscles in proximity to the spine, and training aims to form a robust musculoskeletal structure in the upper body by providing a balanced back and abdominal musculature.²⁴

The purpose of our study was to investigate the effects of Pilates on pain, functional status, and quality of life in fibromyalgia, which is known to be a chronic musculoskeletal disorder.

METHODS

Participants

A total of 50 women participants with an age range of 24 to 63 years (mean \pm SD, 49.16 \pm 7.51) who were admitted to our rheumatology clinic with the diagnosis of FMS according to the American College of Rheumatology criteria²⁵ were included in the study. None of the participants had an accompanying rheumatoid disease, unstable hypertension, severe cardiopulmonary problems, or any psychiatric disorder affecting participant compliance. All participants were instructed to discontinue nonsteroidal anti-inflammatory drugs throughout the study period. The participants who had been begun antidepressive and/or sedative drugs at or prior to 1 month before the start of the study were allowed to continue their medication. They also were allowed to take acetaminophen when they had severe pain. For a more accurate pain assessment, patients were asked to not take acetaminophen on the morning of the assessment day. The participants were fully informed about the nature and purpose of the study, and an informed consent was obtained from each. Approval by the local ethics committee for the study was obtained.

Treatment Protocol

All participants were given an education session by a physiotherapist about the description and available diagnosis and treat-

ment methods of FMS. Next, they were assigned randomly into 2 groups using a random number table by the researcher other than the one who performed the evaluation throughout the study.

In group 1, a Pilates exercise program of 1 hour was given by a certified trainer to 25 participants 3 times a week for 12 weeks. The exercise program follows the basic principles of the Pilates method. Our protocol comprised 9 modules: postural education, search for neutral position, sitting exercise, antalgic exercises, stretching exercises, proprioceptivity improvement exercises, and breathing education. Resistance bands and 26cm Pilates balls were used as supportive equipment.

In group 2, designed as the control group, 25 participants were given a home exercise relaxation/stretching program, which has previously been routinely used for FMS patients in our clinic. The participants were instructed about this program of 1 hour 3 times a week for 12 weeks. We checked on this group's execution of the exercise program once a month. This exercise program consisted of relaxation techniques based on the published regimen by Ost²⁶ and dynamic (slow, controlled leg and arm swings), active stretching (ie, bringing the leg up high and holding it there without anything to keep it in that extended position), and passive stretching (ie, reaching out to the feet while sitting up).²⁷ Exercise in both groups was stopped at the end of week 12, and all were reevaluated at the end of week 24 after a period of 12 weeks free from exercise.

Evaluation Parameters

Evaluations were performed just before (week 0), immediately after (week 12), and 12 weeks after the treatment (week 24) by the same researcher, who was unaware of the groups the participants belonged to. All participants were asked to give no information to the examiner about their treatment protocol.

Primary Outcome Measures

Pain. Evaluation was done according to the visual analog scale. The patients were presented with a 10cm line and asked to mark an X on the line indicating the intensity of their pain over the past week. The line was labeled "no pain" at point zero at one end and "the worst pain you can imagine" at point 10 at the other end. The distance from point 0 was measured with a metric ruler and was scored between 0 and 10.

Fibromyalgia Impact Questionnaire. The FIQ is an assessment and evaluation instrument developed to measure fibromyalgia participant status, progress, and outcomes.^{28,29} It has been designed to measure the components of health status that are believed to be most affected by FMS. The FIQ is composed of 10 items. The first item is related to physical functioning. Items 2 and 3 ask the participant to mark the number of days they felt well and the number of days they were unable to work (including housework) because of fibromyalgia symptoms. Items 4 through 10 are horizontal lines, 10cm in length, on which the participant rates work difficulty, pain, fatigue, morning tiredness, stiffness, anxiety, and depression.^{24,25} A separate scoring system is used for each item. The first item consists of 11 questions that make up a physical functioning scale. The 11 questions are scored and summed to yield one physical impairment score. Each item is rated on a 4-point Likert-type scale. Raw scores on each item can range from 0 (always) to 3 (never); thus, the highest total possible raw score is 33. Item 2 is scored inversely so that a higher number indicates impairment (ie, 0=7, 1=6, 2=5, 3=4, 4=3, 5=2, 6=1 and 7=0). Raw scores can range from 0 to 7. Items 4 through 10 are scored in 10 increments. Raw scores can range from 0 to 10. The higher the FIQ score, the greater is the impact of FMS on the participant.

Table 1: Pretreatment Data for 2 Groups

	Group 1 (n=25)		Group 2 (n=24)		P
	Median	Mean ± SD	Median	Mean ± SD	
Age (y)	47.0	48.20±6.5	51.5	50.0±8.4	.118
Pain (VAS) (cm)	6.0	6.10±1.7	6.9	6.3±1.8	.580
FIQ	82.5	80.80±17.2	80.2	80.1±18.7	.976
Number of tender points	18.0	16.76±1.8	18.0	17.2±1.2	.464
Algometric score (kg/cm ²)	47.8	48.90±9.6	49.1	49.2±6.6	.726
Chair stand test (number/minute)	21.0	21.40±5.3	22.5	22.0±5.2	.489
NHP	325.6	297.10±124.2	266.8	280.3±86.6	.497

Abbreviation: VAS, visual analog scale.

Exploratory Outcome Measures

Tender points count. The number of tender points was obtained by application of a pressure of 4kg/cm² on 18 different points described in American College of Rheumatology criteria using a standard pressure algometer (Force Dial FDK 60^a).³⁰ The point was counted as tender if any pain was experienced by the subject when the 4kg/cm² pressure was applied.

Algometric score. Algometric score (kg/cm²) was calculated as the average of the minimum pain-generating pressure values obtained from 18 points.^{31,32}

Chair test. Lower-extremity endurance of each participant was evaluated by chair test. The outcome was the number of times the subject could sit down on and stand up from a chair in 1 minute.³³

Nottingham Health Profile. Life quality was assessed using the NHP. The participants were asked to answer yes or no to the items in the questionnaire. There were 8 questions on pain and physical activity, 5 on sleep, 3 on tiredness, 5 on social isolation, and 9 on emotional reaction. The weighted score for the related question was given for each yes answer, and 0 was given for each no score. The overall score was calculated separately for each parameter, and the NHP total score was obtained from the sum of the scores of these 6 parameters.^{34,35}

Statistical Analysis

We did all statistical calculations under the supervision of the staff biostatistician using the SPSS 16.0 program.^b We compared posttreatment changes occurring in each group with pretreatment values using Wilcoxon test. We compared the results between the 2 groups using Mann-Whitney U test after calculating the percentage changes for measured values and the difference scores for overall score values. We used Bonferroni correction for primary outcomes. Any P value less than .025 was considered significant.

RESULTS

One participant in group 2 was excluded from the study because she was started on selective serotonin reuptake inhibitor in a psychiatric examination during the study. Evaluation was done on the remaining 49 participants. Table 1 shows data for age and week 0 values for the evaluation parameters in both groups. Pretreatment data showed no significant difference between the 2 groups for any parameter.

Primary Outcome Measures

In group 1, pain and FIQ showed significant improvement at week 12 (P=.000), but there was no significant change at week 24 (table 2). In group 2, these parameters were not found to

Table 2: Results and Statistical Comparisons of the Pretreatment (Week 0), and Posttreatment (Week 12 and Week 24) Evaluation Parameters in Groups 1 and 2

	Week 0		Week 12		Week 24		P (Week 12 vs Week 0)	P (Week 24 vs Week 0)
	Median	Mean ± SD	Median	Mean ± SD	Median	Mean ± SD		
Pain (VAS) (cm)								
Group 1	6.00	6.1±1.70	4.0	4.1±1.7	4.8	5.2±2.5	.000	.089
Group 2	6.95	6.3±1.80	6.3	6.0±2.1	7.0	6.5±2.1	.398	.708
FIQ								
Group 1	82.50	80.8±17.20	59.0	63.5±19.6	66.3	69.3±24.7	.001	.021
Group 2	80.20	80.1±18.70	80.3	77.5±21.4	72.5	77.6±22.2	.440	.797
Number of tender points								
Group 1	18.00	16.7±1.80	14.0	13.2±3.6	14.0	13.5±3.8	.000	.000
Group 2	18.00	17.2±1.20	15.5	14.1±4.5	16.0	14.6±3.6	.001	.001
Algometric score (kg/cm ²)								
Group 1	47.80	48.9±9.60	57.0	59.1±11.3	56.6	60.1±13.8	.000	.000
Group 2	49.10	49.2±6.60	57.8	60.7±17.4	54.3	57.3±11.3	.001	.001
Chair test (no. in 1 minute)								
Group 1	21.00	21.4±5.36	22.5	23.3±4.6	23.0	22.7±3.5	.084	.266
Group 2	22.50	22.0±5.20	21.0	20.7±4.9	22.0	22.3±2.9	.099	.782
NHP								
Group 1	325.60	297.1±124.20	167.7	196.6±111.3	212.8	224.2±129.1	.000	.000
Group 2	266.80	280.3±86.60	258.2	256.5±112.4	254.4	246.3±128.1	.116	.081

Abbreviation: VAS, visual analog scale.

Pain VAS

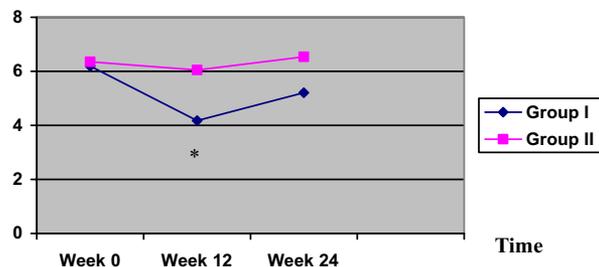


Fig 1. The change in pain severity VAS in both groups. * $P < .05$.

have significantly changed at week 12 and week 24 (see table 2) (figs 1, 2). Comparison of the groups showed significantly superior results for group 1 for both parameters ($P = .002$ for pain, $P = .01$ for FIQ) (table 3).

Exploratory Outcome Measures

In group 1, number of tender points, algometric score, and NHP showed significant improvement ($P = .000$), while there was no significant change for chair test both at week 12 and week 24. In group 2, statistically significant improvement was observed for number of tender points and algometric score, both at week 12 and week 24 ($P = .001$). The results in group 2 did not change significantly for chair test and NHP at week 12 and 24.

Comparison of the 2 groups on the basis of the posttreatment (both week 12 and week 24) percentage changes and difference scores relative to pretreatment (week 0) values showed a significant difference for chair test ($P = .014$) and NHP ($P = .005$) scores at week 12. There was no significant difference between groups at week 24.

DISCUSSION

The results of our study have shown that Pilates exercises had positive effects on pain and FIQ, especially immediately after the exercise program. Relaxation/stretching exercises were not shown to improve these parameters. Comparison of these 2 treatment groups showed superiority of Pilates over relaxation/stretching exercises in the short term for pain and FIQ, but no statistical difference existed between groups 3 months after the end of the treatment program.

Although the Pilates method has been used as part of fitness programs for a long time, it has only recently been shown to improve flexibility, abdominal muscular endurance, and static and dynamic balance in healthy people. Subsequently, it has become the subject of scientific research investigating its efficiency in patients with musculoskeletal diseases.^{23,36-40} Chronic low back pain patients were reported to benefit from Pilates exercises.¹⁹ The basic goal of Pilates training is improvement in body flexibility and general health, with emphasis on core (truncal) strength, posture, and coordination of breathing with movement. Another important contribution of the Pilates technique is avoidance of positions that demand unnecessary muscle recruitment and the ensuing early fatigue, decreased stability, and impaired recovery.²⁴ This may be an important factor that might have contributed to the ability of all participants in our study to finish the training program with no physical problems.

We observed that Pilates significantly improved pain in the participants. The effect of exercise on pain in FMS has been

investigated in an increasing number of studies since the publication of the report of Moldofsky and Scarisbrick⁴¹ about the relation between exercise and sleep deprivation. They showed that interference with stage IV sleep led to an increase in musculoskeletal symptoms in sedentary individuals, whereas trained athletes were spared this effect of sleep deprivation. In another study by Bennett et al,⁴² FMS patients were found to be unfit compared with sedentary healthy individuals. The mechanisms responsible for the analgesic effect of exercise are not clearly understood.⁴³ Although it is a widely accepted hypothesis that activation of the endogenous opioid system during exercise plays a key role in the analgesic response mechanism, several researchers have also suggested a multiple analgesic system including nonopioid mechanisms mediated by other substances such as growth hormone and corticotrophin.^{43,44} Analgesic effect of exercise may also help break the vicious cycle of pain-immobility-pain by encouraging the patients to participate in the exercise programs.⁵ Exercise may also increase the well-being of patients by preventing muscular hypoxia seen in FMS patients.⁴⁵ The failure to obtain improvement in fatigue and pain-related parameters in the relaxation/stretching exercises group in our study may suggest that standard relaxation/stretching exercises are not as effective as a Pilates program for these criteria. However, controlling home exercise participants once a month may not be enough to provide the ideal adherence to the program. Besides, performance of the exercises under direct and constant supervision of the instructor in the Pilates group might have created a placebo effect, which could have contributed to the improvement in the pain scores of the participants.

In our study, FIQ and NHP scales were used to assess the efficiency of Pilates on physical function and life quality in FMS participants. Improvement in the Pilates group was significantly superior to the relaxation/stretching exercise group after the training program, according to FIQ and NHP. Pain relief and increased flexibility provided by Pilates exercises may contribute to improved physical performance and reduced energy requirements for movement of joints (because of reduced tissue tension).

Cognitive-behavioral therapy may be of benefit to some patients with fibromyalgia in accordance with European League Against Rheumatism recommendations.¹ Pilates techniques have been developed with a goal of attaining a strong mind and using it to gain total mastery or control over the body, besides physical training. Joseph Pilates, who founded and theorized this discipline, has repeatedly emphasized the effect of Pilates on strengthening and conditioning of the mind as well as its importance as a physical regimen for the body and named his methodology "the art of controlology."²⁴ We strongly

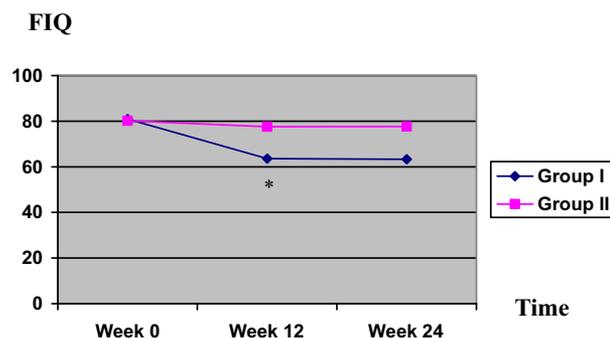


Fig 2. The change in FIQ in both groups. * $P < .05$.

Table 3: Comparison of the 2 Groups on the Basis of the Posttreatment (Both Week 12 and Week 24) Percentage Changes and Difference Scores Relative to Pretreatment (Week 0) Values

	Week 12					Week 24				
	Group 1		Group 2		P	Group 1		Group 2		P
	Median	Mean ± SD	Median	Mean ± SD		Median	Mean ± SD	Median	Mean ± SD	
Pain (VAS) (cm)	-2.2	-0.3±0.2	0.0	0.0±0.3	.002	-0.80	-0.1±0.3	0.0	0.0±0.4	.170
FIQ	-16.3	-0.2±0.2	-5.7	0.0±0.2	.010	-15.20	-0.1±0.2	-0.1	0.0±0.2	.142
Number of tender points	-3.0	-3.5±3.6	-2.0	-3.1±3.8	.481	-2.00	-3.2±2.9	-2.0	-2.6±3.1	.311
Algometric score (kg/cm ²)	0.1	0.2±0.2	0.2	0.2±0.2	.936	0.26	0.2±0.2	0.1	0.1±0.1	.180
Chair test (number in 1 minute)	0.1	0.1±0.2	-0.6	0.0±0.1	.014	0.08	0.1±0.2	0.0	0.0±0.2	.592
NHP	-80.4	-0.3±0.2	-18.3	0.0±0.3	.005	-57.10	-2.1±2.3	-45.4	-1.2±2.8	.401

Abbreviation: VAS, visual analog scale.

believe that this mental conditioning effect may have contributed to the positive results in our study.

Chair tests, which were used to assess lower-extremity endurance, were not found to show significant changes. This was not unexpected, because Pilates is not an aerobic exercise but uses isometric contractions and targets abdominal and back muscles much more than the extremities.

One of the most striking points of our study was the failure to observe statistically significant improvement 3 months after the end of the Pilates program. This finding points to the necessity of an uninterrupted Pilates program in order to sustain the significant improvement obtained immediately after the treatment period. The importance of long-term follow-up in exercise-related studies has been emphasized by several authors. Also, FMS is a syndrome characterized by chronic pain, and any proposed treatment modality should continue indefinitely, because there is no promise of a curative effect.

None of the participants quit the training program, and we observed no adverse effect of Pilates exercises, corroborating the belief that Pilates is a safe program.

Study Limitations

The most important limitation in our study arose from the inability to form a no-intervention group as a result of the attitude of fibromyalgia participants, who understandably demanded a certain type of treatment program in return for giving consent for the study. Another limitation was the relatively small participant number and short follow-up period.

In light of the results of our study, we suggest Pilates exercises as an effective and safe method for FMS patients. But the superior results in the Pilates group obtained at week 12 may also suggest that compliance to exercise was better in the Pilates group because of close supervision provided by the instructor over the study period. Our study is the first clinical study designed to investigate the role of the Pilates method in FMS treatment. We believe that further research with more participants and longer follow-up periods could help assess the therapeutic value of this popular physical exercise method.

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Suppliers

- a. Force Dial FDK 60; Wagner Instruments, PO Box 1217, Greenwich, CT 06836.
- b. SPSS Inc, 233 S Wacker Dr, 11th Fl, Chicago, IL 60606.