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ORIGINAL ARTICLE

# Effect of supervised exercise program including balance exercises on the balance status and clinical signs in patients with fibromyalgia

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**Abstract** The objective of this study is to investigate whether the supervised exercise program including balance exercises was superior to home exercise programs in improving clinical parameters and balance status in patients with FM. Fifty women who were diagnosed with primary FM were assigned into supervised exercise group (Group 1) and home exercise group (Group 2). Evaluation parameters were *clinical parameters* [pain, number of tender points (NTP), Beck Depression Scale (BDS), Fibromyalgia Impact Questionnaire (FIQ)], and *parameters associated with balance* [timed up and go test (TUGT), four square step test (FSST), Berg Balance Scale (BBS), Activities-Specific Balance Confidence Scale (ABC), and static balance measurements]. Significant differences were determined between all pre- and post-exercise clinical follow-up parameters at 12th week in Group 1. There was a significant difference only in the BDS score between baseline and at the 24th week. When the changes in balance parameters in Group 1 were investigated, a significant difference was noted at the 12th week in terms of TUGT, FSST, and ABC scale scores compared to baseline; however, the significant change maintained only in ABC scale at the 24th week compared to baseline. Significant differences were noted in all clinical parameters in Group 2 at the 12th week, whereas no difference was observed at the 24th week. Evaluation of balance parameters in Group 2 at the 12th week revealed significant differences in terms of the TUGT, FSST, BBS, and ABC scale scores compared to baseline, whereas 24th week evaluation revealed significant differences only in the BBS and ABC scale scores. When the two groups were compared, a significant difference was observed in favor of Group 2 only for the BBS at the 12th week evaluation. Exercise programs had short-term beneficial effects on either clinical signs or dynamic balance.

**Keywords** Fibromyalgia · Balance · Exercise

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## Introduction

Fibromyalgia (FM) is defined as the chronic pain syndrome characterized by extensive pain, fatigue, sleep disorders, and tender points on certain parts of the body [1]. The disease may reduce the quality of life of the patients by affecting their daily activities. A multidisciplinary approach is of importance in the treatment for FM. Since accompanying complaints are specific to each patient, the treatment should also be patient-specific. The first step in the treatment for FM is to enhance patients' level of knowledge and awareness about the disease. Although many pharmacological treatments have been tried up to date, there is no drug that completely controls or cures the disease.

The European League against Rheumatism (EULAR) developed recommendations for the treatment for FM in 2007 [2]. According to these recommendations, the most appropriate treatment approach is the combination of pharmacological and non-pharmacological treatment modalities that would be effective on the symptoms such as pain, depression, fatigue, sleep, and functional disorders.

There are many studies suggesting that exercise has beneficial effects on the clinical signs of patients with FM [3–5]. There is strong evidence showing the efficacy of aerobic exercises in reducing pain and the number of tender points (NTP), in enhancing quality of life, and in reducing depression [6]. In addition to aerobic exercises, relaxation and stretching exercises, as well as programs such as Tai chi, Yoga, and Pilates, which have regained their popularity in the recent years, has been shown to be beneficial in controlling pain and other symptoms in patients with FM [7–9].

Balance is the ability of an individual to keep the body's center of gravity within the base of support and to maintain this condition. Balance disorders and related falls are serious problems that unfavorably affect the lives of many people. Although balance disorders and increased risk for falls appear to be the problems most commonly encountered in the elderly population, they have also become a problem of the young population with a gradually increasing prevalence along with various muscle–skeletal diseases and an important cause of morbidity and mortality. Studies have shown that balance disorders and tendency to falls are more common in patients with FM as compared to the healthy subjects [10, 11]. The researchers of these studies have highlighted the necessity of developing postural stability-preserving programs by considering that FM affects central and peripheral postural control mechanisms.

In the literature, the number of studies evaluating the exercise programs for balance disorders is limited. In a very recent study, Gusi et al. [12] applied vibratory exercises to 41 patients with FM using vibratory platform and determined significant improvement in dynamic balance parameters in the exercise group as compared to the control group. In that particular study, they suggested the need for further research to specify standard programs concerning this issue.

The aim of the present study was to investigate whether the supervised exercise program including balance exercises was superior to home exercise programs in improving clinical parameters and balance status in patients with FM.

## Patients and methods

Fifty women aged between 20 and 50 years, who were diagnosed with primary FM according to the criteria of the American Rheumatology Association and willing to participate in the long-term exercise program, were included in the study.

Patients with inflammatory rheumatic disease, those with severe musculoskeletal system deformities and mechanical problems limiting the capacity for exercise, those with unstable hypertension, severe cardiac and respiratory system problems, those in the postmenopausal period, those with diabetes, hypoglycemia, vitamin D deficiency, hypothyroidism, hyperthyroidism, osteoporosis, vertigo, and hearing and visual problems, those with prosthesis or implant in any of the joints that would contraindicate exercise, and those with a neurological disease, were excluded from the study.

All participants were prohibited from receiving non-steroidal anti-inflammatory drugs (NSAIDs) or myorelaxants during the study period. Patients who had been commenced on pregabalin or antidepressants at least 1 month prior to the study were continued on their medications. The patients were allowed to take paracetamol in the presence of severe pain; however, they were asked not to receive paracetamol on the day of evaluation. The patients were informed about the aim of the study, and they were educated about the disease and the exercise program that would be performed. Informed consent form approved by the Local Ethics Committee was obtained from all patients.

Fifty patients were assigned into supervised exercise group (Group 1, $n = 25$) and home exercise group (Group 2, $n = 25$) by simple random sampling. The first group was assigned to an exercise program consisted of stretching and balance–coordination exercises after a 10-min warm-up period under the supervision of a trainer; the exercise was conducted for 12 weeks, 3 days in a week, 1 hour daily [13]. The stretching exercises included the following muscle groups: neck, shoulder, dorsal, lumbar, gluteal, thigh, and cruris ($1 \times 10$ repetitions for each muscle group). The balance–coordination exercises included balancing on one foot and on both feet, tandem exercises, standing with a partner, bending, squatting exercises, lateral and backward movements, skipping, scissoring, rolling, and twisting. The second group was trained about the stretching exercises ($1 \times 10$ repetitions for each of the neck, shoulder, dorsal, lumbar, gluteal, thigh, and cruris muscle groups) to be performed for 3 months, three times in a week after a 10-min warm-up period. Patients in this group performed their exercise program at home. The patients were phoned twice a week to control whether they exercised regularly or not. Both exercise programs were discontinued after 12 weeks.

Pre-exercise (baseline) and post-exercise 12th week and 24th week controls of the patients were performed by a researcher who was blinded to the treatments.

### Evaluation parameters

#### *Clinical parameters*

*Pain* Pain experienced by the patients within the last week was assessed using a visual analogue scale (VAS).

*Number of tender points (NTP)* The NTP was assessed by applying a pressure of 4 kg/cm$^2$ on 18 tender points associated with FM using pressure algometry (Force Dial FPK 60, Wagner Instruments, Greenwich, CT, USA).

*Beck Depression Scale (BDS)* The BDS was used to evaluate mood status of the patients within the last week. This scale was developed to evaluate overall body health, anxiety level, and the degree of depressive mood. It consists of 21 items including four sentences, each of which is rated between 0 and 3. The validity and reliability study of the Turkish version of the BDS was performed by Hisli et al. [14].

*Fibromyalgia Impact Questionnaire (FIQ)* The current health status of the patients was evaluated by the FIQ including 10 items. This questionnaire measures 10 different features including physical functioning, status of feeling well, inability to go for work, difficulty in working, pain, fatigue, morning fatigue, stiffness, anxiety, and depression. Total score is 100; higher scores indicate a greater impact of the disease on the patient. It was developed by Burckhardt et al. [15] to measure the functional status of FM patients. The validity and reliability study of the Turkish version of the FIQ was performed by Sarmer et al. [16].

### *Parameters associated with balance*

*Timed up and go test (TUGT)* The patients were instructed to sit on a chair with a back support. A mark was placed on the floor three meters away from the front of the chair. The patients were asked to stand up, walk to the mark on the floor, turn around themselves, walk back to the chair, and sit down. Performance was measured in seconds. Patients with a score of $\leq$14 s were considered to have a high risk of falls [17].

*Four square step test (FSST)* Four squares were formed by placing canes on a flat floor. Each square was numbered. At the beginning of the test, patients, who were standing in the square number 1 facing the square number 2, were asked to step as fast as possible into each square consecutively (1-2-3-4-4-3-2-1) without touching the canes and both feet making contact with the floor. The time taken to complete the cycle was recorded as the score. Patients with a score of <15 s were considered have a high risk of falls [18].

*Berg Balance Scale (BBS)* The BBS was used to evaluate dynamic balance status. The BBS consists of 14 items evaluating daily functioning. The level of competence in each activity is rated on a 5-point scale ranging from 0 (unable to do) and 4 (able to do independently and safely). Each functional parameter was individually explained and demonstrated to the patient. The patients were asked to perform all parameters; total score was calculated as the sum of the scores obtained from each parameter. The maximum score that can be obtained from the test is 56; 0–20 points indicate high fall risk, 21–40 points indicate moderate fall risk, and 41–56 points indicate low fall risk. The validity and reliability study of the Turkish version of the BBS was performed by Şahin et al. [19].

*Activities-Specific Balance Confidence (ABC) Scale* Participants were asked to rate 16 questions evaluating their balance confidence in daily activities between 0 and 100. The mean value of the scores was calculated. Patients with a score of <67 % were considered to have a high risk of falls. The validity and reliability study of the Turkish version of the ABC scale was performed by Karapolat et al. [20].

*Static balance measurements* Static balance measurements were evaluated using TeknoBody PK stabilometry balance platform (Bergamo, Italy). Measurements were taken while the subject was standing firmly on both feet on the balance platform. Images on the computer monitor that was placed just in front of the platform and at the patient's eye level were introduced to the patient. The patient was explained that the place of X sign on the monitor would change with the movement of his/her body's center of gravity. The patient was asked to try to keep the X sign stable for 30 s. Static balance measurements were taken with the eyes open and closed (30 s for each). The following variables were obtained depending on the displacement of the body's center of gravity on the balance platform: X, mean movement toward the right and left (mm); Y, mean movement toward the fore and back (mm); C, circumference of the ellipse including the oscillation area (mm); A, area of the ellipse including the oscillation area (mm$^2$). Increase in these values indicated impaired static balance.

## Statistical analysis

Statistical analyses were performed using the Statistical Package for Social Sciences (SPSS, Inc., Chicago, IL, USA) version 13.0. The Kolmogorov–Smirnov test was used to test the normality of continuous variables. The Wilcoxon test was used for intragroup comparisons, whereas percentage change and difference score were used for intergroup comparisons. The data obtained were compared using the Mann–Whitney $U$ test. A $p$ value of <0.05 was considered statistically significant.

## Results

During the study period, seven (two patients from Group 1 and five patients from Group 2) of 50 patients quitted the study voluntarily. One of the patients in Group 1 quitted because of concomitant health problem, whereas the other quitted because of the transportation problem. Three of the patients in Group 2 did not attend follow-up visits because of concomitant health problems, whereas one patient did not attend because of moving out of the city, and one patient did not attend without giving any excuse.

The mean ages and the pre-treatment evaluation parameters of the patients in the groups are presented in Table 1. Among all these parameters, a significant difference was noted between the groups only in BBS scores.

When the measurements of dynamic balance parameters at baseline, and at the 12th and 24th weeks of follow-up were evaluated, it was observed that all scores of the TUGT were lower than 14 s, all scores of the FSST were lower than 15 s, and the lowest score was 48 on the BBS. Thus, it was determined that the patients had no significant balance disorder. When the ABC scale scores were evaluated, 44.1 % ($n = 19$) of all participants were observed to have a score lower than 67 % at baseline; however, the mean score was above 67 % in each group. The values of the participants obtained from static balance measurements were within the range of healthy or ideal levels defined by the manufacturer of the device.

**Table 1** The mean ages and the pre-treatment evaluation parameters of the patients in the groups

| | Group 1 ($n = 25$) | Group 2 ($n = 25$) | $p$ value |
|---|---|---|---|
| Age | 44.65 ± 5.3 | 44.4 ± 5.2 | 0.883 |
| Pain (VAS) | 6.43 ± 2.0 | 6.9 ± 2.2 | 0.383 |
| NNT | 14.83 ± 8.5 | 12.0 ± 3.4 | 0.184 |
| BDS | 15.04 ± 5.9 | 17.6 ± 9.4 | 0.407 |
| FIQ | 87.84 ± 20 | 89.85 ± 21.4 | 0.821 |
| TUGT (s) | 8.14 ± 0.94 | 8.36 ± .2.2 | 0.549 |
| FSST (s) | 8.0 ± 1.4 | 8.75 ± 2.2 | 0.510 |
| BBS | 53.17 ± 1.7 | 51.9 ± 2.3 | **0.044** |
| ABCS | 69.55 ± 18.5 | 68.9 ± 18.8 | 0.951 |
| X EO (mm) | 7.61 ± 6.0 | 10.15 ± 5.1 | 0.366 |
| Y EO (mm) | 10.09 ± 9.0 | 11.1 ± 7.4 | 0.277 |
| C EO (mm) | 274.17 ± 17.3 | 275.15 ± 27.4 | 0.569 |
| A EO ($mm^2$) | 104.09 ± 38.3 | 107.8 ± 32.2 | 0.560 |
| X EC (mm) | 7.48 ± 5.0 | 10.05 ± 5.6 | 0.290 |
| Y EC (mm) | 10.96 ± 7.4 | 10.40 ± 6.9 | 0.679 |
| C EC (mm) | 320.48 ± 50.2 | 332.75 ± 82.2 | 0.871 |
| A EC ($mm^2$) | 143.78 ± 62.3 | 162.8 ± 86.6 | 0.842 |

The values were given as mean value (SD)

Bold value indicates $p$ <0.05

*NTP* number of tender points, *BDS* Beck Depression Scale, *FIQ* Fibromyalgia Impact Questionnaire, *TUGT* timed up and go test, *FSST* four square step test, *BBS* Berg Balance Scale, *ABCS* Activities-Specific Balance Confidence Scale, *X* mean movement toward the right and left, *Y* mean movement toward the fore and back, *C* circumference of the ellipse including the oscillation area, *A* area of the ellipse including the oscillation area, *EO* eyes open, *EC* eyes closed

Significant differences were determined between all pre- and post-exercise clinical follow-up parameters at 12th week in Group 1 (Table 2). There was a significant difference only in the BDS score between baseline and at the 24th week ($p = 0.026$), whereas no significant difference was found in other parameters.

When the changes in static and dynamic balance parameters in Group 1 were investigated, a significant difference was noted at the 12th week in terms of TUGT, FSST, and ABC scale scores compared to baseline; however, the significant change maintained only in ABC scale at the 24-week compared to baseline (Table 2). Although the improvement in BBS score was not statistically significant at the 12th week, it was statistically significant at the 24th week. The changes in the static balance parameters were not statistically significant at the 12th and 24th weeks.

Similar to Group 1, significant differences were noted in all clinical parameters in Group 2 at the 12th week compared to baseline, whereas no difference was observed at the 24th week compared to the pre-exercise period (Table 3).

Evaluation of static and dynamic balance parameters in Group 2 at the 12th week revealed significant differences in terms of the TUGT, FSST, BBS, and ABC scale scores compared to baseline, whereas 24th week evaluation revealed significant differences only in the BBS and ABC scale scores compared to baseline. While the improvement in X GK value, one of the static balance parameters, was not statistically significant at the 12th week, a significant difference was observed at the 24th week evaluation compared to baseline. The changes in the other static balance parameters were not statistically significant (Table 3).

When the two groups were compared in terms of clinical and balance parameters, a significant difference was observed in favor of Group 2 only for the BBS at the 12th week evaluation; however, no difference was observed between the groups in terms of other parameters (Table 4).

## Discussion

The present study revealed that each exercise program has favorable effects on clinical findings and on dynamic balance in patients with FM. Additionally, supervised balance exercises were not found to be significantly superior to home exercises.

**Table 2** The results and statistical comparisons of the baseline and post-treatment (week 12 and week 24) evaluation parameters in Group 1

| | Baseline | Week 12 | Week 24 | p value (week 12 vs. baseline) | p value (week 12 vs. baseline) |
|---|---|---|---|---|---|
| Pain (VAS) | 6.43 ± 2.0 | 5.04 ± 1.9 | 6.26 ± 1.4 | **0.002** | 0.597 |
| NNT | 14.83 ± 8.5 | 13.09 ± 9.5 | 14.09 ± 8.9 | **0.008** | 0.083 |
| BDS | 15.04 ± 5.9 | 11.78 ± 7.1 | 11.74 ± 7 | **0.024** | **0.026** |
| FIQ | 87.84 ± 20 | 73.13 ± 27.1 | 81.46 ± 25.5 | **0.008** | 0.249 |
| TUGT (s) | 8.14 ± 0.94 | 7.59 ± 0.92 | 7.99 ± 0.82 | **0.002** | 0.265 |
| FSST (s) | 8.0 ± 1.4 | 7.52 ± 1.2 | 7.79 ± 1.1 | **0.003** | 0.147 |
| BBS | 53.17 ± 1.7 | 53.78 ± 1.4 | 54.09 ± 1.3 | 0.072 | **0.004** |
| ABCS | 69.55 ± 18.5 | 75.14 ± 16.8 | 72.25 ± 16.5 | **0.001** | **0.001** |
| X EO (mm) | 7.61 ± 6.0 | 6.87 ± 4.5 | 6.83 ± 4.4 | 0.526 | 0.651 |
| Y EO (mm) | 10.09 ± 9.0 | 12.09 ± 9.2 | 15.52 ± 11.1 | 0.475 | 0.124 |
| C EO (mm) | 274.17 ± 17.3 | 273.7 ± 20.7 | 285.65 ± 28.5 | 0.927 | **0.041** |
| A EO ($mm^2$) | 104.09 ± 38.3 | 109.52 ± 41.7 | 138.61 ± 72.1 | AD | 0.066 |
| X EC (mm) | 7.48 ± 5.0 | 6.0 ± 4.6 | 7.09 ± 4.1 | 0.347 | 0.650 |
| Y EC (mm) | 10.96 ± 7.4 | 12.0 ± 8.4 | 14.39 ± 10.7 | 0.807 | 0.235 |
| C EC (mm) | 320.48 ± 50.2 | 308.87 ± 37.9 | 317.35 ± 44.0 | 0.553 | 0.976 |
| A EC ($mm^2$) | 143.78 ± 62.3 | 146.39 ± 62.4 | 164.22 ± 59.7 | 0.927 | 0.287 |

The values were given as mean value (SD)

Bold values indicate $p$ <0.05

*NTP* number of tender points, *BDS* Beck Depression Scale, *FIQ* Fibromyalgia Impact Questionnaire, *TUGT* timed up and go test, *FSST* four square step test, *BBS* Berg Balance Scale, *ABCS* Activities-Specific Balance Confidence Scale, *X* mean movement toward the right and left, *Y* mean movement toward the fore and back, *C* circumference of the ellipse including the oscillation area, *A* area of the ellipse including the oscillation area, *EO* eyes open, *EC* eyes closed

The study conducted in 1976 by Moldofsky and Scarisbrick [21] initiated the interest in exercise for the treatment for FM syndrome (FMS) showing that stage IV sleep disorder did not lead to musculoskeletal system complaints in sportsmen. This finding was corroborated by Bennet et al. [22] showing that 80 % of FMS patients were physically unfit as compared to the sedentary controls. In light of these findings, many studies have been conducted on the efficacy of exercises in FMS [6–9, 12, 23, 24]. Different exercise programs have been investigated in almost all of these studies. The most beneficial outcomes have been obtained from aerobic, strengthening, stretching, and flexibility exercises. In addition to the land-based exercises, water exercises have been the focus of these studies. One of these studies was performed in our clinic, and it was demonstrated that water exercises provided an improvement up to 6 months in patients with FM [23]. In addition to these classical programs, movement therapies such as Tai chi and Pilates have also been studied in FMS [7, 9]. In another study conducted in our clinic, Pilates was found to be beneficial in the short-term; however, it was observed that this effect was not maintained at the 3rd month after discontinuation of the exercise [9].

Despite numerous studies on exercise programs in FMS, there is no consensus on the type of exercise, as well as on the duration and frequency of a particular exercise session. In addition, there are conflicting data whether the patients should perform these exercises at home or as supervised group exercises. While some researchers have suggested that supervised exercises would be more beneficial, many studies have demonstrated that home exercises are as effective as supervised exercises, as was observed in the present study [24]. In the reviews investigating the efficacy of exercise on locomotor system diseases, the common conclusion is that the patient compliance and persistence, rather than the type and protocol of the exercise, are essential [25]. Improvement in parameters by home exercise programs in the present study might be attributed to the enhancement of patient compliance and motivation by phone calls at short intervals.

Unlike the previous studies on FMS, we used balance exercises together with a stretching/relaxation program in the present study. Balance disorders, together with various diseases of the musculoskeletal system, are one of the leading causes of morbidity and mortality, the prevalence of which has been gradually increasing among young patients. In the studies comparing FM patients with healthy subjects, balance disorders have been determined in patients with FM who have been found to be prone to falls [10, 11]. It has been suggested that central and peripheral

**Table 3** The results and statistical comparisons of the baseline and post-treatment (week 12 and week 24) evaluation parameters in Group 2

| | Baseline | Week 12 | Week 24 | *p* value (week 12 vs. baseline) | *p* (week 12 vs. baseline) |
|---|---|---|---|---|---|
| Pain (VAS) | 6.9 ± 2.2 | 5.5 ± 2.5 | 6.55 ± 1.8 | **0.048** | 0.382 |
| NNT | 12 ± 3.4 | 10.25 ± 3 | 12.3 ± 3.5 | **0.013** | 0.547 |
| BDS | 17.6 ± 9.4 | 12.7 ± 7 | 14.85 ± 7.3 | **0.007** | 0.083 |
| FIQ | 89.85 ± 21.4 | 79.95 ± 24.1 | 82.93 ± 26.0 | **0.025** | 0.391 |
| TUGT (s) | 8.36 ± .2.2 | 7.87 ± 1.6 | 8.13 ± 1.7 | **0.004** | 0.120 |
| FSST (s) | 8.75 ± 2.2 | 7.91 ± 1.7 | 8.55 ± 1.9 | **0.004** | 0.285 |
| BBS | 51.9 ± 2.3 | 53.5 ± 1.6 | 53.05 ± 1.7 | **0.001** | **0.003** |
| ABCS | 68.9 ± 18.8 | 72.84 ± 13.0 | 71.6 ± 14.6 | **0.001** | **0.001** |
| X EO (mm) | 10.15 ± 5.1 | 8.05 ± 4.0 | 8.1 ± 4.6 | 0.099 | 0.116 |
| Y EO (mm) | 11.1 ± 7.4 | 13.6 ± 6.9 | 15.05 ± 11.0 | 0.286 | 0.243 |
| C EO (mm) | 275.15 ± 27.4 | 274.65 ± 43.9 | 280.1 ± 31.6 | 0.501 | 0.519 |
| A EO ($mm^2$) | 107.8 ± 32.2 | 123.3 ± 51.4 | 136.8 ± 49.0 | AD | AD |
| X EC (mm) | 10.05 ± 5.6 | 8.05 ± 4.8 | 7.0 ± 4.0 | 0.081 | **0.025** |
| Y EC (mm) | 10.40 ± 6.9 | 12.1 ± 6.1 | 15.2 ± 11.0 | 0.285 | 0.218 |
| C EC (mm) | 332.75 ± 82.2 | 317.8 ± 74.5 | 310.2 ± 44.0 | 0.145 | 0.204 |
| A EC ($mm^2$) | 162.8 ± 86.6 | 151.1 ± 92.0 | 217.95 ± 197.4 | 0.135 | 0.243 |

The values were given as mean value (SD)

Bold values indicate $p < 0.05$

*NTP* number of tender points, *BDS* Beck Depression Scale, *FIQ* Fibromyalgia Impact Questionnaire, *TUGT* timed up and go test, *FSST* four square step test, *BBS* Berg Balance Scale, *ABCS* Activities-Specific Balance Confidence Scale, *X* mean movement toward the right and left, *Y* mean movement toward the fore and back, *C* circumference of the ellipse including the oscillation area, *A* area of the ellipse including the oscillation area, *EO* eyes open, *EC* eyes closed

**Table 4** Comparison of the two groups on the basis of the post-treatment (both week 12 and week 24) percent changes and difference scores relative to baseline values

| | Week 12 | | | Week 24 | | |
|---|---|---|---|---|---|---|
| | Group I | Group II | *p* value | Group I | Group II | *p* value |
| Pain (VAS) | −1.39 ± 0.39 | −1.4 ± 3.01 | 0.951 | −0.17 (1.94) | −0.35 (1.92) | 0.785 |
| NNT | −0.11 (0.22) | 0.09 (0.27) | 0.617 | 0.07 (0.76) | 0.09 (0.32) | 0.067 |
| BDS | −0.17 (0.29) | −0.09 (0.2) | 0.450 | −0.04 (0.37) | −0.04 (0.29) | 0.821 |
| FIQ | −0.18 (0.3) | −0.12 (0.71) | 0.942 | −0.18 (0.45) | 0 (0.68) | 0.381 |
| TUGT (s) | −0.06 ± 0.08 | −0.05 ± 0.07 | 0.487 | −0.15 ± 0.07 | −0.18 ± 0.05 | 0.942 |
| FSST (s) | −0.05 ± 0.08 | −0.05 ± 0.09 | 0.817 | −0.02 ± 0.07 | −0.01 ± 0.08 | 0.893 |
| BBS | 0.01 ± 0.02 | 0.03 ± 0.02 | **0.023** | 0.01 ± 0.02 | 0.02 ± 0.02 | 0.418 |
| ABCS | 0.12 ± 0.27 | 0.12 ± 0.47 | 0.932 | 0.07 ± 0.23 | 0.09 ± 0.28 | 0.770 |
| X EO (mm) | 0.84 ± 3.56 | −0.03 ± 0.86 | 0.787 | 0.47 ± 2.63 | 0.01 ± 0.86 | 0.797 |
| Y EO (mm) | 0.76 ± 2.07 | 1.32 ± 3.04 | 0.557 | 1.86 ± 3.64 | 1.13 ± 2.02 | 0.927 |
| C EO (mm) | 0 ± 0.07 | 0 ± 0.14 | 0.609 | 0.04 ± 0.11 | 0.02 ± 0.14 | 0.450 |
| A EO ($mm^2$) | 0.19 ± 0.64 | 0.28 ± 0.96 | 0.884 | 0.19 ± 0.9 | −0.06 ± 0.38 | 0.480 |
| X EC (mm) | 0.9 ± 3.12 | −0.18 ± 0.36 | 0.705 | 0.64 ± 2.66 | 0 ± 0.71 | 0.910 |
| Y EC (mm) | 0.39 ± 1.18 | 0.5 ± 1.21 | 0.667 | 0.69 ± 1.45 | 1.03 ± 2.25 | 0.869 |
| C EC (mm) | −0.01 ± 0.18 | −0.02 ± 0.25 | 0.527 | 0.01 ± 0.21 | −0.03 ± 0.19 | 0.381 |
| A EC ($mm^2$) | 0.33 ± 1.12 | 0.07 ± 0.89 | 0.394 | 0.48 ± 1.26 | 0.59 ± 1.59 | 0.922 |

The values were given as mean value (SD)

Bold value indicates $p < 0.05$

*NTP* number of tender points, *BDS* Beck Depression Scale, *FIQ* Fibromyalgia Impact Questionnaire, *TUGT* timed up and go test, *FSST* four square step test, *BBS* Berg Balance Scale, *ABCS* Activities-Specific Balance Confidence Scale, *X* mean movement toward the right and left, *Y* mean movement toward the fore and back, *C* circumference of the ellipse including the oscillation area, *A* area of the ellipse including the oscillation area, *EO* eyes open, *EC* eyes closed balance control mechanisms are disturbed in such subjects, thus their risk for falls increases. Balance disorders may be expected in patients with FM due to abnormal central nervous system functions (such as neural integration impairments that lead to abnormal audio-vestibular perception), vertigo, presence of dizziness, presence of pain, and decrease in muscle strength and endurance associated with inactivation. In the present study, the static balance measurements and the TUGT and FSST scores of the FM patients were within the normal ranges. The BBS scores indicated that all participants were in the "low fall risk" category. The reason for not assessing any significant balance disorder in the participants of the present study could be attributed to the evaluation of younger patients as compared to the other studies in the literature and the exclusion of patients with concomitant risk factors (such as vitamin D deficiency, diabetes, anemia, and menopause) that could affect the balance. In their study, in which the effects of osteoporosis and menopausal status on balance parameters were evaluated, Günendi et al. [26] reported that the premenopausal women without osteoporosis had the best scores, as was in the present patient group.

Despite the absence of a significant balance disorder in our patients at baseline, it was observed that both exercises favorably affected the preexisting dynamic balance parameters. It was interesting to observe favorable effects also in the group not assigned to balance exercises. However, some studies have shown that the stimulation of joint mechanoreceptors, muscle fibers, and tactile receptors via exercise programs may cause an increase in proprioception. Perrin et al. [27] demonstrated that aerobic exercises could cause an improvement in balance control by providing better use of somatosensorial inputs. Similarly, the favorable effects of stretching exercises on balance and walking have also been demonstrated [28, 29]. The results of the present study might have arisen from the favorable effects of stretching exercises assigned to the patients. Another intriguing result of the present study was the higher improvement in BBS scores at the 12th week in the home exercise group compared to the supervised exercise group. This result could be explained by the lower mean BSS scores in the home exercise group at baseline evaluations. Contrary to the TUGT and FSST, in which a few activities are evaluated, the maintenance of significant improvement in the BBS and ABC scale scores at the 24th week may be attributed to calculation of the total score by the evaluation of many activities.

In addition to the dynamic balance parameters, the static balance parameters were also evaluated in the present study. However, it was observed that exercise had no significant influence on the static balance, in contrast to the favorable outcomes obtained for dynamic balance. To the best of our knowledge, there is no study evaluating the static balance using stabilometer in the literature. The common disadvantage of the tests used in the evaluation of static balance is their inability to assess adaptive postural responses used during many daily activities [30]. We are in the opinion that this may explain the inconsistency between the results obtained for static and dynamic balance parameters our study.

In the present study, we observed that exercise programs had short-term beneficial effects on either clinical signs or dynamic balance, and that the improvement ceased almost as soon as the patient quitted the exercise. These findings verify the opinion that uninterrupted exercise programs should be an essential part in the management of patients with FM. Moreover, no significant difference was found between the supervised and home exercise groups in both clinical evaluations and balance parameters. Thus, it can be concluded that home exercise program, which is cheaper and relatively more effortless, may be successful in patients with FM when adequate motivation is provided.

The limitations of the present study are the small sample size, relatively short follow-up period (6 months), and the lack of a control group not assigned to an exercise program. We are in the opinion that further randomized controlled studies with a larger sample size and a longer follow-up period are needed on this issue.

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