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ORIGINAL ARTICLE

Effectiveness of aquatic therapy in the treatment of fibromyalgia syndrome: a randomized controlled open study

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Abstract The aim of this study was to investigate the efficacy of aquatic exercises in fibromyalgia syndrome (FMS). A total of 63 patients were included and allocated to two groups. Group I ($n = 33$) received an aquatic exercise program and Group II ($n = 30$) received a home-based exercise program for 60 min, 3× a week, over 5 weeks. Patients were evaluated for pain (visual analogue scale, VAS), number of tender points (NTP), Beck depression inventory (BDI), and functional capacity (fibromyalgia impact questionnaire, FIQ). All assessment parameters were measured at baseline, and at weeks 4, 12, and 24. There were statistically significant differences in FIQ and NTP in both groups at the end and during follow-up ($P < 0.05$). Group I showed a statistically significant decrease in BDI scores after 4 and 12 weeks ($P < 0.05$) that remained after 24 weeks ($P < 0.001$). In Group II, a significant decrease in BDI scores was observed at the end and during follow-up ($P < 0.001$). Also, a significant improvement was found in VAS at weeks 4 and 12 in both groups ($P < 0.001$). The average of reduction in pain scores was 40% in Group1 and 21% in Group II. However, this was still significant at week 24 only in the aquatic therapy group. A comparison of the two groups showed no statistically significant difference for FIQ, NTP, and BDI scores except VAS ($P < 0.001$) Our results showed that both aquatic therapy and home-based exercise programs have beneficial effects on FIQ, BDI, and NTP. In pain management, only aquatic therapy seems to have long-term effects.

Keywords Aquatic therapy · Fibromyalgia · Home exercises

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Introduction

Fibromyalgia syndrome (FMS) is a chronic disorder, characterized by diffuse, widespread, musculoskeletal pain and tender points [1]. Various etiologic factors have been proposed but FMS is not clearly understood as yet. There are large numbers of treatment regimes for FMS including antidepressants, analgesics, physical therapy, exercise, and patient education programs. It is widely accepted that multidisciplinary approaches are increasingly important in the treatment of FMS [2, 3]. The treatment goals should include the management of pain and sleep disorders, improvement in fibromyalgia related symptoms such as stiffness, swelling, sicca, headache and the others, physical capacity and emotional well being.

In recent years, various studies have shown the effectiveness of exercise programs on FMS; however, no standard program has been accepted. The great majority of these studies focused on land-based, and in particular aerobic, exercise programs [4–6]. The benefits of aerobic training in treating FMS have been used as a guide for developing other exercise regimes to increase relaxation, strength, and flexibility. Generally home-based programs are preferred, but these present a difficulty in ensuring compliance. For this reason, others have suggested group exercises and these may take place on land or in a pool.

Aquatic therapy includes aquatic exercises that have a great value in the treatment of various rheumatologic

conditions. It is well known that warm water provides pain relief, muscle relaxation, and significant improvement in general well being [7]. Clinical trials have indicated that balneotherapy and warm water baths are effective on tender points, quality of life, and pain parameters in FMS patients [8, 9]. Following on from these findings, aquatic aerobic training programs have become popular. Some studies have shown beneficial effects for both balneotherapy and aquatic exercises [10]. Recently, Gowans and Dehueck [11] summarized pool exercises as an effective intervention for FMS, which is better tolerated and has greater benefits on mood and sleep disorders.

In this study, we aimed to investigate the effects of exercise therapy on FMS patients and to compare aquatic and home-based exercise programs.

Materials and methods

This study was designed as a prospective, randomized, controlled open study. A total of 63 FMS patients (mean age 43.4) were enrolled in the study. The diagnosis of fibromyalgia was based on the 1990 American College of Rheumatology (ACR) criteria. After a physical examination, routine laboratory investigations, including full blood count, erythrocyte sedimentation rate (ESR), and biochemical markers, were evaluated.

The exclusion criteria for this study included the presence of severe cardiovascular disease, unstable hypertension, malignancy, inflammatory joint diseases, heat intolerance, and pregnancy. In addition, patients taking either antidepressive drugs or nonsteroidal anti-inflammatory drugs and who have exercise habitation regularly were excluded from the study.

Clinical outcomes

Patients were evaluated according to number of tender points (NTP), pain, depression, and functional capacity.

Tender points were determined by a standard pressure algometer (Greenwich, USA). Eighteen points were evaluated according to ACR criteria. Pain was assessed using a 10 cm visual analogue scale (VAS), where 0 indicated no pain and 10 indicated worst pain. Functional capacity was evaluated by fibromyalgia impact questionnaire (FIQ), a self administered questionnaire consisting of ten criteria, including physical function, work status, anxiety, pain, fatigue, sleep, depression, stiffness, and well-being. Higher scores indicate greater impairment [12]. Beck's depression inventory (BDI) was used to assess the level of depression. The BDI is a well established and validated instrument consisting of 21 items with a range of 0–63, where higher scores are related with major depression. The cutoff value of BDI is 17 and the scores over this indicate major depression [13].

Co-existing symptoms such as fatigue, stiffness, insomnia, paresthesia, irritable bowel syndrome, pseudo-Raynaud's phenomena, sicca symptoms, headache, and bladder dysfunction were also investigated.

Treatment

Patients were allocated to the groups in order of their admittance. They were treated as outpatients. Aquatic therapy group participated under the supervision of a physiotherapist during the therapy program. Home exercises were demonstrated by a physiotherapist on one occasion and then they were given written advice.

The program consisted of 15 sessions, 3× per week for 5 weeks. Group I ($n = 33$) received an aquatic exercise program in a swimming pool at 33°C. Each session was conducted in groups of 7–8 patients and lasted 60 min. The program included 20 min of poolside exercises including warming up, active range of motion (ROM), and relaxation. This was followed with 35 min of aquatic exercises in the pool including warming up by walking backwards and forwards in the pool; aerobic exercises such as jumping and jogging; active ROM; stretching of neck and the extremities; and relaxation such as lying supine and low impact swimming. The training ended with cooling-down for the last 5 min.

Group II ($n = 30$) received a home-based exercise program. This was a 60 min program and included warming up, ROM, relaxation, aerobic, stretching, and cooling-down exercises.

This study was approved by the University of Kocatepe Human Research Ethics Committee. Before treatment, all participants were informed of the trial and gave written consent.

Statistical analysis

The means and standard deviations were given as descriptive statistics. A level of significance of $P < 0.05$ (two-tailed) was accepted for this study. The Friedman test was used to calculate the difference between the pre- and post-treatment values. In order to compare the differences between the groups, Mann–Whitney U test was used. All analyses were performed using the SPSS for Windows 15.0 software program.

Results

Sixty-one patients completed the study. Two patients in Group I dropped out due to personal reasons. No side

effects were observed during the program. There were no statistically significant differences in the pre-treatment evaluation parameters of the patients. The demographic properties of the patients are given in Table 1. The results of full blood count ESR and biochemical markers were within normal ranges for both groups.

Initially, there was no significant difference regarding pain. At the end of the therapy there was a statistically significant decrease in VAS scores in Groups I and II ($P = 0.000$ and $P = 0.003$). This improvement remained after 12 weeks in both groups (Group I: $P = 0.000$; Group II: $P = 0.016$). The average of reduction in pain scores was 40% in Group1 and 21% in Group II. However, during follow up (week 24), it was still significant only in aquatic therapy group ($P = 0.010$) (Table 2).

Both groups had statistically significant improvement in FIQ scores at the three assessments with P values of 0.002 in aquatic therapy group and 0.001 in home-based exercise group, respectively. No significant difference was found between the groups. FIQ results are given in Fig. 1.

Additionally in all groups, NTP scores were found to have decreased at the end of the therapy (Group I: $P = 0.009$; Group II: $P = 0.016$) and after 12 weeks ($P = 0.002$ and $P = 0.006$). After 24 weeks, this improvement was still significant in both Group I and Group II ($P = 0.006$ and $P = 0.000$, respectively). No statistically significant difference was found between the groups (Table 3).

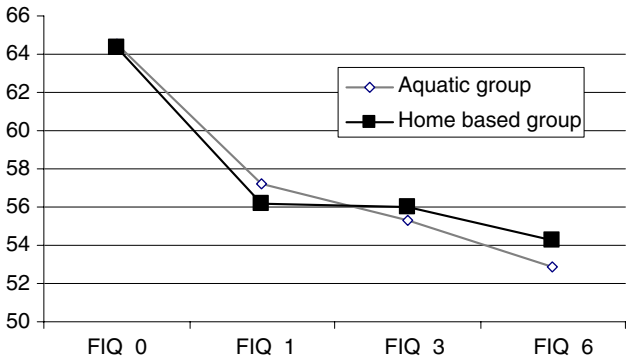

Fig. 1 Baseline and follow-up results of fibromyalgia impact questionnaire (FIQ) for both groups. *FIQ 0* before treatment, *FIQ 1* at the end of the therapy, *FIQ 3* after 3 months, *FIQ 6* after 6 months

In Group I, there was a statistically significant decrease in BDI scores after 4 weeks ($P = 0.005$) and 12 weeks ($P = 0.028$). This improvement remained after 24 weeks ($P = 0.000$). In Group II, there was also a statistically significant decrease in BDI scores at the end and during follow-up (after 12 and 24 weeks) ($P = 0.000$). None of our patients had a BDI score over 17. However, no significant difference was observed between the groups. The results are shown in Fig. 2.

There was an improvement in co-existing symptoms including pain, fatigue, stiffness, insomnia, paresthesia, Raynaud's phenomena, headache, and bladder dysfunction. The frequency of these symptoms during therapy is shown in Table 4.

Table 1 Demographic data of both groups

	Group I (aquatic exercise, $n = 31$)	Group II (home-based exercise, $n = 30$)
Age	43.8 ± 7.7 (29–60)	42.8 ± 7.6 (21–52)
Gender (F/M)	31/0	30/1
Disease duration (years)	3 ± 2.3 (1–10)	3 ± 1.9 (1–8)
Body mass index	25.6 ± 3.8 (19–36)	27.9 ± 5.1 (19–41)
Employed	13 (41.9)	5 (16.7%)

Table 2 The results of pain parameter initially, at the end of the therapy, and during follow-up for both groups

	Group I ($n = 31$) (aquatic exercise)	Group II ($n = 30$) (home exercise)	P value
VAS before treatment	6.2 ± 1.7	6.1 ± 1.9	0.475
VAS after treatment (4 weeks)	4.2 ± 1.6	5.1 ± 1.9	0.049
P	0.000	0.003	
VAS in follow-up (12 weeks)	4.0 ± 1.5	5.1 ± 1.8	0.037
P	0.000	0.036	
VAS at the end of therapy (24 weeks)	3.9 ± 1.9	5.1 ± 2.1	0.004
P	0.000	0.197	

Data are expressed as means ± standard deviation

VAS visual analogue scale

Table 3 Comparison of number of tender points in both treatment groups and within the groups before therapy, and after 3 and 6 months

	Group I ($n = 31$)	Group II ($n = 30$)	P value
NTP before treatment	15.7 ± 2.8	14.3 ± 3.0	0.770
NTP after treatment (4 weeks)	11.9 ± 5.6	12.0 ± 4.5	0.788
P	0.009	0.016	
NTP in follow-up (12 weeks)	11.8 ± 4.7	11.4 ± 4.6	0.667
P	0.002	0.006	
NTP at the end of therapy (24 weeks)	11.6 ± 5.2	11.4 ± 5.3	0.913
P	0.006	0.000	

Data are expressed as means ± standard deviation

NTP number of tender points

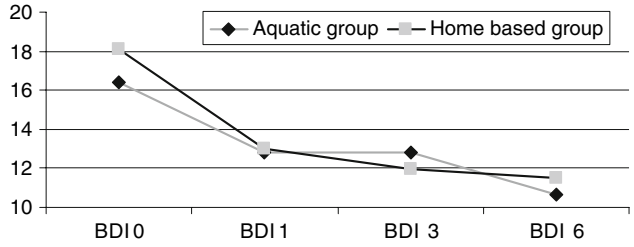

Fig. 2 The results of Beck's depression inventory (BDI) before and after the therapy, and at 12 and 24 weeks in both groups. *BDI 0* before treatment, *BDI 1* at the end of the therapy, *BDI 3* after 3 months, *BDI 6* after 6 months

Discussion

Fibromyalgia is mainly associated with pain and the interest in nonpharmacological interventions has increased in recent years. The researchers investigate the importance of regular exercise and physical activity programs for its treatment. Exercise program included aerobic, strength training, and flexibility relaxation techniques. In FMS, abnormal pain modulation and muscle ischemia are suggested to induce widespread pain. Aerobic exercise has been shown to activate endogenous opioid system, increase pain threshold and pain tolerance, which may result in analgesic response [14]. Several reviews about exercise programs in treatment of FMS have been published over the years [15, 16]. Most of them showed that exercises with low to moderate intensity have positive effects on pain relief, sleep, and mood improvement. Jones et al. [16] summarized that self-modified, symptom-limited, and appropriate intensity exercise program is an important part of the treatment with FMS patients. Aerobic exercise training has been found to have benefits on physical capacity and the symptoms of FMS. Also, aerobic exercise was suggested to be superior over stretching exercises in relation to cardiovascular fitness, depression and emotional parameters [6, 17]. Some authors suggested home-based exercise programs that are a relatively low-cost treatment, and have positive effects on pain, functional capacity, and psychological distress [18]. Ramsay et al. investigated the comparison of supervised and unsupervised aerobic exercise regiments in FMS. They either applied cardiovascular fitness, stretching, and relaxation supervised by a physiotherapist or a home program during 12 weeks. They found no statistically significant differences in pain and other outcome measurements except psychological well-being [19].

Previous studies recommended balneotherapy or warm-water baths in managing chronic widespread muscle pain [9, 10]. However, aquatic therapy programs have not been extensively studied. Gusi et al. [20] evaluated the short- and long-term efficacy of exercise therapy in a warm, waist-high pool, in women with fibromyalgia. They observed pain relief, improvement in health-related quality of life, and muscle strength in lower limbs, and most of them were maintained long term. Mannerkorpi et al. [21] showed the beneficial effect of 6 months of pool exercises combined with an education program in pain, physical function, grip strength, social functioning, psychological distress, and quality of life in patients with FMS. Similarly, a 6 week, self management based program of pool-based exercises and education program was found to have efficacy in functional

Table 4 The frequency of co-existing symptoms of both groups before, after, and during follow-up period

	Pre-treatment (%)	Post-treatment (%)	12th week (%)	24th week (%)
Pain				
Aquatic	90.3	58.1	75.9	72.4
Home-based	100	76.7	89.7	75.9
Fatigue				
Aquatic	96.8	87.1	82.8	72.4
Home-based	100	90	82.8	82.8
Stiffness				
Aquatic	71	58.1	65.5	69
Home-based	86.7	73.3	69	69
Insomnia				
Aquatic	74.2	61.5	65.5	55.2
Home-based	70	50	44.8	55.2
Paresthesia				
Aquatic	71	41.9	62.1	55.2
Home-based	73.3	63.3	65.5	58.6
Reynaud				
Aquatic	12.9	6.5	0	3.4
Home-based	40	20	17.2	13.8
Sicca				
Aquatic	54.8	58.1	58.6	55.2
Home-based	70	56.7	48.3	55.2
Daire				
Aquatic	48.4	45.2	48.3	51.7
Home-based	50	36.7	34.5	41.4
Headache				
Aquatic	71	67.7	72.4	62.1
Home-based	76.7	70	75.9	72.4
Libido				
Aquatic	32.3	45.2	48.3	31
Home-based	53.3	43.3	37.9	37.9
Urgency				
Aquatic	51.6	29	17.2	24.1
Home-based	53.3	33.3	37.9	34.5
Swelling				
Aquatic	74.2	67.7	69	65.5
Home-based	70	60	58.6	58.6

capacity and quality of life parameters compared to control group in FMS and these improvements were sustained for at least 6 months after completion of the program [22].

The present study investigated the comparison between the effects of 5-week aquatic and home-based exercise program in FMS. We observed clinically significant gains in pain, functional capacity, BDI, and quality of life parameters up to week 12 in both groups. However, long-term results (week 24) showed a significant difference in pain scores only in the aquatic therapy group.

There are few studies comparing pool-based and land-based exercise programs in treatment of fibromyalgia. Jentoft et al. [23] reported significant improvements in cardiovascular capacity, walking time, and daytime fatigue after 20 weeks of pool-based or land-based aerobic exercise program. However, improvement in pain, depression, anxiety, number of days feeling good, and physical impairment was observed only in pool-based exercise group. Recently, Assis et al. [24] compared the clinical effectiveness of 15 weeks of aerobic water exercises (deep water running, DWR) and land-based exercises (LBE) in women with FMS. They used VAS, BDI, FIQ, Short Form 36 Health Survey (SF-36), and patient's global assessment (PGA) parameters. They found significant reduction in pain intensity (36%) in both groups. PGA was better and improvement in FIQ depression and total scores were faster in the pool-based exercise group. They concluded that DWR was a safe exercise and had superiority in emotional aspects over LBE group. Our FIQ, BDI, and NTP results were similar to previous studies. This supports the finding that aerobic training program combined with stretching and relaxing exercises, either pool-based or home-based, has significant beneficial effects in the treatment of functional capacity, quality of life, and psychological distress in FMS. Comparing with other studies, the ratio of pain reduction of our patients was higher (40%) and this improvement was still significant after 6 months only in the aquatic therapy group. A recent study evaluated the effects of a 12-week period of aquatic training on health-related quality of life (HRQOL) and found significant positive effects in some of the components of HRQOL including body pain and role of emotional problems which were maintained for up to 3 months [25]. It is well known that warm water is useful in relaxation of muscles, pain reduction, and increase in joint flexibility and functional ability. Aquatic therapy is safe, well-tolerated, and an enjoyable form of exercise. In addition, it results in less pain or injury.

Although we have a larger sample size and treatment period compared with other studies, the main limitation of our study is the absence of the placebo control group with double-blind design.

As a result, both aquatic therapy and home-based aerobic exercise programs have beneficial effects in the treatment of physiological well-being, quality of life, and pain parameters in FMS. As most of our patients are housewives, unemployed or retired, we observed that they applied their home program willingly and it was a good motivating factor for their sedentary lives. Aquatic therapy seems to have more advantage in long-term pain management. We suggest more researches in FMS will be better to understand the mechanism of aquatic therapy in pain relief.

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