# Effect of a 24-week physical training programme (in water and on land) on pain, functional capacity, body composition and quality of life in women with fibromyalgia

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*Competing interests: none declared.*

**ABSTRACT**

**Objective.** *To analyse the effect of a 24-week physical training programme in water and on land on women with fibromyalgia.*

**Methods.** *A controlled study was conducted from December 2009 to May 2010. Seventy-two women with fibromyalgia (age: 51.79±7.87 years) were assigned to an exercise group (3 sessions/week, 2 sessions in water, 1 session on land) (n=42) and to a control group (n=30). The variables analysed were: number of tender points, visual analogue scale (VAS) of pain, algometer score, functional capacity (leg strength, hand-grip dynamometry, flexibility, agility, balance, aerobic endurance, heart response), body composition (body mass index, fat mass index, skeletal muscle mass index and percentage of body fat) and psychological variables (Fibromyalgia Impact Questionnaire [FIQ] and Short Form Health Survey 36 [SF-36]).*

**Results.** *The exercise group improved in the algometer score (p<0.001), positive tender points (p=0.005), VAS (p<0.001) and FIQ (p<0.001). Improvements were also detected in functional capacity (leg strength, p=0.001; hand-grip dynamometry, p=0.001; flexibility, p<0.001; balance, p=0.006; 6-minute walk test, p<0.001; mean heart rate, p=0.031; maximum heart rate, p<0.001 and $VO_2$ max, p<0.001). There was a decrease in the percentage of body fat (p=0.040). There was also an improvement in the subscales of the SF-36; vitality (p=0.004), mental health (p=0.001) social role functioning (p=0.020) and general health functioning (p=0.002).*

**Conclusions.** *The findings of this study show that a 24-week physical training programme (3 sessions/week, of which 2 sessions are in water and 1 session is on land) reduces pain and disease impact and improves functional capacity in women with fibromyalgia.*

## Introduction

Fibromyalgia (FM) is a chronic disease characterised by generalised pain and the existence of specific points sensitive to touch and pressure on the musculoskeletal system, called tender points (1, 2). Other common symptoms are muscle stiffness, reduced physical condition, fatigue, non-restorative sleep, anxiety, cognitive difficulties (3, 4) and reduced physical work capacity (5). Pain and fatigue in these patients limit those activities that require a physical component (6). FM is thus associated with physical disability in daily life activities as basic as walking, lifting and carrying objects or working with arms and hands in high, medium or low positions, which specially reduces the quality of life of the individuals affected by FM (7). Patients with FM show a low level of physical activity when compared to healthy people, and the great majority of them are sedentary, with a functional capacity similar to that of elder people (8). Moreover, FM has been associated with a prevalence of overweight and obesity higher than in the general population. Physical exercise has been defined as an effective instrument for improving health and quality of life of FM patients (9, 10). There exist much evidence showing that monitored training consisting in aerobic exercises causes beneficial effects on the physical capacity and the symptoms of FM patients, although more studies are needed about the long-term effects of strength-gaining training and muscle flexibility (9). Furthermore, specification, intensity and duration of the exercise programme needed to improve symptoms have not been clearly described yet (11). It has been found that training in water and training on land have both beneficial effects on cardiovascular capacity and daily fatigue (12). A recent meta-analysis (13) showed that there is no evidence suggesting that aerobic exercise in water causes comparatively better results than similar on-land exercises, and established that an aerobic exercise programme for FM patients should consist of in water or on land exercises of intensity ranging from light to moderate, two or three times a week, for at least four weeks. Few studies have used training programmes combining exercises on land and in water (14, 15), showing that this combination of exercises may improve physical function, mood and symptom severity. The objective of this study is to analyse the effect of a 24-week physical training programme consisting in two sessions a week of in-water exercise and one of on-land exercise on pain, functional capacity, body composition and quality of life in women with FM.

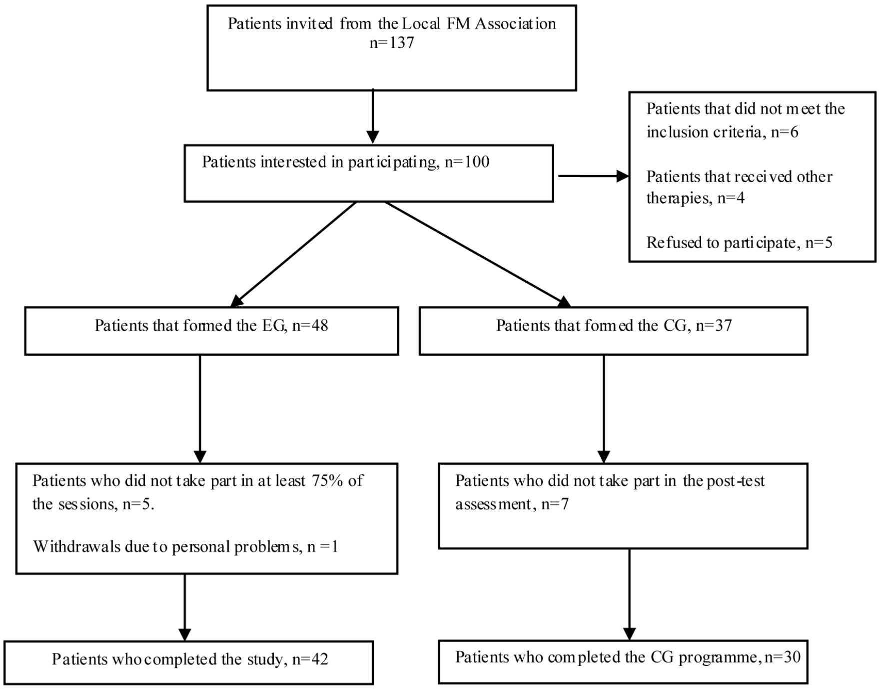


**Fig. 1.** Flowchart describing how patients evolved throughout the study. EG: Experimental Group. CG: Control Group.

## Materials and methods

*Participants*

One hundred and thirty-seven patients from a local fibromyalgia association (AFIXA, Jaen, Spain) were summoned to an informative meeting. One hundred women agreed to take part in the study and signed the informed consent. We established as inclusion criteria the Criteria for the Classification of Fibromyalgia established by the American College of Rheumatology (ACR) (16), besides not suffering any other serious somatic disease or psychiatric or medical disorder that required immediate treatment or that be incompatible with physical activity (exercise in swimming pools included). In addition, participants were not allowed to follow any other type of therapy at the same time. Figure 1 shows the flowchart detailing the patients' progress throughout the study. Eighty-five women (age: 51.79±7.87 years), diagnosed with FM by doctors of the Public Health System of Andalucía, met the inclusion criteria and were admitted to the study. Patients were not engaged in regular physical activity >20 minutes on >3 days/week. An ethical obligation with AFIXA obliged us to provide medical treatment to all the patients who took part in the study, but due to the limitation of resources – intervention was only possible at specific hours – the randomisation of the groups of patients was impossible. Thus, those patients who attended during the specific hours formed the experimental group (EG, n=42), whereas the rest formed the control group (CG, n=30). The study meets the ethical principles of the 1964 Declaration of Helsinki of the World Medical Association, revised in 2000, and was approved by the committee on biomedical ethics of the University of Jaén (Spain).

*Interventions*

Three times a week for a 24-week period patients took part in 60-minute sessions of physical training. Of those three weekly sessions, two consisted in exercise in water and one in exercise on land. The on-land exercise session was on Monday, whereas the two in-water sessions (in swimming pool) were on Wednesday and Friday. Both types of sessions (on land and in water) were conducted by a specialist in physical activity, who monitored a group of eight patients. Each session was structured into a warm-up (5 minutes), exercises of muscular strengthening (10–15 minutes), aerobic exercises (15–30 minutes) and a cool-down (5 minutes) following the guidelines for exercise prescription of the ACSM (17). Effort intensity was controlled throughout the intervention by means of the Borgh Scale (1982) (18). The volume of work of the sessions was increased by adding 5 minutes to strength exercises and 5 minutes to aerobic exercises every four weeks. Exercise intensity was increased during the whole programme, by modifying the number of reps per set, by introducing weights (in on-land exercises, 0.5–2 kg per exercise) and materials that rose the resistance offered by water, by increasing movement speed and by reducing rest time between exercises. Cardiovascular exercises included walking at different speeds, aerobic dance and other continuous and rhythmic activities that involved great muscle groups. Strength training consisted in 1–3 sets of 8–12 reps per exercise (biceps curl, jerk, lateral arm raises, shrugs, lateral leg raises, stands up from a sitting position, rotations and skipping). In-water training was conducted in the public waist-high warm pool of the city of Jaén (Spain), in During this 24-week period, participants in the CG continued with their daily activities, that did not include any kind of physical exercise similar to that of the study (in any case never more than 30 minutes three times a week).

*Measures*

The participants were monitored over a whole week in order to prevent fatigue and exacerbation of the symptoms. On the first day the different questionnaires were completed, body composition was registered and the tests of flexibility and hand-grip dynamometry were carried out. Forty-eight hours later participants took part in the tests of agility, balance, leg strength and aerobic endurance. All participants were assessed by the same group of researchers in order to reduce measurement error in the pre-test and the post-test.

Pain sensitivity was assessed using a standard pressure algometer (EFFEGI, FPK 20, Italy), by means of measuring the 18 tender points according to the criteria of the ACR (16). Tender point scored as positive when the patient noted pain at a pressure of 4 kg/cm$^2$ or less. The total count of such positive tender points was recorded for each participant. The algometer score was calculated as the sum of the minimum pain-pressure values obtained for each tender point. Moreover, generalised pain was assessed using a 10-cm visual analogical scale (VAS) where 0 means "no pain" and 10 "a lot of pain". Functional capacity was assessed using the Senior Fitness Test Battery (19). More concretely, we used the 30-Second Chair Stand, the 6-Minute Walk (6-MWT) and the 8-Foot Up and Go tests. Furthermore, the Sit and Reach (20), the Stork Balance Stand (21) and the hand grip strength (measured with dynamometer TKK 5101 Grip-D, Takey, Tokyo, Japan) tests were also used.

Mean heart rate and maximum heart rate during the 6-MWT was registered with a heart rate monitor (Polar RCX5 GPS). Oxygen consumption ($VO_2$) in patients was calculated by means of the regression equation of King *et al.* (22), that predicts it in the 6-MWT, using BMI as additional parameter, $VO_2$ (ml/kg/min) = 21.48+ (-0.4316×BMI)+ [0.0304 × distance (m)].

Height (cm) was measured with a stadiometer (Seca 22, Hamburg, Germany) and weight and body composition parameters with a bioimpedance analyser (Inbody 720, Biospace, Seoul, South Korea). Body mass index (BMI) was calculated by dividing weight (in kilograms) by height$^2$ (in meters). In this study we have used the degrees of obesity established by the World Health Organisation (WHO, 2003) (23): underweight if BMI<18.5 kg/m$^2$; normal weight if BMI between 18.50-24.99 kg/m$^2$; overweight if BMI=25.00-29.99 kg/m$^2$ and obesity if BMI>30 kg/m$^2$.

At the same time, we also used the Fibromyalgia Impact Questionnaire (FIQ) validated for Spanish population (24) and the Spanish version of the Short-Form 36 health survey questionnaire (25).

*Statistical analysis*

The data were analysed with the statistical programme SPSS., v.19.0 for Windows, (SPSS Inc, Chicago, USA) and the significance level was set at $p<0.05$. The data are shown in descriptive statistics of mean, standard deviation and percentages. The chi-square

**Table I.** Socio-demographic data.

| | | CG | EG | *p*-value |
|---|---|---|---|---|
| Years since clinical diagnosis, mean (standard deviation) | | 9.06 (3.83) | 9.04 (4.84) | NS |
| Age (years), mean (standard deviation) | | 50.93 (7.72) | 52.40 (8.01) | NS |
| Marital status, n (%) | Married | 28 (93.3) | 36 (85.7) | NS |
| | Single | 0 (0.0) | 3 (7.1) | |
| | Divorced | 1 (3.3) | 2 (4.8) | |
| | Widow | 1 (3.3) | 1 (2.4) | |
| Educational status, n (%) | Primary school | 6 (20.0) | 7 (16.7) | NS |
| | Secondary school | 12 (40.0) | 24 (57.1) | |
| | Pre-University | 9 (30.0) | 7 (16.7) | |
| | University | 3 (10.0) | 4 (9.5) | |
| Employed (%) | Yes | 10 (33.3) | 15 (35.7) | NS |
| | No | 20 (66.7) | 27 (64.3) | |

CG: Control group; EG: Experiment group; NS: Non significant.

**Table II.** Effect of 24 weeks of physical training (in water/on land) on the FIQ, algometer scale, positive tender points and VAS of women with FM.

| | Pre-test [a] | Post-test [a] | Difference post-pre [b] |
|---|---|---|---|
| FIQ (0-100) | | | |
| CG | 64.81 (11.56) | 65.73 (11.82) | 0.92 (9.65) |
| EG | 65.53 (13.52) | 53.34 (16.33) | -12.19 (18.64) |
| *p*-value (groups) | NS | 0.001 | <0.001 |
| Algometer | | | |
| CG | 34.41 (10.03) | 32.76 (9.86) | -1.65 (8.82) |
| EG | 34.91 (10.98) | 49.35 (14.29) | 14.44 (14.45) |
| *p*-value (groups) | NS | <0.001 | <0.001 |
| Positive tender points | | | |
| CG | 17.61 (1.07) | 17.80 (0.87) | 0.19 (0.67) |
| EG | 17.53 (0.99) | 15.41 (3.58) | -2.12 (3.75) |
| *p*-value (groups) | NS | 0.005 | 0.005 |
| VAS in rest (cm. 0-10) | | | |
| CG | 9.08 (1.16) | 8.41 (1.94) | -0.67 (1.77) |
| EG | 9.38 (0.85) | 5.17 (2.23) | -4.21 (2.38) |
| *p*-value (groups) | NS | <0.001 | <0.001 |

[a] ANCOVA with age and IMC as covariates in pre-test and post-test. [b] ANCOVA with pre-test performance and age as covariates in the differences post-pre. CG: Control group; EG: Experiment group. The data are shown in mean and standard deviation. NS: Non significant.

**Table III.** Effect of 24 weeks of physical training (in water/on land) on the functional capacity of women with FM.

| | Pre-test [a] | Post-test [a] | Difference post-pre [b] |
|---|---|---|---|
| Leg strength (nº of reps) | | | |
| CG | 10.76 (2.35) | 11.86 (2.81) | 1.10 (3.19) |
| EG | 11.83 (2.59) | 15.33 (3.99) | 3.50 (4.28) |
| *p*-value (groups) | NS | <0.001 | 0.001 |
| Dynamometry (Kg.) | | | |
| CG | 25.49 (6.48) | 21.76 (4.46) | -3.73 (6.14) |
| EG | 20.30 (5.94) | 23.00 (5.16) | 2.70 (4.60) |
| *p*-value (groups) | 0.001 | NS | 0.001 |
| Flexibility (cm.) | | | |
| CG | -7.28 (7.67) | -6.68 (7.16) | 0.60 (4.31) |
| EG | -5.20 (7.07) | 3.07 (8.36) | 8.27 (5.58) |
| *p*-value (groups) | NS | <0.001 | <0.001 |
| Agility (s.) | | | |
| CG | 5.35 (1.15) | 5.20 (1.32) | -0.15 (1.04) |
| EG | 4.99 (0.88) | 4.64 (0.88) | -0.35 (0.91) |
| *p*-value (groups) | NS | 0.042 | NS |
| Balance (0-60 s.) | | | |
| CG | 19.45 (16.36) | 16.42 (13.66) | -3.03 (17.97) |
| EG | 15.76 (14.98) | 23.57 (15.87) | 7.81 (17.59) |
| *p*-value (groups) | NS | 0.020 | 0.006 |
| Distance 6- MWT (m.) | | | |
| CG | 479.23 (65.11) | 465.98 (70.26) | -13.25 (59.25) |
| EG | 473.63 (60.20) | 556.89 (61.33) | 83.26 (65.33) |
| *p*-value (groups) | NS | <0.001 | <0.001 |
| RPE (6-20) in 6- MWT | | | |
| CG | 13.07 (2.15) | 13.61 (2.43) | 0.54 (3.04) |
| EG | 12.31 (1.98) | 12.48 (1.97) | 0.17 (2.53) |
| *p*-value (groups) | NS | 0.049 | NS |
| HR mean (bpm) in 6- MWT | | | |
| CG | 111.26 (11.61) | 110.57 (12.93) | -0.69 (9.92) |
| EG | 111.19 (12.55) | 117.73 (16.33) | 6.54 (14.91) |
| *p*-value (groups) | NS | NS | 0.031 |
| HR max (bpm) in 6- MWT | | | |
| CG | 120.19 (14.62) | 116.96 (17.86) | -3.23 (13.86) |
| EG | 119.82 (13.38) | 134.46 (18.50) | 14.64 (17.18) |
| *p*-value (groups) | NS | <0.001 | <0.001 |
| $VO_2$ max (ml/kg/min) in 6-MWT | | | |
| CG | 24.16 (2.65) | 23.51 (3.03) | -0.65 (1.95) |
| EG | 23.58 (3.27) | 26.31 (3.19) | 2.73 (2.40) |
| *p*-value (groups) | NS | <0.001 | <0.001 |

[a]ANCOVA with age and IMC as covariates in pre-test and post-test. [b]ANCOVA with pre-test score and age as covariates in the differences post-pre. HR mean (mean Heart Rate), HR Max (maximum Heart Rate). $VO_2$ max (maximal oxygen consumption). CG: Control group; EG: Experiment group. The data are shown in mean and standard deviation. NS: Non significant.

test and the *t*-test were used to compare socio-demographic variables between the groups. ANCOVA was performed in pre-test and pos-test with BMI and age as covariates. Next, the comparison of the groups from the post-test to the pre-test was examined with ANCOVA, with age and pre-test performance (for each variable) as covariates. The comparison of the RPE on land and in water was done with the Wilcoxon signed-rank test.

## Results

Mean adherence to the intervention was 92% (range: 75%–98%). Five CG subjects were not included in the final analysis because they had not attended 75% of the sessions, and one subject abandoned due to personal problems. In the CG, 7 participants were excluded because they did not attend the post-test evaluation. Table I shows the participants' socio-demographic data, from which it is clear that there were no significant differences between the two groups. An analysis of the RPE performed throughout the intervention gives a result of in-water RPE = 11.61 (1.56) and on-land RPE = 12.34 (1.78), $p$=0.004, both can be considered as moderate intensity.

Table II shows significant differences ($p$<0.05) in the change occurred in both groups from the pre-test assessment to the post-test assessment. After intervention, we observe in the EG a significant reduction in the FIQ ($p$<0.001), the algometer score ($p$<0.001), positive tender points ($p$=0.005) and VAS ($p$<0.001).

Table III and Figure 3 show the results of the change occurred in the functional capacity of both groups from the pre-test assessment to the post-test assessment. The EG (when compared to the CG) shows better results in leg strength ($p$=0.001), dynamometry ($p$=0.001), flexibility ($p$<0.001), balance ($p$=0.006), distance covered in the 6-MWT ($p$<0.001), HR mean ($p$=0.031), HR max ($p$<0.001) and $VO_2$ max ($p$<0.001).

Table IV shows the result of the change occurred in both groups in the scales of the SF-36 from the pre-test assessment to the post-test assessment, showing significant differences ($p$<0.05). The EG (in relation to the CG) shows a significant increase in vitality ($p$=0.004), mental health ($p$=0.001), social role ($p$=0.020), and general health ($p$=0.002).

Figure 2 shows the results of the change occurred in the body composition of both groups from the pre-test assessment to the post-test assessment. The EG shows a significant reduction of the fat percentage ($p$=0.040).

## Discussion

The results of these study indicate that a 24-week physical training programme (in water/on land) with three sessions a week and consisting in exercises of muscle strengthening, aerobic endurance and flexibility reduces pain and improves disease impact, functional capacity and quality of life in women with FM. The programme was well tolerated and did not cause any negative effect on the health of the participants.

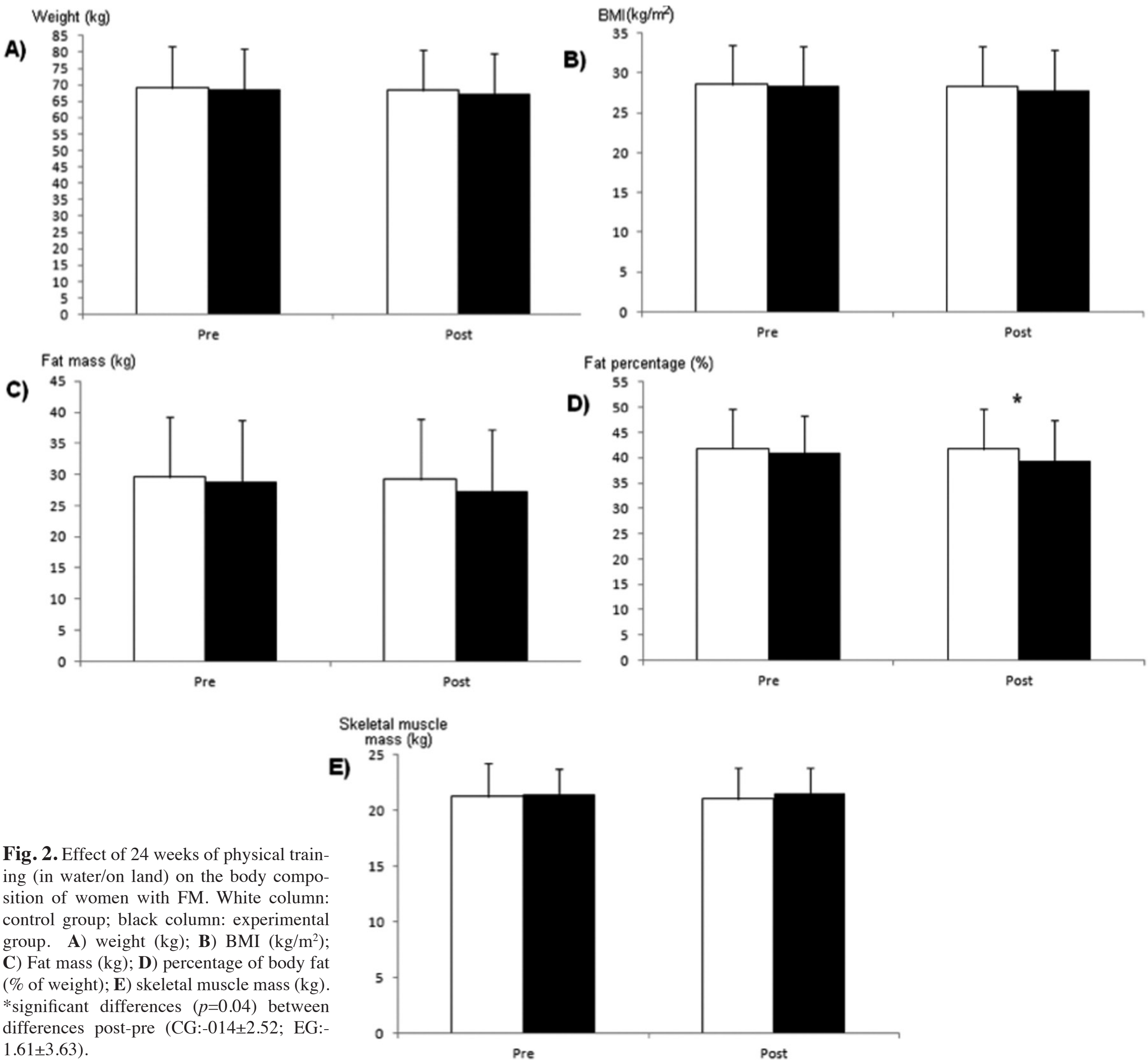


**Fig. 2.** Effect of 24 weeks of physical training (in water/on land) on the body composition of women with FM. White column: control group; black column: experimental group. **A**) weight (kg); **B**) BMI (kg/m$^2$); **C**) Fat mass (kg); **D**) percentage of body fat (% of weight); **E**) skeletal muscle mass (kg). *significant differences ($p$=0.04) between differences post-pre (CG:-014±2.52; EG:-1.61±3.63).

Regarding pain, all the registered parameters related to disease impact (FIQ) and pain (algometer score, positive tender points and VAS) improve significantly ($p$<0.01) in the EG. In line with this study, other authors (26) describe improvements in the FIQ, number of the tender points, algometer score and the VAS after 12 weeks doing 60-minute Pilates sessions three times a week. In turn, Evcik, Yigit, Pusak, and Kavuncu (27) describe in both groups improvements in the FIQ, the number of pain points and reductions in VAS after a 5-week training programme in hot water or on-land exercises at home, in 60-minute sessions, three times a week. Other authors (28) also observed improvements in the FIQ, number of tender points and VAS after a 16-week training programme in hot water consisting in three sessions per week. However, a similar study shows different results about disease impact (29). Other authors (30, 31) reported improvements in the FIQ but not in the number of tender points after a 23-week training programme (three 30-minute sessions a week) and a 28-week training programme consisting in walking and muscular strengthening. Carbonell *et al.*, (32) only found improvements in the number of tender points (a 3-month multidisciplinary training programme consisting in in-water, on-land and psychological sessions, three times a week). The same authors (15) find improvements in FIQ total score, fatigue, stiffness, anxiety, depression and the subscale of sf-36 physical role, bodily pain, vitality and social functioning in a 3 month low-moderate intensity multidisciplinary intervention. Nevertheless, other authors (33) did not find any change in the FIQ and number of pain points after a 12-week muscle strengthening training programme of two sessions a week.

Concerning functional capacity, the EG showed significant improvements ($p$<0.05) in leg strength, dynamometry,

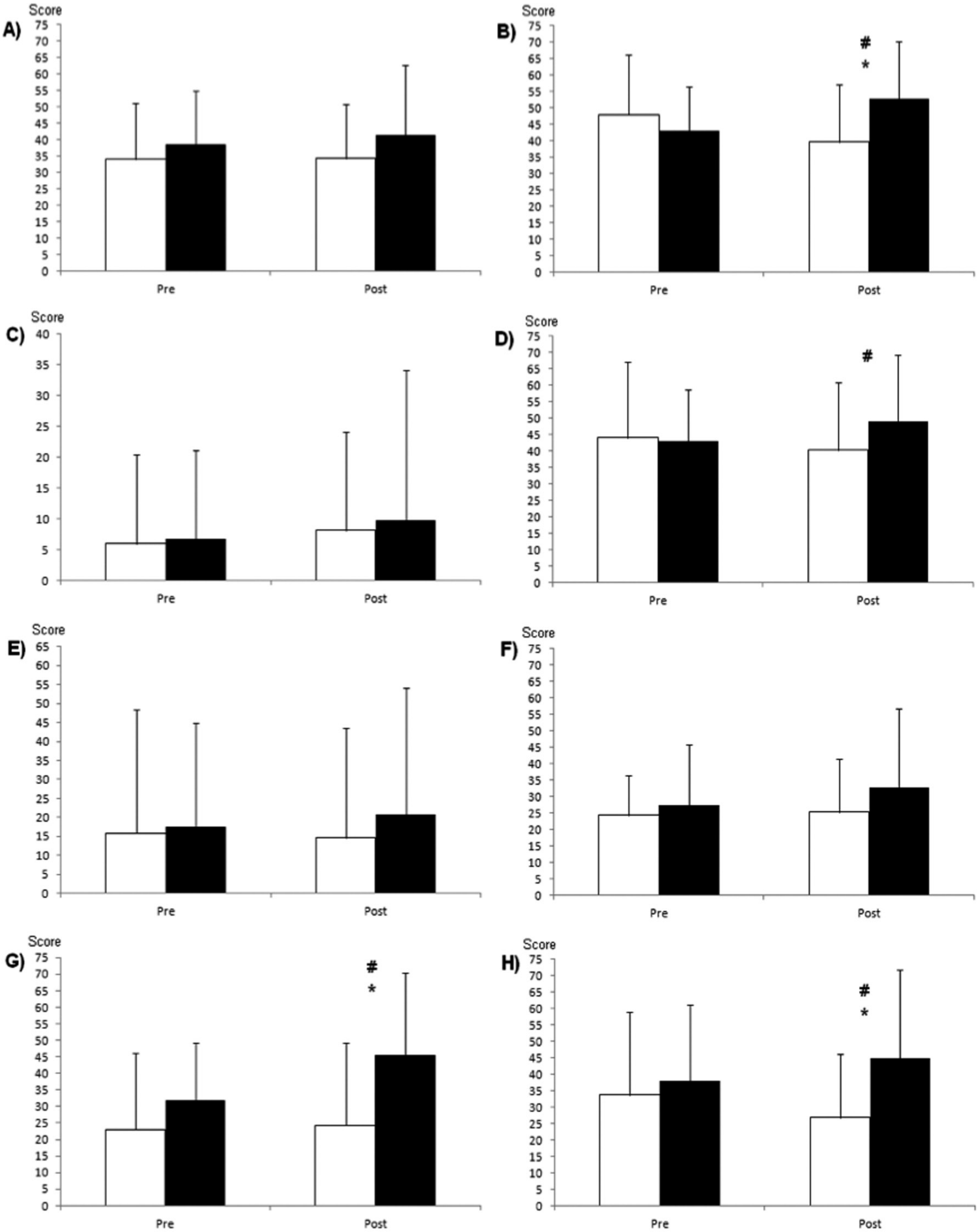


**Fig. 3.** Effect of 24 weeks of physical training (in water/on land) on the scales of the SF-36 questionnaire in women with FM. White column: control group; black column: experimental group. **A**) Physical functioning; **B**) Mental health; **C**) Physical role; **D**) Social role; **E**) Emotional role; **F**) Body pain; **G**) Vitality; **H**) General health. *significant differences in post-test; #significant differences between differences post-pre.

**Table IV.** Effect of 24 weeks physical training (in water/on land) on the scales of the SF-36 questionnaire in women with FM.

| | Pre-test [a] | Post-test [a] | Difference post-pre [b] |
|---|---|---|---|
| Physical functioning | | | |
| CG | 34.00 (17.03) | 34.33 (16.59) | 0.33 (9.37) |
| EG | 38.75 (16.22) | 41.53 (21.30) | 2.78 (17.02) |
| *p*-value (groups) | NS | NS | NS |
| Physical role | | | |
| CG | 6.00 (14.46) | 8.16 (15.94) | 2.16 (8.47) |
| EG | 6.82 (14.30) | 9.75 (24.28) | 2.93 (25.98) |
| *p*-value (groups) | NS | NS | NS |
| Emotional role | | | |
| CG | 15.77 (32.58) | 14.66 (28.78) | -1.11 (23.94) |
| EG | 17.43 (27.56) | 20.73 (33.36) | 3.30 (32.92) |
| *p*-value (groups) | NS | NS | NS |
| Vitality | | | |
| CG | 23.00 (23.17) | 24.33 (25.04) | 1.33 (22.66) |
| EG | 31.82 (17.34) | 45.68 (24.81) | 13.86 (25.84) |
| *p*-value (groups) | NS | 0.001 | 0.004 |
| Mental health | | | |
| CG | 48.00 (18.11) | 39.73 (17.44) | -8.27 (25.91) |
| EG | 43.08 (13.39) | 52.71 (17.45) | 9.63 (18.36) |
| *p*-value (groups) | NS | 0.002 | 0.001 |
| Social role | | | |
| CG | 44.06 (23.10) | 40.33 (20.56) | -3.73 (16.89) |
| EG | 43.15 (15.53) | 49.07 (20.22) | 5.92 (18.08) |
| *p*-value (groups) | NS | NS | 0.020 |
| Bodily pain[#] | | | |
| CG | 24.33 (12.08) | 25.33 (16.18) | 1.00 (15.69) |
| EG | 27.43 (18.30) | 32.68 (24.16) | 5.25 (16.76) |
| *p*-value (groups) | NS | NS | NS |
| General health | | | |
| CG | 33.77 (25.33) | 26.81 (19.38) | -6.96 (28.12) |
| EG | 37.92 (23.37) | 44.87 (26.91) | 6.95 (27.49) |
| *p*-value (groups) | NS | 0.002 | 0.002 |

[#]The higher the punctuation, the less the pain. [a]ANCOVA with age as covariate in pre-test and post-test. [b]ANCOVA with pre-test and age as covariates in the differences post-pre. CG: Control group; EG: Experiment group. The data are shown in mean and standard deviation. NS: Non significant.

flexibility, balance, covered distance in the 6-MWT, $VO_2$ max and, therefore, better heart efficiency, expressed in higher HR mean and HR max. Agility and dynamic balance did not show any significant improvement, unlike static balance, which is clinically relevant because FM has been associated with balance problems and frequent falls (34). The significant improvements in leg flexibility of the EG is also clinically relevant because the reduction of that type of flexibility is associated in elder people with disability and limitations in their daily activities (35). In relation with the 6-MWT, the results of this study are in line with those of Mannerkopi *et al*., (36), that show improvements in the 6-MWT after 20 sessions of in-water training and Gowans *et al*. (14) who showed significant improvements in the 6-MWT after a 23-week physical training in water and on land). Similarly, Valkeinen *et al*. (37) found a significant increase in functional capacity after a 21-week combined training programme of strength and aerobic endurance.

We have found no changes in body composition, except in fat percentage, that has diminished in the EG ($p$=0.040). These results are in line with those of other studies in FM (32, 33). Despite the duration of this intervention (24 weeks), participants continued to be overweight (23), since their weight was higher than the ideal one for healthy Spanish women (IMC=24.4±4.0) (38), but similar to the weight of healthy Andalusian women of that age range (IMC=27.6±4.32-30.2±4.75 (39). After the intervention, the women with FM who took part in this study, presented a fat percentage over 33%, which qualifies them as obese (40). Many authors have pointed out that this propensity to obesity of FM patients could be the consequence of a lower basal metabolic rate, characteristic of this disease, partly derived from a less developed muscle system, which is in turn a consequence of sedentarism (41), although other aspects such as psychiatric comorbidity, depression, dysfunction of the thyroid gland, dysfunction of the GH/IGF-1 axis and the deterioration of the endogenous opioid systems (42) could also play a role in the obesity of FM patients.

Moreover, other important finding of this study is that in the EG we have found significant improvements in the scales of the SF-36: vitality, mental health, social role and general health. These results agree with those of other study (43) that after 32 weeks of training in hot water (three 60-minute sessions per week) found improvements in the physical function, physical role, bodily pain, general health, emotional role, mental health and vitality. Similarly, there are improvements in physical function, general health, vitality and mental health after a 24-week training programme consisting in muscle strengthening, aerobic exercise and flexibility (two sessions a week) (44). In the same way, a 12-week on-land training programme consisting in aerobic exercises and flexibility (three sessions a week) improves the physical function, physical role, bodily pain, vitality, emotional role, social role and mental health (45).

Several studies in FM have got improvements by using therapies consisting in combining different physical exercises. Nonetheless, the global effect of the intervention in this study suggests that there may exist a positive relation between in-water and on-land training and muscle strengthening, aerobic resistance and flexibility.

We did not randomise the members of the CG and the EG, which is a limitation of our study. However, in spite of it, both groups did not show initial differences in the majority of parameters. Another limitation is that we did not check the dietary habits nor the use of medicines during the intervention. Future studies should always include this information, if possible.

## Conclusion

In conclusion, we can affirm that a 24-week intervention consisting in two sessions of in-water exercise and one session of on-land exercise reduces pain and disease impact and improves functional capacity and quality of life in FM patients.

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