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Effects of a functional training program in patients with fibromyalgia: A 9-year prospective longitudinal cohort study

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There are evidences that physical exercise is an effective instrument for improving physical fitness, health, and quality of life and causes beneficial effects on the symptoms of patients with fibromyalgia. The purpose of this study was to analyze effects of a functional training program on pain, fitness, and quality of life in patients with fibromyalgia in a 9-year prospective longitudinal cohort study. Forty women with fibromyalgia participated in this study; 24 received an exercise program and were called the active group; and 16 were the control group. Tender points, visual analogical scale (VAS) of pain, physical fitness, Fibromyalgia Impact Questionnaire (FIQ), and Short-Form Health Survey 36 (SF-36) were analyzed. The active group experienced significant improvements in FIQ, TP, and VAS ($P < .001$), whereas the control group showed significant worsening in the FIQ scale ($P = .004$). Moreover, the active group experienced significant improvements in leg strength ($P < .001$), balance ($P = .033$), cardiorespiratory fitness ($P < .001$), emotional role ($P = .024$), and mental health ($P = .025$); whereas the control group significantly worsened on handgrip strength ($P = .017$), balance ($P = .043$), cardiorespiratory fitness ($P = .020$), and in general health ($P < .001$). A Pearson correlation analysis revealed a significant relationship between the improvement in physical fitness variables and the improvements in FIQ, TP, and VAS. In conclusion, a regular practice of moderate-intensity physical activity shows a positive effect long-term on fitness, pain, the impact of the disease, and the quality of life in women with fibromyalgia.

KEYWORDS
exercise, fibromyalgia, fitness, health, pain

1 | INTRODUCTION

Fibromyalgia (FM) is a chronic condition characterized by widespread pain, muscle stiffness, reduced physical fitness,[1] fatigue,[2] poor sleep, anxiety, cognitive difficulties,[3] reduced physical working capacity,[4] and by the presence of specific points sensitive to palpation and pressure in the skeletal muscle system ("tender points").[5] Around 80% of the diagnosed patients were women, although some cases have also been detected in men.[6] Patients with FM have a low level of physical activity (PA) in comparison with healthy people[7,8] and present a similar level of functional capacity to elderly people.[9,10] Therefore, FM is associated with physical disabilities in everyday activities as basic as walking, lifting, and transporting objects, and this contributes to a reduction in the quality of life.[11] Women with FM show a significant reduction of strength along with the aging process, with significantly lower values than healthy women, representing a risk of dynapenia.[9] Accordingly, it may be that aging in patients with FM has more serious consequences in physical function.

The treatment of pain in FM has focussed on pharmacotherapy and non-pharmacological treatments such as educating the patients, PA, and educational-psychological programs shown to be effective in the relief of the symptoms of FM.[12] There are enough evidences that physical exercise is an effective instrument for improving physical fitness, health, and quality of life and causes beneficial effects on the symptoms of FM patients.[13-17] Overall, studies have reported short-term improvements in pain, quality of life, and physical fitness,[18] although more studies are needed about the long-term effects. However, despite these benefits, a high dropout rate in PA programs is commonly observed among the patients with FM, and a low percentage of patients comply with the weekly PA recommendations.[7,19,20] The high dropout rate is mainly related to general ill-health rather than to worsening of FM symptoms related to participation in the PA program.[19] In this regard, sedentary time is independently and positively associated with levels of pain, fatigue, and impact of the disease in women with FM.[21] When sedentary time is substituted with light PA, better bodily pain, social function, vitality, and disease impact are observed.[22]

Few studies have examined the follow-up of the interventions of physical exercise in FM; Moreover, the long-term effects PA programs remain unknown. A prospective longitudinal study with 70 female FM patients showed a significant improvement in FM status after 3 years. These patients performed a PA during 4 hours per week (walking and sports).[23] Furthermore, R. Isomeri et al carried out a 26-year follow-up study involving 28 patients with FM. They reported that FM symptoms persisted for years or even decades, and despite the fact, these patients performed regularly physical exercise (swimming, relaxation methods, yoga, etc). However, any of these studies were realized with a FM specific training program neither a control group (CG) in parallel.[24] Therefore, the purpose of this study is to analyze the long-term effects of a physical training program for reducing symptoms and improving health-related quality of life and physical fitness of patients with FM. Therefore, it is possible to hypothesize that the realization during several years of this PA program can be important in the positive evolution of fibromyalgia disease.

2 | MATERIAL AND METHODS

2.1 | Participants

Forty women who were diagnosed by rheumatologists of the public healthcare system, as well as also met the Wolfe et al, criteria, took part in this study by way convenience.[25] From an early stage, these women were enrolled into the Jaen Association of FM (AFIXA, Spain). After receiving detailed information about the objectives and process of the study, each participant signed a consent form to participate. The criteria for the classification of FM, established by the American College of Rheumatology (ACR),[26] were used to determine inclusion. In addition, inclusion criteria were as follows: (a) enrolled in the Jaen Association of FM (AFIXA, Spain); (b) being free of cardiovascular disorders, artificial prosthesis, or any disease that contraindicated the exercise program or required special care (ie, coronary artery disease, thrombosis, moderate or severe bone, lung or renal diseases), water activities included. Participants were allocated into the active group (AG, n = 24, age = 61.75 ± 8.05 years, body mass index (BMI) = 27.27 ± 3.42 kg/m^2), which had been regularly and uninterruptedly training for 9 years. Regarding the CG (n = 16, age = 60.75 ± 7.17 years, BMI = 29.61 ± 4.70 kg/m^2), the participants did not exercise regularly neither continuously during the same period of time and were considered regularly inactive according to the public health recommendation for exercise.[27] This study was conducted in accordance with the Declaration of Helsinki, and it was approved by the Ethical Committee of the University of Jaen on Human Research (Spain).

2.2 | Materials and testing

The Fibromyalgia Impact Questionnaire (FIQ) was used to assess symptoms associated with FM. This is a self-administered questionnaire designed to evaluate the severity of FM symptoms. We used the validated Spanish version.[28] The score ranges of FIQ were from 0 to 100, where high scores indicate greater disease severity.[29] In addition, the Health Survey Short-Form 36 (SF-36) was used to assess the general health status. This is a generic tool for assessing the quality of life related to health. It contains 36 items grouped into eight dimensions: physical functioning, role physical, bodily pain, general health, vitality, social function, role emotional, and mental health. In this study, the Spanish version of SF-36[30] was used.

Effort intensity was controlled throughout the intervention by means of the Borg Scale,[31] the scale is divided from 6 to 20 (lower intensity to maximum intensity).

According to the criteria of the ACR, a standard pressure algometer (EFFEGI, FPK 20, Italy) was used to evaluate the pain sensitivity by measuring the 18 tender points (TPs).[26] Increasing the pressure of the algometer, we identified the pain threshold. Participants were told to say "stop" once they felt the pain. For subsequent analysis, we took the mean of the two measurements at each TP. We considered a pressure of 4 kg/cm^2 or less noticed by the subject as a positive TP score. The total of all positive TPs was the individual's TP count. The sum of pain pressure measured for all TP resulted in an algometer score. Furthermore, a 10-cm visual analogue scale (VAS) was used to analyze generalized pain. The VAS was between 0 (no pain) and 10 (a lot of pain).

The main functional capacity components studied were lower body muscle strength, upper body muscle strength, balance, and cardiorespiratory fitness. The 30-second chair stand test (30-s CST)[32] was used to assess lower body muscle strength. This test involves counting the number of times within 30 second that an individual can rise to a full stand from a seated position with his/her back straight and feet flat on the floor and without pushing off the chair with the arms. The handgrip strength test (HS) was used to assess upper body muscle strength. This test involves using a hand dynamometer with adjustable grip (TKK 5101 Grip D; Takey, Tokyo, Japan). According to the formula described by Ruiz et al, it was calculated the optimal grip span.[33] This test was repeated twice in both hands. The participant fully extended the arm so that it formed a 30° angle relative to the trunk. The highest score was recorded for each repetition (kg) for the subsequent analysis, and the average score of the right arm and the left arm was used. The Stork Balance Stand Test[34] was employed to assess static balance. On a flat and hard surface, the participant stood without shoes on one foot and placed the hands on his/her hips with the opposite foot placed against the inside of the supporting knee. On a signal, the subject raised the heel of the foot from the floor and attempted to maintain balance for as long as possible during one minute. The trial ended if the subject either moved the hands from the hips, the kickstand moved from its original position, or if the non-supporting foot lost contact with the knee. The test was timed in seconds using a stopwatch. The stopwatch was started as the heel was raised from the floor. The total time in seconds was recorded for one minute. Two attempts were made with each leg, and the best results (s) were registered. Right and left foot data were both collected, and the average was used. The 6-Minute Walk Test (6MWT) was used to assess cardiorespiratory fitness. Patients walked for 6 minutes, as far as possible along a circuit of 45.7 meters on a flat and hard surface using the methodology specified by Rikli and Jones.[32] The subjects were told to avoid vigorous exercise within 2 hours of beginning the test. The distance walked in the 6MWT was recorded in meters.

2.3 | Procedure

AFIXA is a FM association that gives support to patients with FM. In 2009, an agreement was made with the University of Jaen to develop a PA program, which was subsequently validated. The patients in this association who had not participated in any PA program in the last 9 years, and those who did, were included in this study. All measures were conducted at baseline (2010) and after 9 years (2019). All participants were assessed by the same group of researchers in order to reduce inter-observer error. In the first session FIQ, TP, VAS, and anthropometrics variables were registered. In the second session (48 hours later), the 30-second chair stand test (two trials; the best trial was registered), the handgrip strength test (two trials with left and right hand; the average of both hands was recorded), the balance test (two trials each with left and right leg; the average of both legs was recorded), and 6MWT (one trial was registered) were evaluated.

2.4 | Training program

This training program has been previously validated in studies of the short and medium term.[13,14] The training plan included 3 sessions per week on non-consecutive days, sessions lasted ~35-60 minutes (warm-up and cold down included); two consisted of exercise in water and one of exercise on land. All training sessions were conducted by an experienced personal trainer. Every session consisted of a 5-minute warm-up, 10-15 minutes of muscular strengthening exercises, 15-30 minutes of aerobic exercises, and finally, 5 minutes cooldown. All training sessions were conducted according to The American College of Sports Medicine guidelines.[35] During the whole program, the exercises were intensified by increasing the repetitions per set number and introducing weights (in on-land exercises, 0.5-2 kg per exercise) and using equipment that raises the resistance offered by water. Strength training included a circuit training and exercises of 1-3 sets of 8-12 reps each. Respect to the land exercises, a circuit was established with the follow exercises, every of each performed individually: climbing stairs with medicinal ball, slalom challenges, pull a "rubber bands" with distinct resistances, move a medicinal ball, stand up and sit down in a chair, obstacles, pick up stuff from the floor, ball throw and back and forwards walk, single-leg standing, reduced base of support, stepping over objects, shifting weight from foot to foot, stability ball sitting and turning, and changing direction, etc In the pool, all activities were conducted in a pool with chest-high depth and simultaneously were incorporated movements, such as walking with different sequences of steps (forward, steps up, lateral with large steps), flutter kick with a kickboard, stand up and sit down from the pool wall, sinking the floats, rowing, and throwing and catching a ball with a partner; standing, kneeling, and sitting balance using a pool noodle. The water training was conducted in the public swimming pool with an air temperature of around 30°C.

The intensity of exercises was self-administered by the participants, and effort intensity was controlled throughout the intervention by means of the Borg Scale.[31] Participants in the CG continued with their daily activities that did not include any kind of physical exercise similar to that of the study. Through a personal interview, it was confirmed that they did not take part in the physical activity program ever and were considered regularly inactive according to the public health recommendation for exercise.[27]

2.5 | Statistical analysis

Descriptive statistics are represented as mean and standard deviation (SD). Tests of normal distribution and homogeneity (Kolmogorov-Smirnov and Levene's, respectively) were conducted on all data before analyses. A 2 × 2 analysis of variance (ANOVA) with repeated measures (group x measurement) was conducted for the pre-test and post-test conditions. Additionally, effect sizes for group differences were expressed as Cohen's *d*;[36] effect sizes are reported as trivial (<0.2), small (0.2-0.49), medium (0.5-0.79), and large (≥0.8).[36] A Pearson correlation analysis was conducted between changes (Δ, eg, 6MWT distance trial at pre-test – distance trial at post-test) experienced in physical fitness with FIQ, TP, and VAS. Finally, a simple linear regression analysis was used to determine the association between the improvements in physical fitness variables (independent variable, eg, Δ6MWT) and the improvements in FIQ, TP, and VAS (dependent variables, eg, ΔFIQ) during the intervention. Data analysis was performed using SPSS (version 24, SPSS Inc). The level of significance was $P < .05$.

3 | RESULTS

Approximately the level of compliance of physical training was between 85% and 95%. An analysis of the rate of perceived exertion (RPE) performed throughout the intervention gives a result of in-water RPE = 11.61 (1.56) and on-land RPE = 12.34 (1.78), $P = .004$, both moderate in intensity.

In Table 1, the results of the FIQ, TP, algometer scale, and VAS scale in the pre-test and post-test conditions are shown. The 2 × 2 ANOVA revealed significant effects for the group × time (groups comparison: CG vs AG). Both groups showed similar values at pre-test in all variables ($P \geq .05$) except on the algometer scale, in which the CG showed a higher score than the AG, and significant interactions were found at post-test in different variables. In post-test, the AG displayed better scores than the CG in all variables ($P < .001$). As for time x group interaction (within-group), the AG experienced significant improvements in all variables ($P < .001$), whereas the CG did not experience significant changes in any variable, except on the FIQ scale, which showed a significant worsening ($P = .004$).

Regarding physical fitness (Figure 1), no significant between-group differences ($P \geq .05$) were found at baseline (before the training intervention). However, in post-test, the AG showed a significantly better score in leg strength ($P < .001$; Cohen's $d = 1.431$), handgrip strength ($P = .009$; Cohen's $d = 0.916$), balance ($P = .003$; Cohen's $d = 1.104$), and cardiorespiratory fitness ($P < .001$; Cohen's $d = 1.758$) compared to the CG. As for time x group interaction (within-group), the AG experienced significant improvements in leg strength ($P < .001$; Cohen's $d = 1.034$; $\Delta = 3.25 \pm 4.01$ repetitions), cardiorespiratory fitness ($P < .001$; Cohen's $d = 1.096$; $\Delta = 89.01 \pm 90.82$ m), and balance ($P = .033$; Cohen's $d = 0.512$; $\Delta = 5.58 \pm 14.13$ s), whereas the CG significantly worsened on handgrip strength ($P = .017$; Cohen's $d = 0.659$; $\Delta = -3.86 \pm 5.95$ kg), cardiorespiratory fitness ($P = .020$; Cohen's $d = 1.106$; $\Delta = -46.92 \pm 50.04$ m), and balance ($P = .043$; Cohen's $d = 1.003$; $\Delta = -6.48 \pm 9.08$ s).

Table 2 shows results of SF-36 in the pre-test and post-test conditions. The 2 × 2 ANOVA revealed significant effects for the group × time (groups comparison: CG vs AG).

TABLE 1 FIQ, tender points, algmometer scale, and VAS scale parameters before (pre-test) and after (post-test) interventions

Variables	Groups	Pre-test mean (SD)	Post-test mean (SD)	*P*-value (time × group)	Cohen's d	Δ (post-test and pre-test)
FIQ (0-100)	CG	72.24 (6.22)	80.60 (6.58)	.004	1.348	8.36 (7.82)
	AG	70.06 (9.81)	57.36 (13.05)	<.001	1.128	−12.69 (12.47)
P-value (group × time)		.435	<.001			<.001
Tender points (0-18)	CG	16.81 (1.90)	16.62 (3.61)	.853	0.068	−0.18 (2.76)
	AG	17.33 (1.49)	4.45 (4.53)	<.001	3.918	−12.87 (4.65)
P-value (group × time)		.340	<.001			<.001
Algometer scale	CG	43.66 (24.54)	41.62 (23.52)	.789	0.087	−2.03 (39.26)
	AG	31.53 (10.13)	95.99 (20.77)	<.001	4.047	64.45 (22.31)
P-value (group × time)		.036	<.001			<.001
VAS in rest (0-10 cm)	CG	8.37 (1.58)	8.06 (1.44)	.572	0.211	−0.31 (2.14)
	AG	8.93 (1.13)	4.52 (1.94)	<.001	2.850	−4.41 (2.21)
P-value (group × time)		.199	<.001			<.001

Abbreviations: AG, active group; CG, control group; FIQ, Fibromyalgia Impact Questionnaire; SD, standard deviation; VAS, visual analogue scale for pain.

Both groups showed similar values at pre-test in all variables ($P \geq .05$) except physical function, in which the CG showed higher scores than the AG ($P < .001$), and significant interactions were found at post-test in different variables. In post-test, the AG displayed better scores than the CG in social function ($P = .014$), mental health ($P = .027$), and general health ($P < .001$). As for time x group interaction (within-group), the AG experienced significant improvements in emotional role ($P = .024$) and mental health ($P = .025$), whereas the CG displayed significant worsening in general health ($P < .001$).

Finally, a Pearson correlation analysis (Table 3) revealed significant relationships between the improvement in physical fitness variables and the improvements in FIQ, TP, and VAS. The linear regression analysis showed that Δ6MWT was associated negatively with ΔTP ($R^2 = 0.462$; $P < .001$) (Figure 2).

4 | DISCUSSION

At present, this is the first follow-up study for 9 years, with an exhaustive control of functional training program. The purpose of this study was to analyze long-term effects of a physical training program, consisting of two sessions per week of in-water exercise and one of on-land exercise, on pain, functional capacity, and quality of life in women with FM. The main finding indicated that active patients have improved physical fitness, decreased disease impact and less

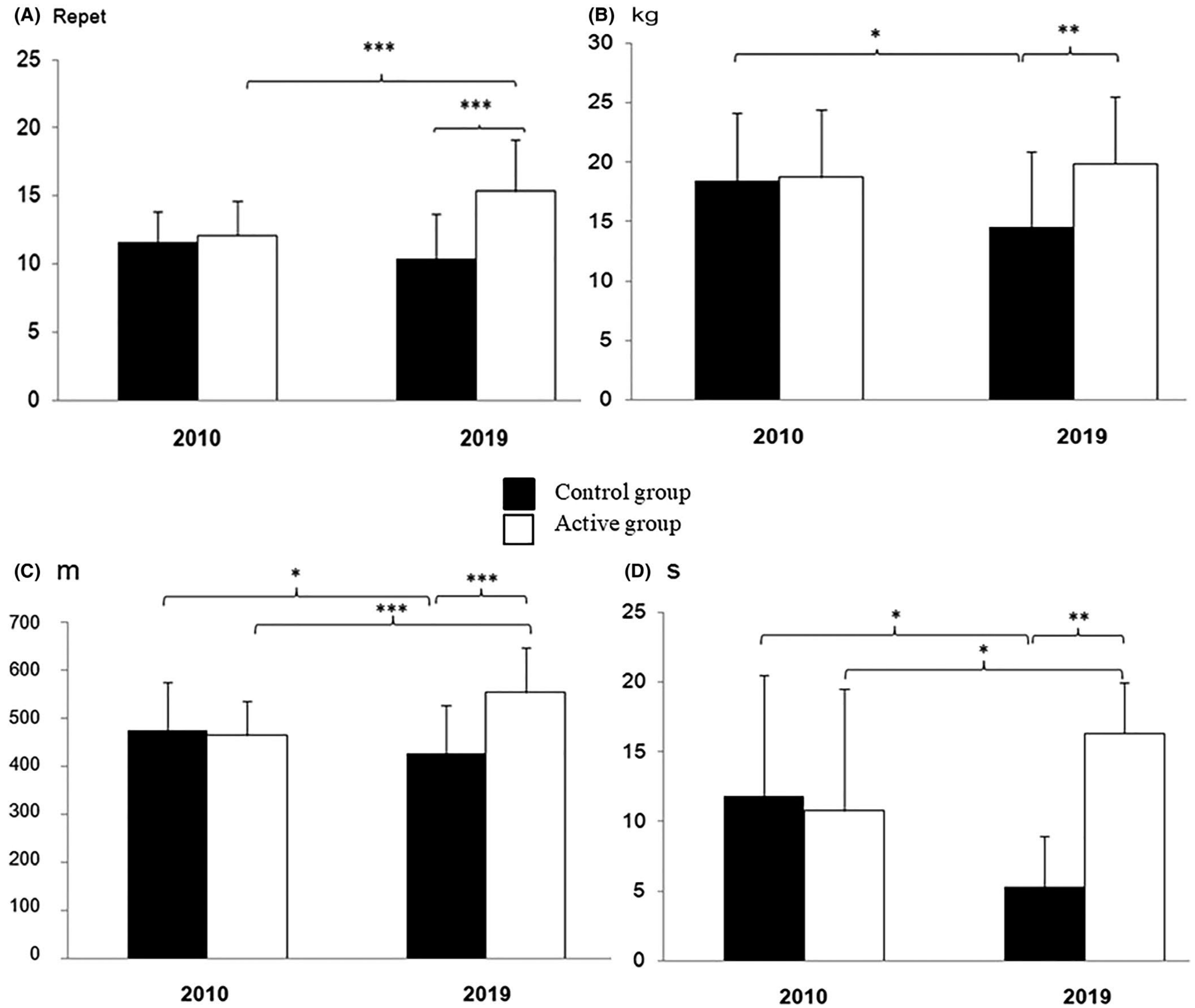

FIGURE 1 Participants completed several fitness tests at the beginning and at the end of the study, in order to verify some kind of improvement after the functional training program. Leg strength (A), handgrip strength (B), and The 6-Minute Walk Test (C) static balance (D). At 2010 (pre-test) and 2019 (post-test) exercise program. Meters (m), repetitions (Repet), kilograms (kg), and seconds (S). *$P < .05$, **$P < .01$,***$P < .001$

TABLE 2 SF-36 parameters before (pre-test) and after (post-test) interventions

Variables	Group	Pre-test mean (SD)	Post-test mean (SD)	*P*-value (time × group)	Cohen's d	Δ (post-test-pre-test)
Physical functioning	CG	57.52 (17.92)	53.69 (17.01)	.419	0.226	−3.83 (19.84)
	AG	33.74 (19.13)	30.95 (25.18)	.470	0.128	−2.79 (18.00)
P-value (group × time)		<.001	.003			.864
Physical role	CG	16.56 (21.34)	4.68 (13.59)	.086	0.685	−11.87 (26.88)
	AG	6.87 (14.73)	16.66 (28.23)	.083	0.463	9.79 (27.04)
P-value (group × time)		.097	.124			.017
Body pain[a]	CG	23.75 (10.04)	21.56 (14.43)	.712	0.181	−2.18 (15.86)
	AG	26.87 (12.25)	34.47 (23.70)	.122	0.413	7.60 (27.45)
P -value (group × time)		.402	.059			.206
General health	CG	36.40 (21.79)	11.56 (5.69)	<.001	1.611	−24.84 (24.26)
	AG	36.77 (19.00)	32.91 (13.09)	.451	0.242	−3.85 (25.10)
P-value (group × time)		.956	<.001			.012
Vitality	CG	26.45 (18.09)	26.87 (18.42)	.945	0.023	0.41 (18.08)
	AG	27.45 (21.04)	32.91 (18.58)	.276	0.282	5.45 (27.45)
P-value (group × time)		.877	.319			.523
Social functioning	CG	38.03 (12.30)	29.68 (17.00)	.312	0.581	−8.34 (22.71)
	AG	35.97 (22.84)	46.35 (21.95)	.127	0.475	10.37 (37.63)
P value (group × time)		.745	.014			.083
Emotional role	CG	9.37 (21.05)	16.66 (27.21)	.484	0.309	7.29 (31.60)
	AG	10.76 (25.24)	30.55 (34.98)	.024	0.665	19.79 (46.43)
P-value (group × time)		.857	.189			.353
Mental health	CG	38.65 (17.39)	37.56 (14.55)	.859	0.070	−1.09 (19.72)
	AG	38.54 (16.93)	50.16 (18.33)	.025	0.675	11.62 (26.98)
P-value (group × time)		.984	.027			.114

Abbreviations: AG, active group; CG, control group; SD, standard deviation.

[a]High values indicate less pain.

TABLE 3 Pearson correlation analysis between the improvement in physical fitness variables and the improvements in FIQ, TP and VAS

	ΔFIQ	ΔAS	ΔTP	ΔVAS	Δ6MWT	ΔCST	ΔHS	ΔB
ΔFIQ	1	−0.603**	0.661**	0.501**	−0.500**	−0.419**	−0.212	−0.257
ΔAS		1	−0.829**	−0.453**	0.538**	0.389*	0.218	0.404**
ΔTP			1	0.633**	−0.679**	−0.534**	−0.342*	−0.362*
ΔVAS				1	−0.506**	−0.598**	−0.406**	−0.292
Δ6MWT					1	0.513**	0.276	0.631**
ΔCST						1	0.346*	0.418**
ΔHS							1	0.466**
ΔB								1

Abbreviations: 6MWT, 6 minutes walking test; AS, algometer scale; B, balance; CST, chair stand test; FIQ, Fibromyalgia Impact Questionnaire; HS, handgrip strength; TP, tender points; VAS, visual analogue scale for pain.

*$P < .05$.

**$P < .01$.

pain, all of which are associated with a better quality of life in comparison with the sedentary patients. The training program was well tolerated and did not cause any negative effect on the health of the participants.

In the current study, all the registered parameters related to disease impact (FIQ) and pain (positive points, algometer scale, and VAS) improved significantly in the AG. These findings are in accordance with previous studies that

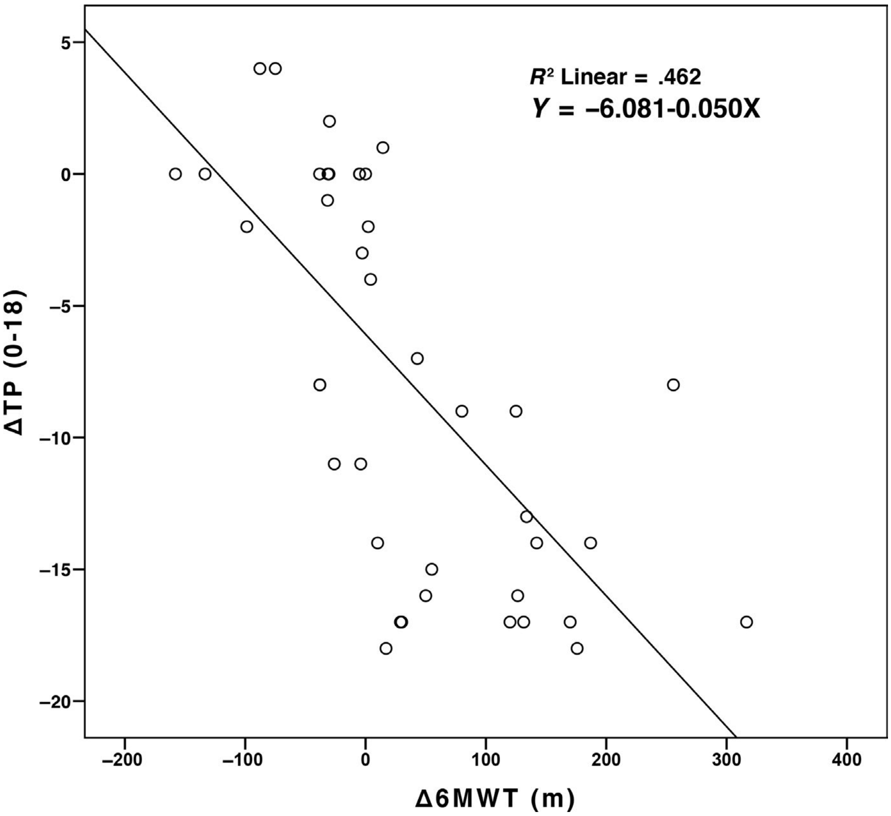

FIGURE 2 Relationships and coefficients of determination (r^2) between the 6-Minute Walk Test (Δ6MWT) and the 18 tender points (TP). Significance is indicated by: ***$P < .001$

found improvements in the FIQ, number of tender points, algometer scale, and the VAS after several physical exercise programs from 12 to 28 weeks.[14,15,37,38] In a review, Cadenas-Sanchez and Ruiz-Ruiz[39] showed that after applying an exercise program, the pain level was reduced between 10% and 44.2%, and the disease impact between 5.3% and 17.9%. In the current study, active women had reduced pain level (49.38%) and reduced disease impact (18,12%); moreover, the CG increased this variable by 11.57%. This review analyzed 33 studies that included dance, water sports, multidisciplinary, and mind-body activities, all with several training programs.

Taken together, physical fitness and leg and hand strength increased or were maintained in the AG compared to age-matched controls in the CG with aging. This decreased muscular strength in sedentary FM patients is consistent with previous literature showing that strength in FM patients is similar to that of healthy older adults.[9,10] In this regard, comparing results of the chair stand test with reference values in older people, it is important to note that in the current study the CG of FM patients obtained a similar result (10.37 ± 3.30 repetitions) to older healthy women 85-89 years of age (10.3 ± 4.0 repetitions).[32] However, the AG obtained even better values (15.33 ± 3,76 repetitions) than the healthy group 60-64 years of age (14.50 ± 4.0 repetitions)[32] or similar values for Spanish healthy women 40-49 years of age (15.46 ± 2.92 repetitions).[9] According to the reference values of physical fitness in women with FM,[40] the AG is located between 90th and 99th percentile, and the CG is located in 60th percentile.

The measurement of handgrip strength has prognostic value with respect to all-cause mortality, cardiovascular mortality, and cardiovascular disease and is an important part of the evaluation of frailty.[41] Maquet et al[2] found a reduction of 39% in the handgrip strength of women with FM compared to healthy women. Considering normative values established in a previous study on healthy people,[41] The AG achieved values in handgrip strength (19.88 ± 5.62 kg) located around the 25th percentile (21 kg) compared to a European healthy group 61-70 years of age, and similar values to Spanish women with FM 40-49 years of age (20.68 ± 8.01 kg).[9] However, the CG achieved the lowest results, below the 25th percentile (14.58 ± 6.35 kg). Specially, taking into account reference values of physical fitness in women with FM,[40] the AG is located between 60th and 70th percentile; however, the CG is located in 30th percentile. Aparicio et al[42] suggested that the handgrip strength test could discriminate between the presence and absence of FM and help determine FM severity in women.

Hence, in the current study, leg and hand strength is 32.35% and 26.65% lower, respectively, in the sedentary women with FM than in the active FM group. Therefore, in accordance with a previous study,[9] sedentary women with FM show a significant reduction of strength, representing a risk of dynapenia. The premature deficit in muscle strength and functional capacity may compromise an independent lifestyle and can lead to negative implications on functionality, which can then lead to disability and a reduction in the quality of life of younger women (<65 years).[43] However, this is the first study that shows a long-term improvement in the life quality in women with FM who performed PA in a systematic and regular way. It should be highlighted that we found an improvement of the emotional condition and the mental health in the AG. A recent study noted that patients with FM who exercised regularly showed a better overall quality of life than inactive subjects who displayed a 1.77-fold likelihood of a greater impact on quality of life.[44]

Regarding cardiorespiratory capacity, in the current study, for all physical performance measures, Δ6MWT distance is the variable that best predicts the pain reduction in patients with FM. In this sense, the 6MWT distance has been significantly related to the FIQ, SF-36, and peak exercise capacity in patients with FM.[45] A longitudinal study estimated the minimal clinically important difference for 6-MWT in patients with FM which was 156-167 m, for a 14% FIQ reduction.[45] In the current study, and comparing the results of the 6MWT with normative values,[32] active women with FM have similar results (554.43 ± 94.21 m) to those of healthy women aged 70 to 74 years (548 ± 98 m), locating into the 25th perecentile range of the 60- to 64-year-old group (545 m). The CG obtained a similar result (427.87 ± 34.51 m) to healthy women aged 85-89 years (426 ± 129 m), which is below the 10th percentile of the 60- to 64-year-old group (595 m).[32] Therefore, in women with FM, walking ability was 16% lower than the corresponding levels for healthy women.[46] In this study, the CG showed 6MWT distance at 22.82% lower than in the AG. According to the reference values of physical fitness in women with FM,[40] the AG is located between 90th and 99th percentile. Nevertheless, the CG is located in 30th percentile.

Finally, a low level of leg strength is associated with impaired balance, the risk for falls, and poor walking ability in women with FM.[46] Therefore, FM has an important impact on balance performance, number of falls, and fear of falling.[47] In this study, the AG displayed an improvement in the balance of 51.81%; however, the CG worsened 54.91%.

Some limitations associated with this study should be considered, such as the failure to check the medication and dietary habits of the patients during the intervention. Furthermore, all participants of this study belong to the same geographical region of Spain (Jaén, Andalucía). Notwithstanding, to our knowledge, this is the first study that analyses the long-term effects of a physical training program in patients with FM.

5 | CONCLUSION

A regular practice of moderate-intensity PA shows a positive long-term effect on functional capacity, pain, the impact of the disease, and the quality of life in women with FM; therefore, PA programs may be important in the clinical evolution of FM disease.

6 | PERSPECTIVES

To the best of our knowledge, this is the first study to apply to a functional training program in women suffering from fibromyalgia with a 9-year longitudinal follow-up. Overall, the results suggest that fibromyalgia female patients who follow a physical training program will have a better quality of life in general, due to improvement of the physical functional capacity. Accordingly, the disease impact and pain could be reduced in comparison with sedentary women equally affected by this disorder. These results are clinically important as they certify the importance of having an active and healthy lifestyle in this population which, in conjunction with continuous monitoring by medical professionals, could reduce pharmacological treatment or even eliminate it completely.

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CONFLICT OF INTEREST

There is no conflict of interest related to the research.

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