Original Article

Effects of a strength training program on daily living in women with fibromyalgia

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ABSTRACT

Background. The fibromyalgia among other symptoms is associated with poor physical condition in relation to the loss of muscle mass, which produces an increase in muscle disability. This directly affects the state of health because it causes limitations to perform the tasks of daily living. Objective. The aim was to analyse the effect of the progressive strength program on dimensions that affects to quality of life and to value the changes produced during the program. Design. Controlled quasi-experimental analytical study evaluating the response to the intervention program at three specific moments. Methods. 41 women with fibromyalgia participated in this study fulfilling the inclusion criteria. The participants completed a total of 24 weeks of training program based on strength work oriented to daily life activities. The program consisted of a total of 3 progressive and controlled phases in volume and intensity to improve muscle strength that affects the performance of daily living activities. Results. We obtained statistical differences ($P < 0.001$) and high clinical effects ($d > 0.60$) in all strength test and all domains of the Revised Fibromyalgia Impact Questionnaire at the end of the intervention. Conclusions. The improvements produced in functional capacity allows them to perform tasks that were previously incapable. The muscle strengthening program based on strength work twice a week on non-consecutive days with a total duration of 1 hour, improves the quality of life related to health, symptomatology, physical function and the severity of disease. **Keywords:** Health; Human performance; Woman; Pathology; Physical activity; Strength.

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INTRODUCTION

Fibromyalgia (FM) is a chronic disorder of unknown aetiology not only characterized by multiple painful regions in at least 12 weeks, but also by a series of added symptoms such as rigidity, loss of strength in extremities, non-refreshing sleep, fatigue, alteration of the mood, anxiety and depression (Sener et al., 2016),(Carmona, Ballina, Gabriel, & Laffon, 2001) and poor healthy associated quality of life (Casanueva et al., 2016). According to the prevalence in Spain is approximately 4.2 % of women suffer from this order, whereas only 0.2% of men are affected. Regarding to the distribution in age groups, FM appears with a maximum prevalence between 40-50 years old (4.9%)(Marques, Santo, Berssaneti, Matsutani, & Yuan, 2017; Mas, Carmona, Valverde, Ribas, & Grp, 2008).

Most of FM patients are sedentary, so their current symptomatology is exacerbated by their poor physical fitness regarding muscle strength (Omoigui, 2007). As a consequence of the increasing muscle disability, these patients suffer from a deficit in their daily living performance and labour, social and family relationships are directly affected (Burckhardt, Clark, & Bennett, 1993; Carmona et al., 2001). It is also interesting to show that this incapacity is also preceded by manual grip strength poor levels (Nordenskiold & Grimby, 1993).

The most beneficial treatment for FM requires a multidisciplinary approach combining education, pharmacological treatment, exercise and cognitive behavioural therapy (Arnold, Clauw, Dunegan, Turk, & FibroCollaborative, 2012; Sanudo, Galiano, Carrasco, de Hoyo, & McVeigh, 2011; F Wolfe et al., 1997). Few exercise studies have studied how this pathology affects about measures of physical function, symptomatology and overall impact on quality of life through a strength training program that includes types of resistance, intensities, frequencies and progression because that it not entirely clear which are the parameters that best suit this type of people, therefore, there are doubts about the prescription of physical activity since the subjects who suffer from this pathology present different initial levels of physical condition, some of them can start with moderate-high intensities, while at others that intensity can worsen the pain which raises the need to assess individual capacity before starting any program in order to adjust the intensity of the exercise(van Santen et al., 2002). However the findings of these studies indicate that strengthening exercises to regulate the inflammation and muscle quality (Hwi-Ryun et al., 2010) and could face limitations in the capacity to perform the routine tasks of daily life that have been reflected in these patients (Bircan, Karasel, Akgun, El, & Alper, 2008; Kingsley et al., 2005).

The aim was to analyse the effect of a progressive strength program including the parameters about multiple dimensions of quality of life in women with FM and to value the changes produced during the intervention comparing the same group at different moments.

MATERIAL AND METHODOLOGY

Participants

All participants were part of the exercise group. The study began with 55 women, of whom 14 withdrew from the study for different reasons (25%): 6% not meeting inclusion criteria, 4% other reasons, 3% incorporation to work due to medical discharge, 1% injuries to work accident. Finally, a total of 41 women with FM participate in the study (Table 1). The inclusion criteria were: a) Women aged between 20 and 75 years; b) Diagnosed with FM by a rheumatologist according to the criteria of the American College of Rheumatology (Wolfe et al., 1990) ;c) not present disabilities, d) report no physical activity practise or a maximum 1 weekly session reported, and e) able to communicate effectively with the study staff. Participants were excluded if they a) are male; b) disease that could be exacerbated by the practice of physical activity; c) are in a

gestational state, and e) change from usual care therapies during the weeks of treatment. All participants were informed about the risks and benefits of the study. This study was approved by the Human Research Review Committee of the Universidad Politécnica de Madrid in accordance with the Declaration of Helsinki.

Table 1. Characteristics at baseline of the women participants

Variable	**Week 0**
(n=41)	**Mean (*SD*)**
Age (yr)	56.36 (8.72)
Height (cm)	159.94 (5.72)
Body Mass Index (kg/m2)	26.67 (5.38)
Weight (kg)	68.12 (14.04)
Heart Rate at Rest (bpm)	76.19 (10.31)
Systolic Blood Pressure (mm Hg)	122.24 (15.88)
Diastolic Blood Pressure (mm Hg)	72.56 (10.90)
Oxygen Saturation (%)	97.59 (1.90)

The contact with these participants was conducted through the Association of Fibromyalgia of the community of Madrid (AFIBROM). The subjects included in the study were chosen using convenience sampling, that is, they were selected according to their availability and willingness to participate in the study.

Strength exercise

The participants completed a total of 24 weeks of gradual strength training program oriented to improve the daily life activities. The participants attended twice a week in non-consecutive days (1h/ session). The program consisted of three progressive and consecutive exercise phases, controlling volume and intensity in order to improve muscle strength that affects the performance of this activities. The intensity was controlled by means of the OMNI - Global Session in the Elderly Scale (OMNI-GSE) (Silva-Grigoletto Viana-Montaner, B. H., Heredia, J., Mata Ordóñez, F., Peña, G., Brito, C. J., ... & García Manso, 2013) used in inexperienced people or in elderly populations, considering their incidence at the functional level (Colado et al., 2012; Gearhart, Lagally, Riechman, Andrews, & Robertson, 2009). The program involved a 1st phase (SL): strength by self-loads including balance, coordination and postural control (five weeks) whose intensity of effort was between 3-4 of the OMNI-GSE scale; 2nd phase (EB): including elastic bands as a training method to increase strength and performance with proprioception work (seven weeks). The intensity was between 4-5 of OMNI-GSE scale, and 3rd phase (EL): including strength work with external loads with proprioceptive work (twelve weeks). The intensity was between 6-8 of OMNI-GSE scale. All the participants completed the three phases at the same time.

The exercise session started with ten minutes of warm-up followed by some circuit work described below and finally ten minutes for cool down with stretching exercises. Each session covered two different circuits (six exercises each). Two series per circuit were performed in each session. The initial work time was 30

seconds per exercise, increasing 5 seconds of work every two weeks until the participant reaches one minute of work per exercise (week 14). For the last 10 weeks the working time was kept at 1 minute. Recovery time was 2 min between the same circuits and 5 min between different ones. At the beginning of the session a correct exercise explanation was provided in order to avoid harmful gestures.

In the 3rd phase, the load was set at a level that patients could easily manage. However, following the recommendations of the other authors (Bircan et al., 2008; Gearhart et al., 2009; Kingsley et al., 2005; Sanudo et al., 2011) during the course of the study the level gradually increased according to the patient's tolerance, the individual knowledge of the symptoms and the level of general fatigue. At the beginning, during and end of all sessions was measured the pulse and oxygen saturation by oximeter because of feeling of fatigue or drowning during the exercise in some participants and finally, the OMNI-GSE scale mentioned previously was passed.

Measures

Physiological and anthropometrics measurements

Height was measured with a stadiometer (Seca 22, Hamburg, Germany) and weight was assessed with a scale (InBody 720, Biospace, Seoul, Korea). Blood Pressure and Heart Rate (HR) were evaluated at rest with an tensiometer (Omron PL-100 Pro Logic, United Kingdom) and an oximeter fingertip (Beurer PO-30, Ulm, Germany) was used to measure oxygen saturation.

Questionnaire outcomes

The sociodemographic questionnaire was used to elicit information about demographic and clinical variables as number of tender points and grade of pain. Also, the Revised Fibromyalgia Impact Questionnaire (FIQR) in Spanish version (Salgueiro et al., 2013) was used to evaluate domains as physical function (FD), overall impact (OID), symptomatology (SD) and total score (TS). All questions were classified between 0-10 each one through numeric scale.

Physical fitness testing

In order to measure physical condition, a Senior Fitness Functional Test was selected because these tests are relatively easy and safe to administer and score, they require a minimum of material and space. Among them we can find; the “30-s chair stand test”, this consisted in counting the number of times within 30 seconds that an individual can rise to a full stand from a seated position with back straight and feet flat on the floor without pushing off with the arms; the "arm curl adapted test" (repetitions in dominant and non-dominant side with a weight of 1.5 kg during 30 seconds sitting in the chair). This test to considered as a measure functional performance. The subjects were asked to perform as fast as they could taking into account the functional limitations.

Additionally, we also evaluated handgrip strength by using a hand-held dynamometer TKK 5101 Grip D; Takey (Tokyo,Japan). Each patient with the arm fully extended in a standing position performed two attempts with each hand (30° with respect to the trunk). The maximum score in kilograms for each hand was recorded.

Statistical analysis

Descriptive statistics were used to present the characteristics of the sample (Table 1). The Kolmogorov Smirnov test was used to determine normality. Normal distribution was assumed when the p-value was higher than 0.05. Differences between moments at week 0, week 0 and week 24 about characteristics were evaluated by comparing mean using the independent sample Student’s T for parametric test. We used mix linear model for repeated-measures to analyse the evolution of strength levels (“30-s chair stand test”, "arm

curl adapted test" and "handgrip strength") throughout of training program phases (week 0, week 12 and week 24) on and how influences these changes in the quality of life using the domains (FD, OID, SD) and the total score of the questionnaire (TS) during the program. Secondly, Cohen effects sizes (ES) were calculated to verify the magnitude of the mean differences between program phases. The ES were interpreted based on the following criteria: <0.2 = trivial, 0.2 to 0.6 = small effect, 0.6 to 1.2 = moderate effect, 1.2 to 2.0 = large effect, and >2.0 = very large 38. The 90% confidence interval (CI) was also calculated. Magnitude Based Inferences were carried out to determine the beneficial, trivial or harmful effect, of the strength training phases. When a clear interpretation was possible, a qualitative inference was given as follows: 0.5% to 5%, very unlikely; 5% to 25%, unlikely; 25% to 75%, possibly; 75% to 95%, likely; 95% to 99.5%, very likely; and >99.5%, most likely (Hopkins, 2007). SPSS version 22 (IBM; Armonk, NY, USA) and Microsoft Excel (Microsoft, Redmond, WA) were used to perform the statistical analyses. All tests were conducted with a 5% significance level (P < 0.05). All data are presented as mean (SD).

Table 2. Evolution of the Revised Fibromyalgia Impact Questionnaire (FIQR) domains along the strength program.

Variable	Week 0	Week 12	Week 24
(n=41)	Mean (SD)	Mean (SD)	Mean (SD)
FD (Points)	57.17 (16.60)	52.19 (15.17)	46.97[#$] (15.64)
OID (Points)	13.00 (4.52)	10.76* (4.39)	9.44[$] (4.12)
SD (Points)	68.92 (15.07)	62.95* (13.10)	53.39[#$] (13.10)
TS (Points)	139.10 (33.23)	125.90* (30.08)	112.78[#$] (29.88)

*Significant differences between weeks 0-12; #P-value between weeks 0-24; $ P-value between weeks 12-24
FD: Function Domain; OID: Overall Impact Domain; SD: Symptom Domain; TS: Total Score of three domains

RESULTS

General characteristics of the subjects are summarized in table 1. The table 2 shown the evolution of questionnaire domains (FIQR) along the training program. We observed significantly different in all moments of measurements except the function domain between week 0-12 and overall impact between week 12-24. The figure 1 shown the evolution of strength levels where we obtained significant differences in all (P < 0.001) test except the handgrip strength in both side between week 12-24.

Interaction between time of measurement about the strength tests in table 3 were found for strength levels significant results. Values relative to arm curl in dominant side (F (2, 42.389) = 123.697; P < 0.001), for non-dominant side (F (2, 41.166) =105.597; P < 0.001), 30-s chair stand test (F (2, 40.690) = 63.6910; P < 0.001), handgrip strength in dominant side (F (2, 4.194) = 46.671; P < 0.001) and finally, non-dominant side (F (2, 40.690) = 123.697; P < 0.001). The effect was greater at 24 weeks than at 12 weeks (d>0.8) except arm curl test in non-dominant size (in week 24; d=0.60 versus week 12; d=0.13) and the effect was considered small (d=0.5) in 12 weeks of training program. Moreover, in table 4 shown relevant results about the interaction between time of measurement and questionnaire domains during the evolution of training program. Values as function domain (F (2, 40.477) = 9.070; P< 0.001), overall impact domain (F (2, 40.545) = 10.932; P < 0.001), symptom domain (F (2, 40.474) = 13.623.; P < 0.001) and total score of three domains (F (2, 40.622) = 4.208; P < 0.001). The effect size was large (>0.8) when the 24 weeks ended except the function domain where the effect was medium (> 0.5 and < 0.8).

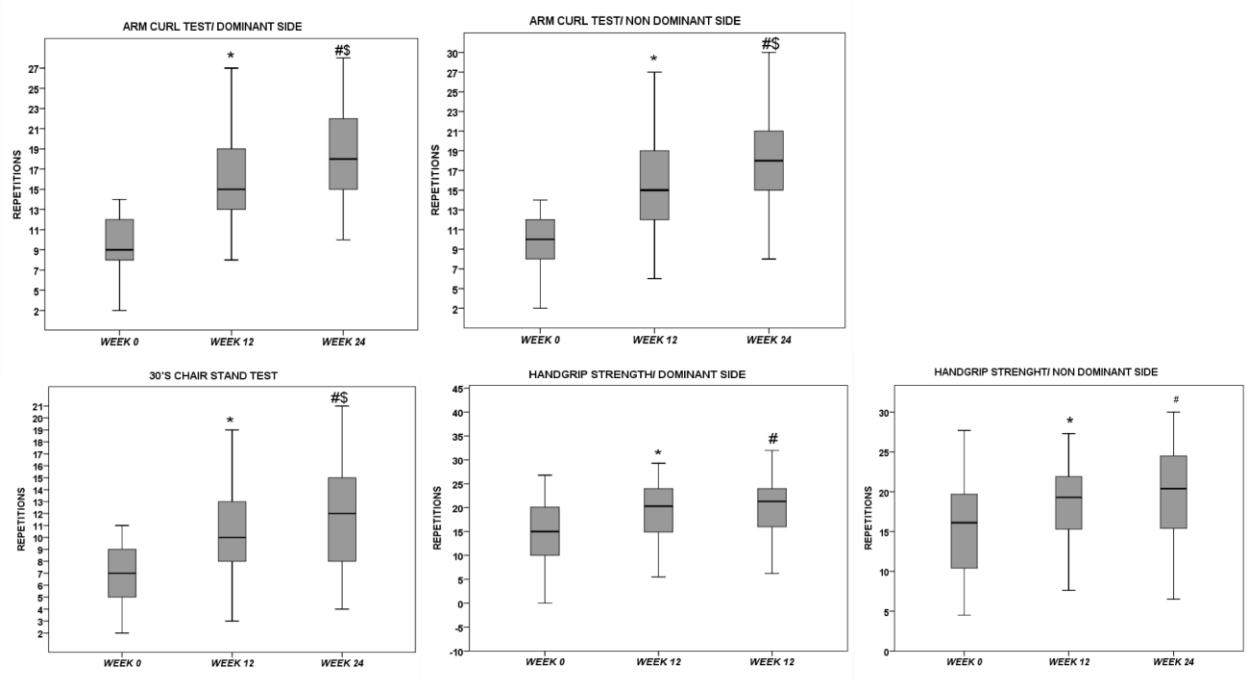

Figure 1. Median and interquartile evolution of strength levels through the training program expressed by repetitions in arm curl test (dominant and non-dominant side), handgrip strength (dominant and non-dominant side) and 30-s chair test. Notes: *P-value between weeks 0-12; # P-value between weeks 0-14; $ P-value between weeks 12-2.

Table 3. Pairwise comparison of strength test in upper and lower body in women diagnosed with fibromyalgia and their evolution along the intervention program. Results expressed as statistical significance, ES and magnitude based inference.

Variable	Training program	ES (90% CI)	P-value	Chances of being positive/trivial/negative	Qualitive inference
Dominant arm curl test	Week 0 vs Week 12	2.60 (1.56, 3.63)	**<0.001***	99.9/0/0	Most likely
	Week 0 vs Week 24	3.57 (2.84, 4.30)	**<0.001***	100/0/0	Most likely
	Week 12 vs Week 24	0.97 (0.44, 1.55)	**<0.001***	99.3/0/0	Very likely
Non-dominant arm curl test	Week 0 vs Week 12	1.95 (0.68, 3.21)	**<0.001***	99.2/0.5/0.4	Very likely
	Week 0 vs Week 24	3.00 (1.97, 4.02)	**<0.001***	100/0/0	Most likely
	Week 12 vs Week 24	1.05 (0.32, 1.78)	**<0.001***	98.5/1.2/0.3	Very likely
30-s chair stand test	Week 0 vs Week 12	1.03 (0.31, 1.74)	**<0.001***	98.5/1.2/0.3	Very likely
	Week 0 vs Week 24	1.60 (0.72, 2.48)	**<0.001***	99.5/0.3/0.2	Most likely
	Week 12 vs Week 24	0.57 (0.04, 1.11)	**<0.001***	93.3/6.0/0.7	Likely
Dominant-handgrip strength test	Week 0 vs Week 12	0.59 (0.19, 0.99)	**<0.001***	97.2/2.6/0.2	Very likely
	Week 0 vs Week 24	0.96 (0.39, 1.53)	**<.001***	99.1/0.8/0.2	Very likely
	Week 12 vs Week 24	0.37 (0.00,0.74)	0.190[b]	85.6/13.9/0.5	Likely
Non-dominant-handgrip strength test	Week 0 vs Week 12	0.13 (-0.28, 0.53)	**<0.001***	32.8/62.7/4.5	Possibly
	Week 0 vs Week 24	0.60 (0.24, 0.97)	**<0.001***	92.8/1.7/0.1	Very likely
	Week 12 vs Week 24	0.48 (0.01,0.95)	0.070[b]	90.6/8.7/0.7	Likely

ES, effect size; CI, confidence interval.
*The Bomferroni correction.
a. All significant pairwais comparisons; b. Non significant pairwais comparisons

Table 4. Pairwise comparison of the dimensions included in the Revised Fibromyalgia Impact Questionnaire (FIQR) and their evolution throughout the intervention program. Results expressed as statistical significance, ES and magnitude based inference.

Variable	Training program	ES (90% CI)	P-value*	Chances of being positive/trivial/negative	Qualitive inference
FD	Week 0 vs Week 12	0.61 (0.17, 1.05)	**0.001**·	67.6/24.8/7.6	Possibly Harmful
	Week 0 vs Week 24	0.63 (0.18, 1.17)	**0.001**·	32.5/33.9/33.6	Possibly Beneficial
	Week 12 vs Week 24	-0.03 (-0.41, -0.46)	**0.001**·	5.6/24.1/70.3	Possibly Beneficial
OID	Week 0 vs Week 12	0.50 (0.06, 0.94)	**0.001**·	100/0/0	Most likely Harmful
	Week 0 vs Week 24	0.82 (0.37, 1.27)	**<0.001**·	100/0/0	Most likely Harmful
	Week 12 vs Week 24	0,77 (0.32, 1.23)	0.05ᵇ	98.9/1/0.1	Very likely Harmful
SD	Week 0 vs Week 12	0.42 (-0.02, 0.86)	**0.001**·	33.6/32.6/33.8	Possibly Beneficial
	Week 0 vs Week 24	0.81 (0.36, 1.26)	**<0.001**·	10.8/15.8/73.4	Possibly Beneficial
	Week 12 vs Week 24	0.42 (-0.02, 0.86)	**0.002**·	2.2/10.9/86.9	Likely Beneficial
TS	Week 0 vs Week 12	0.41 (-0.03, 0.85)	**0.001**·	54.5/30.9/14.6	Possibly Harmful
	Week 0 vs Week 24	0.82 (0.37, 1.28)	**<0.001**·	16.8/25.6/57.5	Possibly Beneficial
	Week 12 vs Week 24	0.22 (-0, 0.87)	**0.001**·	2.3/11.8/85.8	Likely Beneficial

ES, effect size; CI, confidence interval.

*The Bomferroni correction.

a. All significant pairwais comparisons; b. Non significant pairwais comparisons. FD: Function Domain; OID: Overall Impact Domain; SD: Symptom Domain; TS: Total Score of three domains

DISCUSSION

The main finding of this study was that the 24-week muscle strength work-based training programme was effective in improving the quality of life of women diagnosed with fibromyalgia. There is little consensus in the literature about the importance of exercise protocol in FM; however, there is some evidence that exercise interventions of longer duration are most effective (Bardal, Roeleveld, & Mork, 2015; Sanudo et al., 2011; Valim et al., 2003). In our data, the benefits obtained at 24 weeks were greater than at 12 weeks, a fact that supports the finding provided by the authors mentioned. The idea of using strength training to improve symptoms is recent because it was overlooked due to its direct relationship to muscle trauma. Currently, several scientific studies has been suggested that strength could curb these women's lack of physical condition (Jones, Burckhardt, Clark, Bennett, & Potempa, 2002), although their treatment continues to be limited to a few studies(Bircan et al., 2008; Kingsley et al., 2005; Valkeinen et al., 2004). Our data showed differences in symptom domains with the training program. The improvement of symptoms in these women with fibromyalgia once the 24 weeks completed, not would have been enough with 12 weeks to improve these.

There are few previous studies that have used a similar training program as that used in the current study and have also used the FIQR as their primary outcome. One of them and the first was that after 12 weeks where they showed a slight improvement in FIQ scores, but not reach statistical significance (Kingsley et al., 2005). We considered that a more prolonged strength training programme is necessary to achieve clinical and statistical improvements in patients with FM, such as that used in our study.

Another study compared the effectiveness of a strengthening program versus flexibility program and demonstrated statistically and clinically significant changes in Fibromyalgia impact questionnaire (FIQ) score in the strengthening group (Jones et al., 2002). This finding supports what happened in our study where it showed that in total score domain (TS) important changes occurred. In the same way others researchers also demonstrated a reduction in number of active tender points, and a tendency towards improvement in

pain, sleep and fatigue after 21 weeks of strength training and improvements in some symptoms of Fibromyalgia in 8 weeks of strength training (Sanudo et al., 2011).

These results are in line with ours, where it is seen that a 12-week program is already effective to reduce symptoms. In addition, our results also indicate that it seems that the effect of the program is greater as the duration of the program lasts. The intervention as we have already mentioned above (Sanudo et al., 2011; Valkeinen et al., 2004). This effect is also reflected by the effect size obtained in our study in relation to the symptom domain. On the other hand, in previous studies on resistance training obtained that women with FM who practice strength resistance training for 16 to 21 weeks improve ability to do normal activities, pain, tenderness, muscle strength and overall well-being (Dominguez, Garnacho-Castano, & Mate-Munoz, 2016; Rebutini, Giaretta, da Silva, da Silva Mayork, & Cal Abad, 2013). In our study, we can see that in the domain function, dimension that encompasses the ability to perform the tasks of daily life, we did not obtain significant differences at 12 weeks, but we observed a median clinical effect, instead at 24 weeks and there were highly significant and clinical difference. Furthermore, our results suggesting that strength programs might be a relevant component of physical fitness in this population.

Although exercise programs rarely focus on specific strength training. The present study provides evidence for future intervention based on strength work, since it is a component associated an increase in quality of life, specifically, physical function and ability to perform the tasks of daily life, decrease in symptoms and impact of the disease (Bircan et al., 2008; Kingsley et al., 2005). In our study we considered these limitations, so that we have designed a training program specific of strength adapted and controlled obtaining more representative and significant results than similar studies taken out previously (Kingsley et al., 2005). The improvement percentages obtained in relation to the strength levels were in the lower limb 12%, in the dominant arm 139%, non-dominant arm 123%, dominant manual force 46% and non-dominant 40%. The improvement of strength in the study was followed by very low changes in the body mass index (BMI) obtaining a loss of 1%.

It is true that more research is needed in this area to determine if women with fibromyalgia have the ability to increase the percentage of body mass through training programs. The clinical manifestations of FM usually appear when patients are in their 40 or 50 years; hence, we can affirm that the majority of these patients are perimenopause. The body composition during this period of life is characterized by increased fatty tissue, particularly abdominal fat, undoubtedly owing to the loss of oestrogen and the decrease in physical activity (Hwi-Ryun et al., 2010). This phenomenon has been related to any number of metabolic disorders, such as dyslipidaemia, insulin resistance, high blood pressure, and an increase in coronary heart diseases (Folsom et al., 2000).

In relation to the grip strength, is a common measurement used in the assessment of hand function. It can be used as an indicator of improvement to value the effectiveness and ability to realize daily activities (function domain) (Nordenskiold & Grimby, 1993). In previously studies, were observed improvements in manual grip strength at the end of the program (Valkeinen et al., 2004). In our results, handgrip strength initially were lower than those of the healthy control group analysed in other studies recent (Koklu, Sarigul, Ozisler, Sirzai, & Ozel, 2016). In the dominant side, it was produced a high clinical effect at 24 weeks and medium effect in 12 first weeks. In the no dominant side, the clinical effect in 12 first weeks was null, at the 24 weeks and the last 12 weeks the effect was medium. Being a musculature that does not participate in the tasks of life, the improvement is proportional to the duration of the program, that is, the longer the program lasts, the greater the improvement in strength levels. In contrast, in the dominant musculature, being

constantly involved in daily activities, the effect is greater in the first weeks of the program, stabilizing as it passes.

Taking into account previous studies where they analysed receiver operating characteristic curve analyses and revealed that the handgrip strength threshold that best discriminated between the presence and absence of FM was 23.1kg (area under the curve [AUC]= 88; 95% confidence interval [CI], 0.82-0.94; P≤.001), whereas the handgrip strength threshold that best discriminate between severe and moderate FM was 16.9kg (AUC=.67; 95% CI, 0.53-0.80; P≤.05). Logistic regression analysis showed that handgrip strength 23.1kg or less was associated with 33.8 times higher odds for having FM after adjustment for age (95% CI, 9.4-121.5). In the FM group, handgrip strength 16.9kg or less was associated with 5.3 time's higher odds for having severe FM (95% CI, 1.9-14.5). Therefore, our results showed that the participants started with a severe FM (mean: 15.4 kg) and ended with a mean of 19.7 improving the impact of the pathology and moving to moderate FM(Aparicio et al., 2011).

In relation with the dominance or non-dominance of manual musculature, our initially results showed higher values in dominant side that in non-dominant and the clinical evolution was different in both sides. In the dominant, it was produced a high clinical effect at 24 weeks and medium effect in 12 first weeks. In the no dominant it different happened, the clinical effect in 12 first weeks was null, at the 24 weeks and the last 12 weeks the effect was medium. Being a musculature that does not participate in the tasks of life, the improvement is proportional to the duration of the program, that is, the longer the program lasts, the greater the improvement in strength levels. In contrast, in the dominant musculature, being constantly involved in daily activities, the effect is greater in the first weeks of the program, stabilizing as it passes.

The level of exercise compliance was high in our study; patients who completed the study attended all of the exercise sessions. However, reduction the exercise adherence is common in supervised exercise programs once finished. Our research program continued one more year with the same line of work, achieving an adherence regarding the participants of the previous year of 50%, which would be interesting to assess the improvement over the previous year. Another aspect to consider is the fact of exercising in a group setting, which have also provided additional benefits through increased social support in the group.

The study is limited by the fact that it did not include a "no treatment" control group but was compared the intervention considering the time as factor intragroup within a program with previously described exercise. The recommendations that are broadly accepted from at ethical point of view and in clinical practice. Gains of functionality, symptomatology and impact of disease observed in intervention might have been the result of the fact that the participants initially consented to participate in a study that would prescribe and counsel about strength exercise with the goal of increasing fitness and improving the quality of life.

Considering the variety of symptoms and limitations that fibromyalgia encompasses, considering the wide prevalence and onset of the disease, which is becoming earlier and earlier, it would be important to differentiate the domains, limitations or points of affectation divided by age range in order to design, prescribe and treat the disease in a more specific manner within the different affectation subgroups.

CONCLUSIONS

In conclusion, the results of this study show that a muscle strengthening program based on strength work twice a week on non-consecutive days with a total duration of 1 hour, improves the quality of life related to health, symptomatology, physical function and the severity of disease.

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CONFLICT OF INTEREST

The authors declare that no conflict of interest exists.

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