

Resistance training reduces pain in women with fibromyalgia

*O treinamento resistido reduz a dor em mulheres com fibromialgia*Alexandro Andrade¹, Sofia Mendes Sieczkowska¹, Flávia Aguiar da Silva¹, Guilherme Torres Vilarino¹

ABSTRACT

Resistance training (RT) is an intervention strategy for the treatment of fibromyalgia (FM) that has low cost, easy access, easy application and a positive effect on general health maintenance. **Objective:** To investigate the effect of four weeks of RT on pain in patients with FM. **Method:** This is a non-randomized controlled clinical trial with fifty-four women with FM (age: 53.74 ± 8.54 years). Patients were allocated to the intervention group (n= 33) and the control group (n= 21). The intervention consisted of a four-week supervised RT program. For pain assessment, an algometer and a visual analogue scale were used. To assess differences after the intervention, ANOVA two-way was used. **Results:** Patients in the intervention group had a significant reduction in pain perception and increased pain threshold, but there was no difference when compared to the control group. **Conclusions:** The practice of RT for four weeks reduces the pain of patients with FM; however, no significant differences were found with the control group. For this reason, the significant results of this study should be considered with caution, reinforcing the need for further studies.

Keywords: Fibromyalgia, Exercise, Resistance Training, Pain, Rheumatic Diseases

RESUMO

O treinamento resistido (TR) é uma estratégia de intervenção para o tratamento da fibromialgia (FM) que possui baixo custo, fácil acesso, fácil aplicação e efeito positivo na manutenção geral da saúde. **Objetivo:** Investigar o efeito de quatro semanas de TR na dor de pacientes com FM. **Método:** Trata-se de um ensaio clínico controlado não randomizado com cinquenta e quatro mulheres com FM (idade: $53,74 \pm 8,54$ anos). As pacientes foram alocadas no grupo intervenção (n= 33) e no grupo controle (n= 21). A intervenção consistiu em quatro semanas de um programa de TR supervisionado. Para a avaliação da dor foi utilizado um algômetro e a escala visual analógica. Para avaliar as diferenças após a intervenção, foi utilizada a ANOVA de dois fatores. **Resultados:** Os pacientes do grupo intervenção tiveram redução significativa da percepção da dor e aumento do limiar de dor, mas não houve diferença quando comparados ao grupo controle. **Conclusão:** A prática do TR por quatro semanas reduz a dor de pacientes com FM, entretanto, não foram encontradas diferenças significativas com o grupo controle. Por esse motivo, os resultados significativos deste estudo devem ser considerados com cautela, reforçando a necessidade de novos estudos.

Palavras-chaves: Fibromialgia, Exercício Físico, Treinamento de Força, Dor, Doenças Reumáticas

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INTRODUCTION

Fibromyalgia (FM) is a rheumatic disease of a multifactorial etiopathogenesis characterized by generalized chronic pain; in many cases, the patients' pain is perceived as hyperalgesia.^{1,2}

In addition to increased pain sensitivity, FM is associated with other disorders, such as depression, anxiety, fatigue, sleep disorders, bowel dysfunction, and frequent headaches.^{1,3,4}

Poor quality of life is also frequently associated with FM owing to the limitations in performing daily life tasks caused by symptoms and comorbidities.⁵

To date, there is still no consensus on the etiology and pathogenesis of FM among researchers; some researchers have raised the possibility of a low degree of inflammation in affected patients.⁶ The difficulty in clarifying such is attributed mainly to the fact that FM is not detected by laboratory tests.⁷

The American College of Rheumatology (ACR) presents diagnostic guidelines for this condition which are one of the most commonly used guidelines in clinical practice;⁸ the most recent guideline was published in 2016.¹ As previously described, the main criterion still used for the evaluation in clinical research is the presence of pain on palpation in 11 of the 18 common pain points, called "tender points" (TPs).⁹ In medical practice, the guidelines extend to the analysis of the dimensions of the associated symptoms, in addition to performing tests to exclude other diseases and for achieving greater reliability of diagnoses.^{1,7}

The pain of patients with FM is associated with negative effects on work capacity and daily physical activity performance, resulting in a direct association with a worsening quality of life.⁵ Different from what was previously thought, the origin of FM symptomatology may be associated with abnormalities in central pain processing, not in the musculoskeletal periphery.¹⁰ Researchers in the area of neurology sought to understand the sensorial responses related to pain in FM and found that pain is exacerbated, with a greater sensitivity to touch.¹⁰

The most frequently used alternative for the treatment of FM symptoms is pharmacological therapy, as the immediate effect of medications is mainly observed on pain symptoms.¹¹

However, the literature suggests that the adequate treatment for FM should be interdisciplinary, considering pharmacological and non-pharmacological methods.¹² Non-pharmacological methods include complementary therapies, conventional psychological counseling, and physical exercise (PE).^{3,13-15}

The use of PE as a treatment is a more satisfactory method of maintaining patients' health, considering the minimal long-term losses, its global performance in the aspects of health, and its easy accessibility.^{16,17} While medications mask the symptoms with possible long-term organ damage, PE has considerable positive global effects and lesser economic impact on both patients and the country.²

Among PE modalities, resistance training (RT) is recommended in the general population for the improvement and maintenance of physical fitness and for the prevention of loss of muscle mass, which is consequently associated with other diseases.¹⁴

Several studies have looked at resistance training in FM, and these studies found that RT provides benefits such as with

decrease of pain intensity and improves quality of life, sleep quality, fatigue and depression.¹⁷⁻²¹ There are even studies analyzing the acute effect of RT in these patients, showing conflicting results in pain and possible positive effect on mood.²²⁻²⁴

Most of the studies that found changes in patients' pain used protocols with durations of ≥ 8 weeks,²⁵⁻²⁷ making it important to test the effects of RT in shorter durations to determine if it is possible to obtain positive responses therein.

OBJECTIVE

The objective of this study was to investigate the effect of 4 weeks of RT on pain in patients with FM.

METHODS

This study was a non-randomized controlled clinical trial that followed the recommendations of the Transparent Reporting of Evaluations with Nonrandomized Designs.²⁸ This study was conducted in accordance with the Declaration of Helsinki principles, approved by the research ethics committee involving human subjects under protocol number 24584213.0.0000.0118, and registered in the Brazilian Registry of Clinical Trials (<http://www ensaiosclinicos.gov.br/>) under number RBR-74pcmw. All patients were informed of the study procedures and signed the informed consent form.

The patients were recruited through postings in hospitals and health facilities and advertisements in the local newspapers of a metropolitan city in south of Brazil. The inclusion criteria were as follows: 1) female sex; 2) age ≥ 18 years; 3) medical diagnosis of FM according to the 1990 criteria of the ACR;⁸ and 4) medical release for the practice of PE. We used the following exclusion criteria: we did not select patients with severe cardiopulmonary diseases or with physical problems that made it impossible to participate in the proposed protocol and who have performed exercises in the last two months.

Initially, 106 patients with a clinical diagnosis of FM were eligible for the study. Of the 106 patients, 16 declined to participate; 25 had health and family problems; and 11 had other reasons. After the allocation process, there were no dropouts. Patients interested in participating in the study were contacted via telephone calls for an initial evaluation. The objectives, evaluation procedures, relevance of the study, and assurance of confidentiality were explained. Patients who agreed to participate signed the written informed consent form.

After the initial evaluation, the patients were allocated into two groups according to schedule availability: intervention (n= 33) and control groups (n= 21), as presented in Figure 1. The intervention group underwent 4 weeks of RT and was reassessed 1 day after the final session; the control group was asked to maintain their regular lifestyle habits (dietary patterns and medications) throughout the study. After the intervention period, they were invited to participate in the RT program.

Intervention

The intervention was conducted following the Consensus on Exercise Reporting Template.²⁹ It was performed in a university in a metropolitan city in south of Brazil, and the

practice was performed by a physical education professional trained and accompanied by two undergraduate students; they verified the presence of the participants in all the classes to evaluate their average adherence. The exercise protocol was similar to that used in other studies,^{4,18} where the initial load was based on the patients' perception of effort, mainly using exercises for large muscle groups. The intervention was conducted three times a week for 4 weeks, and there were three sets of 8-12 repetitions.

The patients were encouraged to increase the load when they could achieve 12 repetitions, and the interval between the sets was 1 minute. The exercises were performed in pairs (when all the patients were present, one performed the exercises alone, with the participants always alternating with each other); while one patient was performing the exercise, the other was performing the interval. This was also considered a motivational factor.

Each RT session had a duration of 60 minutes, divided into three phases: initial warmup, main part, and final stretching. The warmup consisted of 10 minutes of stretching for the large and small muscle groups. During the main part of the session, the following exercises were performed: knee extension, knee flexion, bench press, fly, adductors, low rowing, high pulley, elbow extension, lateral raise, arm curl, standing calf raise, and abdominal crunch. The exercises were performed on machines and with dumbbells (weight varying from 1 kg to 4 kg). At the end of the session, 10 minutes of stretching was performed for the exercised muscles. No exercise was planned to be performed at home, and at the end of the program, the patients were instructed not to stop exercising.

Measurements

The evaluations were performed before and after the intervention by the same examiner and individually in each patient. To evaluate the outcomes, the following instruments were used: 1) a questionnaire on demographic and clinical profiles to characterize the sample; 2) an algometer to determine the pain threshold; and 3) the visual analog scale (VAS).

Demographic and Clinical Profiles

To assess the patients' profiles, a questionnaire on their sociodemographic and clinical characteristics was used.³⁰ The characterization of the sociodemographic profile was elaborated with the following information: age, marital status, and work information.

To characterize the clinical profile, the following variables were investigated: presence of generalized pain symptom and pain symptom and use of analgesic or anti-inflammatory agents.

Pain Threshold

The pain threshold was assessed according to Fischer's parameters,³¹ using the digital Fischer algometer (Commander, JTech Medical Industries, EUA), which presents its results in N/cm² transformed in kg/cm².

An algometer is a pressure device applied to the 18 common pain points of FM, following the recommendations of Wolfe et al.⁸ to assess the pain threshold.

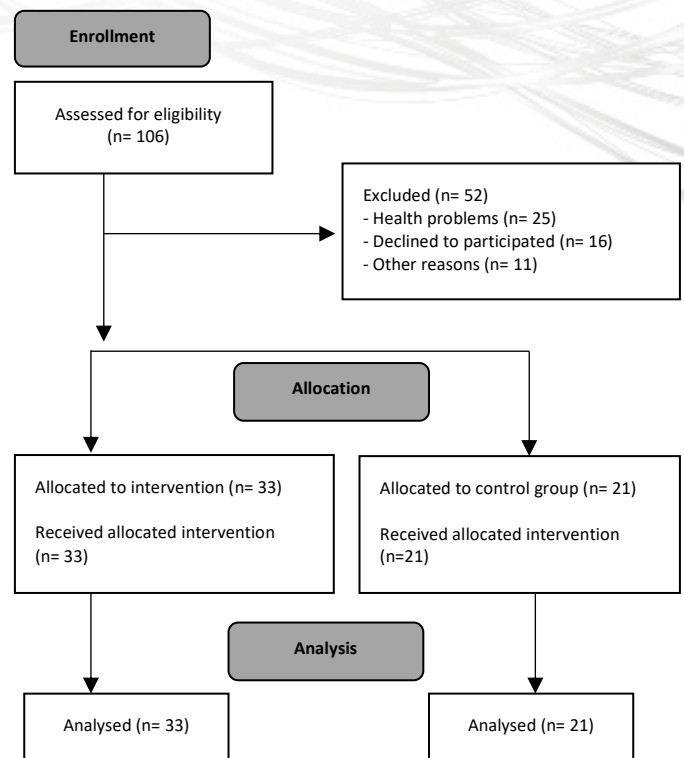


Figure 1. Flow chart of participants' progress throughout the study

The use of TPs is an important method in clinical research owing to the consistency of the evaluation results.⁹ Lower scores indicate a lower pain threshold, which is inversely proportional to the intensity of the pain at the moment of pressure; the lower the pain threshold, the greater the pain experienced. The test was performed by a trained evaluator, who increased the pressure gradually over the points, exerting a force of an average of 1 kg/s. The 18 points were evaluated separately, and the mean value of the total pain threshold was also obtained.

Pain Intensity

The perceived intensity of pain was assessed using the VAS. The patients were asked regarding the intensity of the pain they felt in the past week; the scores range from 0 to 10.

Statistical Analysis

To determine the appropriate size of the sample, the GPower 3.1 program was used, considering a type 1 error of 5% and a type 2 error of 20%.³² In this analysis, it was necessary to have at least 18 patients in each group.

The data were analyzed using the IBM SPSS Statistics (version 20.0). Descriptive statistics (means, standard deviations, and frequencies) were used to present the characteristics of the participants, and inferential tests were used to analyze the differences between the groups. To verify the difference between the intervention and control groups and between pre-training and post-training, we use the Wilcoxon Test and U the Mann Whitney test.

The effect size was verified using Hedges'g. The magnitudes of the effect size were interpreted as follows: <0.2, trivial; 0.2–

0.6, small; 0.7–1.2, moderate; 1.3–2.0, large; 2.1–4.0, very large; and >4.0, perfect 33. To determine the effect of the intervention, we calculate the delta value ($\Delta = (\bar{x} \text{ post-training} - \bar{x} \text{ pre-training})$) of the primary outcomes (Pain VAS and total pain threshold).³³

RESULTS

The overall mean age of the 54 study participants was 53.74±8.54 years. Approximately 61.1% had a partner, and 70.4% had no work activities.

Generalized pain was the most common symptom (94.4%), followed by localized pain (90.7%) and headache (63%). It was verified that 87% of the participants had a medical diagnosis of depression, and 54.4% used antidepressants. The patients also reported the use of other medications, such as analgesics (59.3%) and muscle relaxants (48.1%). The average percentage of class attendance was 82.9%.

Table 2 shows the comparisons of the total pain threshold and pain perception between the pre- and post-training periods in the intervention and control groups. Although there were initial differences in three TPs, there were no differences in the total threshold and perception of pain at pre-training.

Further, the intervention group achieved a significant reduction in the perception of pain and a tendency of improvement in the pain threshold, but both with small effect sizes; however, there were no differences when compared with the control group.

Table 2. Comparison of pain in FM patients after 12 sessions of RT

	Resistance Training			Control Group			Effect Group		Effect Time	
	Baseline	Post	Delta (95 % IC)	Baseline	Post	Delta (95 % IC)	p	Effect Size	p	Effect Size
Pain threshold	23.19±12.03	27.02±12.02 ^a	3.83 (.16; 7.48)	23.93±7.43	26.13±9.89	2.20 (-1.0; 8.74)	-		.05	-.31
Pain (VAS)	8.53±2.37	7.70±2.20 ^a	-.83 (-1.73; .06)	8.43±1.93	8.20±1.82	-.25 (-1.30; .57)	-		.04	.35

Values in mean ± standard deviation; VAS: visual analogue scale; ^a significant difference baseline x after RT

DISCUSSION

The present study aimed to verify the effect of 4 weeks of RT on pain in patients with FM. Generalized pain is the main symptom in determining a diagnosis of FM. Pain in FM is typically diffuse and may oscillate at different levels of intensity throughout the day and be intensified by external or psychological factors.³⁴ FM is often confused with others chronic pain syndrome; however, FM is diagnosed in the presence of pain in the pre-established regions and other specific associated symptoms.^{1,35}

Low levels of strength and muscular endurance are often observed in affected patients, which are attributed to the low level of physical activity identified in this population 18. In fact, sedentary behaviors are common in patients with chronic pain syndrome, resulting from the fear that PE will increase the sensation of pain.^{36,37} A reduced pain threshold also contributes to a low tolerance to PE stimuli.³⁸ In the present study, localized pain and generalized pain were prevalent in the two groups investigated; among all patients, 94.4% reported generalized pain, and 90.7% reported localized pain. After 4 weeks of RT, they demonstrated a significant improvement in pain perception and pain threshold.

Table 1. Sociodemographic and clinical characteristics of patients with FM

	General (n= 54)	RT (n= 33)	CG (n= 21)
Age (years), mean ± SD	53.74 ± 8.54	53 ± 9.17	54.90 ± 7.49
Marital Status, n (%)			
With Partner	33 (61.1)	20 (60.6)	13 (61.9)
Without Partner	21 (38.9)	13 (39.4)	8 (38.1)
Work, n (%)			
Yes	16 (29.6)	7 (21.2)	9 (42.9)
No	38 (70.4)	26 (78.8)	12 (57.1)
Presence of Pain, n (%)			
Localized pain	49 (90.7)	28 (84.8)	21 (100.0)
Generalized pain	51 (94.4)	30 (90.9)	21 (100.0)
Headache	34 (63.0)	20 (60.6)	14 (66.7)
Face Pain	19 (35.2)	13 (39.4)	6 (28.6)
Diagnosis of Depression, n (%)			
Yes	47 (87.0)	28 (84.8)	19 (90.5)
No	7 (13.0)	5 (15.2)	2 (9.5)
Use of medicine, n (%)			
Antidepressant	31 (57.4)	21 (63.6)	10 (47.6)
Analgesic	32 (59.3)	18 (54.5)	14 (66.7)
Muscle Relaxant	26 (48.1)	16 (48.5)	10 (47.6)

The use of RT for managing pain in patients with FM is time-consuming and is indicated as effective only after 12 weeks of intervention.³⁹ Thus, the results verified in this short period are extremely important for understanding the effects of RT in this condition. Hooten et al.⁴⁰ also found significant results in terms of the perception of pain using RT for only 3 weeks. This result may have been influenced by a differentiated training protocol, wherein the practices were performed daily, alternating the days on which the lower and upper limbs were exercised. Increased progression of the loads per week was also encouraged, respecting the limitations of each patient.

However, Assumpção et al.⁴¹ investigated the effect of 12 weeks of stretching exercises and body building in individuals with FM and found no significant reductions in pain in the group, and also they observed that the group that performed stretching had better pain results. The protocol used for the intervention group, which consisted of practice twice a week and training without load at baseline and with an increasing load (by 0.5 in 0.5 kg) per week thereafter, may have diminished the effectiveness of the program in reducing pain.

In the present study, the protocol used provided practice of RT three times a week, with loading based on the subjective perception of the patients; however we do not found a

difference between the intervention group and the control group, so the recommendation that patients with FM should exercise at preferred intensities to avoid exacerbated pain may be valid for aerobic exercise, but not for RT, as in a previously study.²³ Sedentary behaviors are also a factor that could justify the positive effect of the exercise even if practiced in a short period; however, further studies are needed to understand this relationship.

Based on these results, we may assume that RT protocols that provide practices more frequently and that encourage the progression of training intensity yield significant pain results more rapidly. However, other analyses are necessary for this hypothesis to be substantiated. The intensity of perceived pain correlates directly with the worsening of the quality of life and depression in this population.³⁹

In the present study, 87% of the patients had a medical diagnosis of depression. Nevertheless, the relationship of FM with depression and other mood disorders is still poorly understood. These symptoms are altered by a range of environmental and genetic factors, which are complex and heterogeneous.⁴² Thus, determining methods of PE that accurately measure the improvement of these symptoms is challenging.

Pharmacological treatments are the most commonly used and most indicated method in medical practice.¹¹ But, following a further review based on the findings of qualified studies, the European League Against Rheumatism (EULAR) indicate that PE should be the first treatment-of-choice for this population.¹³

Other guidelines, such as those by the American Pain Society and the Association of the Scientific Medical Societies in Germany, also consider PE as a primary factor in the treatment of FM.⁴³

Another important reason to seek other non-pharmacological methods as treatment is that the long-term use of medications can generate dependence among their users; patients with severe catastrophic pain and low functional capacity (including patients with FM) are more likely to develop this dependence.⁴⁴

PE is a reliable, easily accessible, and inexpensive method. Therefore, the results of the present study are important, reinforcing the positive effects of RT on the perception of pain in patients with FM. In addition, it is possible to find evidence that RT generates a positive impact on most symptoms, such as depression, sleep disorders, fatigue, and poor quality of life.²⁰

This study has some limitations, including the non-randomization of the patients. In addition, in determining eligibility, some patients were unable to attend the RT sessions owing to time constraints. To reduce sample loss, these patients were allocated into the control group, which included patients on the waiting list for the exercise group.

However, the patients were not intentionally selected or randomized, and the researchers could not predict which patient would be in which group. The time restrictions were checked only after the first evaluation. Nevertheless, the strengths of this study are the use of a standard method in assessing the pain threshold with a considerable number of participants. We also think is import publish articles without a significant difference so we can see where the lack in this area is.

CONCLUSION

After 4 weeks of RT patients with FM showed a significant reduction in pain perception and tendency of improvement in pain threshold. And this study is innovative because was using the gold standard method for the analyses of pain. Thus, RT can be an effective practice for improving pain in patients with FM, however, no significant differences were found with the control group.

For this reason, the significant results of this study should be considered with caution, reinforcing the need for further studies, in addition further trials also needed for to evaluate different intensities and intervention periods to obtain more specific results, given the variability of the results when compared with those of other studies using the same modality.

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