Effect of supervised physical exercise on flexibility of fibromyalgia patients

Efeito do exercício físico supervisionado sobre a flexibilidade de pacientes com fibromialgia

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ABSTRACT

BACKGROUND AND OBJECTIVES: Fibromyalgia is characterized by chronic diffuse musculoskeletal pain. The syndrome, of still unknown etiology, predominantly affects females. Considering that aerobic, resisted and flexibility exercises may help improving the negative impact of fibromyalgia on quality of life, this study aimed at observing the effect of supervised physical exercise on the flexibility of female patients with fibromyalgia treated in the Extension Project "Interdisciplinary treatment of fibromyalgia patients", developed in the Universidade do Rio de Janeiro.

METHODS: The study consisted in a program of supervised physical exercises lasting six months. Training frequency was equal to two weekly sessions lasting one hour each. Flexibility evaluation tool was the sit and reach test, which was applied in the beginning, three months and six months after intervention.

RESULTS: Sample was made up of 29 females (age: 48.6±10.3 years) diagnosed with fibromyalgia. No significant changes in flexibility were observed after three months of intervention. ANOVA one-way has shown significant improvement ($p<0.05$) from beginning of intervention to completion ($\Delta=22.77\%$).

CONCLUSION: Six months intervention with supervised physical exercises may improve flexibility levels of fibromyalgia females.

Keywords: Female, Fibromyalgia, Flexibility, Pain, Physical exercise, Rehabilitation.

RESUMO

JUSTIFICATIVA E OBJETIVOS: A fibromialgia é uma síndrome caracterizada por dor musculoesquelética crônica e difusa no corpo humano. A síndrome, que ainda não tem etiologia conhecida, acomete predominantemente pacientes do sexo feminino. Considerando que exercícios aeróbicos, resistidos e de flexibilidade podem colaborar na redução do impacto negativo que a fibromialgia impõe à qualidade de vida, o objetivo deste estudo foi verificar o efeito do exercício físico supervisionado sobre a flexibilidade de pacientes mulheres com fibromialgia tratadas no Projeto de Extensão "Tratamento Interdisciplinar para pacientes com fibromialgia", desenvolvido na Universidade do Estado do Rio de Janeiro.

MÉTODOS: A intervenção do estudo consistiu em um programa de exercícios físicos supervisionados com duração de seis meses. A frequência de treinamento foi igual a duas sessões semanais com uma hora de duração cada. O instrumento utilizado para avaliação da flexibilidade foi o teste de sentar e alcançar, o qual foi aplicado no início, depois de três meses e após seis meses de intervenção.

RESULTADOS: A amostra do estudo foi composta por 29 mulheres (idade: 48,6±10,3 anos) diagnosticadas com fibromialgia. Após os três primeiros meses de intervenção com exercício físico supervisionado, não foram encontradas alterações significativas na flexibilidade da amostra do estudo. A ANOVA *one-way* apresentou melhora significativa ($p<0,05$) na amostra do momento inicial para o final ($\Delta=22,77\%$).

CONCLUSÃO: Uma intervenção de seis meses de duração com exercícios físicos supervisionados pode melhorar os níveis de flexibilidade de mulheres com fibromialgia.

Descritores: Dor, Exercício físico, Feminino, Fibromialgia, Flexibilidade, Reabilitação.

INTRODUCTION

Fibromyalgia (FM) is a clinical syndrome mainly characterized by diffuse and chronic musculoskeletal pain[1]. Besides pain, it is often associated with a set of signs and symptoms, such as pervasive fatigue, morning stiffness, cognitive disorders[2], headaches, anxiety, depression[3], dyspnea, sleep and mood disorders, among others[4,5]. According to Mattos and Luz[6] and Álvarez-Gallardo et al.[7], FM patients present decreased physical capacity due to pain, causing a vicious cycle between physical inactivity and functional limitations. In some cases, the level of pain is very intense, interfering in

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the work, in the activities of daily life and in the quality of life (QOL)[5,6].

The levels of physical aptitude, flexibility, muscular strength and aerobic endurance are low in patients with FM[7-9]. Subjective complaints associated with FM may contribute to the functional disability of patients[10]. Pain, the main symptom and complaint of the patient with FM, is related to higher levels of physical inactivity and lower levels of physical activity[11,12].

The prevalence of FM in world population varies between 0.66 and 4.4%, affecting eight times more women in the age group between 35 and 60 years. In Brazil, it reaches about 2% of the population[13]. The syndrome diagnosis is clinical, with no existing pathophysiological evidence showing the diffuse and chronic pain[14]. In 2009, the American College of Rheumatology published preliminary criteria for the diagnosis of FM. It counts the painful body areas, the so-called Widespread Pain Index (WPI), which can range from 0 to 19; and the severity of symptoms fatigue, non-restorative sleep, and cognitive aspects added to the intensity/number of somatic symptoms, designating the Symptom Severity (SS) *scale score*, resulting in a score of 0 to 12. According to these criteria, to be classified as a having FM, the patient must present WPI ≥ 7 and SS scale score ≥ 5 or WPI of 3 to 6 with SS scale score ≥ 9[15].

When it comes to the treatment of FM, an interdisciplinary approach is ideal, combining pharmacological and non-pharmacological treatments[16-20]. Aerobic exercise, cognitive-behavioral therapy, and drugs are considered effective strategies[21-23]. Thus, interdisciplinary programs contribute to the improvement of QOL in patients with FM[24]. Furthermore, physical exercise, such as stretching, walking, and low-impact exercises have been a high point in the treatment of this syndrome[22,25,26].

Stretching exercises are used for maintenance or development of flexibility. This is an adjustment that is characterized by the extent of the joint movements. Flexibility, as well as muscle strength and aerobic endurance, is a physical adjustment needed to perform the activities of daily life and the conservation of health[27,28]. There is evidence about the importance of muscle stretching on the treatment of FM[29,30]. Muscle flexibility can contribute to the execution of efficient movements and maintain balance, positively correlating with the QOL[31]. Muscle stretching, when present at physical training sessions, promotes positive and significant effects on QOL of patients with FM. The training of flexibility needs to be part of the non-pharmacological intervention because it can reduce pain and soreness on the sensitive points of the patients[32-34].

A research aiming to assess the physical aptitude of patients with FM, through a battery of physical tests, including the sit and reach test, found no correlation with pain or with the total of the Fibromyalgia Impact Questionnaire (FIQ) scale. The sit and reach test pointed out significant differences between patients with FM and healthy individuals[35].

Thus, the objective of this study was to check the effect of supervised physical exercise over the flexibility of women patients with FM treated in a university extension project in Rio de Janeiro.

METHODS

The participants were women diagnosed with FM from the Extension Program "Interdisciplinary Treatment for patients with Fibromyalgia," linked to the Extension Program "Body Health Practices" (Práticas Corporais de Saúde - PRACORSAU), of the State University of Rio de Janeiro (UERJ). All participants in the study signed an Free and Informed Consent Term (FICT). The sample was of convenience related to the number of individuals enrolled in the program and who have agreed to participate effectively in all stages of the study.

Inclusion criteria were: a) medical referral requesting the inclusion in the Extension Project; b) cardiac evaluation with a stress test. Exclusion criteria were: a) performed the sit and reach test at some point not foreseen in this study; b) absences exceeding 20% of the number of classes.

The extension project "Interdisciplinary Treatment for patients with Fibromyalgia" offers physical exercises supervised by Physical Education teachers in two weekly sessions of 1 hour each (Tuesdays and Thursdays), biweekly nutritional guidance and weekly psychological support by qualified professionals. Project activities are free. Women who come to the Extension Project are referred by the Rheumatology Service of the University Hospital Pedro Ernesto (HUPE), by the Piquet Carneiro Polyclinic and, exceptionally, by private or public physicians from other entities.

The activities are divided into three phases. I) Adaptation (3 months): physical exercise sessions are offered twice a week aiming at the development of health-related physical fitness, involving strength, flexibility, and aerobic resistance training; II) Transition (4-6 months): these months include the participation in psychological support group supervised by two psychologists, in addition to physical exercises; III) Interaction (7th month onwards): period during which the participants dedicate themselves only to physical exercises and release the vacancies of psychological support group to new participants.

The physical exercise session is divided into four parts: 1) warm-up (5 to 8 minutes); 2) aerobic training (30 minutes); 3) strength training (15 minutes); 4) flexibility training (10 minutes).

Aerobic training is divided into three blocks, each lasting 10 minutes, with a three-minute run/walk in between (RuWa) around a hall with two-minute activities taught by the teacher. These activities are characterized by the collective, by playful and cooperation, involving: circuits, activities with hula hoops, balls and/or ropes, dances, competitions, relay race, gymnastics, among others (Table 1).

The heart rate (HR) is measured by the participant himself every 10 minutes on the radial artery, with the help of the index and

Table 1. The structure of the aerobic training in the Extension Project "Interdisciplinary Treatment for patients with fibromyalgia"

Block I	Block II	Block III
3 minutes of RuWa	3 minutes of RuWa	Activity V
Activity I	Activity III	3 minutes of RuWa
3 minutes of RuWa	3 minutes of RuWa	Activity VI
Activity II	Activity IV	3 minutes of RuWa

RuWa = running and walking; activities I to VI = 2 minutes each.

middle fingers. The intensity of aerobic exercises is calculated using the HRR calculator. Thus, the resting HR is subtracted from the maximum HR obtained in the stress test. Later, it is taken 52 and 60% of the HRR and add each of these values to the Resting HR to obtain the variation of target HR[36].

Strength training consists of 10 exercises, in a series of 10 maximum repetitions of each exercise. The external load is adjusted so that the participant can carry out a series with 10 repetitions in a painless way and with the correct biomechanical pattern. The major muscle groups of the body are demanded through 10 exercises: leg press, plantar flexion, biceps curl, triceps curl, abduction machine, adduction machine, leg curl machine, T-bar rowing and chest press machine (Technogym©).

Flexibility training is static and involves the main musculature of the body, with a supporting time at the threshold of discomfort for 10 seconds[37]. The main demanded groupings are biceps brachii, triceps brachii, pectoral, gluteal, deltoid, hip adductors, quadriceps adductors, hamstrings, triceps surae, scapula and low back muscles.

The sit and reach test was used to evaluate the flexibility, whose goal is to register the maximum distance achieved in trunk flexion over the hip, in a sitting position[38]. The test was carried out at the time of entering the Extension Project, after three months of training and after six months. The procedure of this test consisted in the individual being barefoot under the Wells' Bench, knees fully extended (the evaluator can hold them), elbows extended in front of the body, with one hand over the other (palms facing down). From that position, the individual attempted to achieve the maximum distance along the measuring scale. This procedure was carried out three times, with a 30-second interval between repetitions, without prior warm-up or running test. It was considered the maximum distance achieved in one of the three attempts[35,38,39].

The study was approved by the Study Ethics Committee of the University Hospital Pedro Ernesto (CEPHUPE), with the following registration of the Presentation Certificate to Ethics Assessment (CAAE): 49971715.3.0000.5259.

Statistical analysis

Data were handled by the statistical package IBM SPSS Statistics 20 for Windows and presented in descriptive form with the use of average, standard deviation and absolute and relative frequencies. The normality and homogeneity of variance of the sample data were verified by the Shapiro-Wilk test and Levene tests, respectively. The variance analysis (ANOVA one-way) was used, followed by the Tukey post hoc, to check possible differences in the studied variables. The research adopted the value of $p<0.05$ for statistical significance.

RESULTS

The sample was composed of 29 women diagnosed with FM, with an average age of 48.6±10.3 years. Table 2 presents the absolute and relative frequencies of diseases present in patients who participated in the study. Of the 29 patients, 4 (13.8%) are affected only by FM; 6 (20.7%) are affected by FM and one other disease; 7 (24.1%) had FM and also two more diseases, and 12 (41.4%) are affected by FM and by three or more other diseases. Figure 1 represents the comparative analysis of the sample levels of flexibility. In the first column is the average of the flexibility variable at the pre-intervention moment, that is, before the beginning of the intervention with physical exercise. The second column represents the average of the flexibility variable 3 months after beginning the intervention. Finally, the last column represents the average of the same variable 6 months after intervention.

The intervention with supervised exercise during the first three months after the entry caused no significant changes in the flexibility of the studied sample. It should be noted that the flexibility training included the muscles evaluated in the sit and reach test. Contrary to results found with 3 months of intervention, after 6 months of entering the Project, there have been signifi-

Table 2. Other diseases presented in the sample (n=29)

Illness	n	%
Depression	14	48.3
Systemic arterial hypertension	11	37.9
Dyslipidemia	8	27.6
Disc herniation	5	17.2
Hypothyroidism	4	13.8
Diabetes	3	10.3
Panic disorder	2	6.9
Carpal Tunnel Syndrome	2	6.9
Arthrosis	2	6.9
Tendonitis	2	6.9
Morton's neuroma	1	3.4
Chondromalacia patella	1	3.4
Scoliosis	1	3.4
Spur	1	34
Plantar fasciitis	1	3.4
Osteoporosis	1	3.4
Anemia	1	3.4
Thyroid dysfunction	1	3.4
Inflammation in the knees	1	3.4

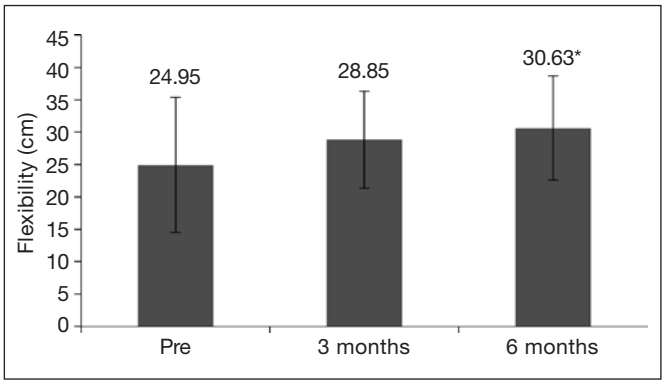

Figure 1. Comparative analysis of the sample levels of flexibility
*p < 0.05; pre versus 6 months.

cant and positive changes in the flexibility of the participants in the project, where the ANOVA *one way* showed significant improvement ($p<0.05$) in the sample from the beginning to the end ($\Delta=22.77\%$). However, no significant changes were found in flexibility between months 3 and 6.

Average differences between the moments of evaluation of the sample were analyzed in this study. The difference between the first moment of evaluation (pre-intervention) and the second time (3 months) was -3.90cm. The difference between the first and the third time (6 months) was -5.68 cm. The difference between the second and the third moment of the evaluation was of -1.78cm.

The significance ($p=0.040<0.05$) was found on the first time (pre)*versus* third time (6 months). There were no significant changes in the other moments of evaluation.

DISCUSSION

Due to few studies addressing the relationship between flexibility and FM, the present study stands out because it focuses on a field with limited scientific evidence[30,33,34,40]. It should be noted that physical valances trained during the project sessions are those related to physical aptitude and health[11,14], that is, physical valances essential to the studied population.

Marques et al.[41] also studied the effect of physical exercise on the flexibility of patients with FM. The exercise could improve the symptom framework of the syndrome, the QOL, and flexibility in patients with FM. The 50-minute sessions, once a week, were composed exclusively of stretching exercises. Ten sessions were sufficient to significantly increase the flexibility of the patients in a period fewer than 3 months of training. By contrast, in the present study was not observed a significant increase in flexibility in the first 3 months, which may have occurred because only 10 minutes of the total class time was dedicated to flexibility training.

According to Ferreira et al.[42], it is necessary at least 20 seconds of static stretching to improve flexibility. The methodology of the present study does not corroborate this other study[42] because stretching was sustained with less than 20 seconds. However, Cyrino et al.[43] warn that flexibility is dependent on the level of use, and can be improved through other types of training, especially if the practitioners are people who don't use their joints that much. The authors[43] found positive and significant results of strength training on flexibility. Strength training and aerobic training in the studied sample may have also contributed to the significant increase in flexibility after 6 months of intervention.

As presented in the methods, all participants exercised twice a week, training flexibility for 10 minutes per exercise session. This methodology was enough to point out positive results on the sample flexibility. Coelho and Burini[44] corroborate the methodology adopted in this study, because they recommend that flexibility exercises should be performed at least twice a week, with 10 minutes per training session, being these recommendations to promote health and prevent functional disability in the elderly.

In line with the present study, Coelho and Araújo[45] state that a regular participation between 3 and 18 months in a supervised exercise program, with at least 10 minutes of flexibility per training session can lead to significant increases in adults' flexibility. The findings of this study point to the same direction, because the six-month intervention with supervised exercise caused significant and positive changes in the sample flexibility.

In relation to the absence of significant increase in flexibility from the third to the sixth month, the changing potential of a physical variable could be the answer. According to Azevedo et al.[46], the changing potential of a physical variable is greater when beginning training. This phenomenon can be called adaptation window. Therefore, the less trained the individual, the greater the change potential with the training and the greater the adaptation window. The participants reached the third month with an average flexibility superior to pre-intervention, that is, the adaptation window reduced, causing the changing potential of the flexibility variable to require an increasingly significant stimulus. The stimulus on the participants in the project may have been insufficient to significantly increase the flexibility from the third to the sixth month.

In this study, participants trained not only flexibility, because the exercise session was also composed of exercises of strength and aerobic endurance. Likewise, the participants of Reis et al.[47] study experienced concurrent training, because they were training more than one physical valance (flexibility and aerobic endurance) per training session. Just as in the present study, the authors[47] also found positive results for the concurrent training on flexibility.

Gonçalves, Gurjão and Gobbi[48] and Vale et al.[49] studied the effects of strength training sessions on the levels of flexibility. In both studies, strength training seemed not to compromise improving flexibility. Vale et al.[49] add that the amplitude of movement in strength training explains the flexibility gains. In this research, all the participants were also involved in counter-resistance exercises.

Campos et al.[50] also noted positive effects of concurrent flexibility training. The exercise program proposed by the researchers consisted of aerobic training and muscle resistance training, with a sample consisting of hypertensive women (age: 63.7±5.1 years). The present study presents some similarities because the sample was also made up of women who performed strength and aerobic endurance training, 37.9% of the sample being composed of hypertensive women.

The findings of Salvat et al.[51] also noticed the importance of interdisciplinary treatment for patients with FM. According to the results, patients with FM of the interdisciplinary group showed significant improvement of physical aptitude.

CONCLUSION

From the results, it was concluded that six months of supervised exercise can significantly enhance the flexibility of women with FM. The applicability of the study is confirmed, because it tried to verify the effect of supervised physical ex-

ercise upon a conditional physical valance, being flexibility a component of health related to physical aptitude. It points out the need for new studies on flexibility and FM, and it is suggested the use other assessment tools, in addition to the sit and reach test.

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