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REVIEW ARTICLE

The effect of different exercise modalities on pain and quality of life in individuals with fibromyalgia: systematic review and meta-analysis

Efeito das diferentes modalidades de exercício na dor e qualidade de vida em indivíduos com fibromialgia: revisão sistemática e meta-análise

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ABSTRACT

BACKGROUND AND OBJECTIVES: Fibromyalgia (FM) is a chronic rheumatic disease characterized by widespread pain. Common treatments for fibromyalgia include the use of drugs. However, pharmacological treatment alone is not sufficient. A multidimensional approach, including physical exercise, is recommended as a non-pharmacological method for treating fibromyalgia. The objective of this study was to identify evidence on the effects of different types of exercise commonly used in the treatment of FM (aerobic exercise, resistance exercise, stretching and Pilates) on the pain and quality of life of these individuals, with the intention of identifying the most appropriate type of exercise for managing the symptoms of this syndrome.

CONTENTS: A systematic literature search was conducted using the online Pubmed database. After eliminating duplicate articles and screening for inclusion criteria, a total of 12 studies were identified for review and data extraction. The findings of this study indicate that comparisons among different exercise modalities do not allow consistent conclusions regarding the superiority of one modality over another. Furthermore, the results highlight the gap in the literature regarding standardization and definition of the ideal type of exercise.

CONCLUSION: The results showed no significant evidence of superiority of any of the evaluated modalities in improving the outcomes analyzed. Despite this, physical exercise continues to be widely recommended as a non-pharmacological strategy in the management of fibromyalgia. Regular exercise, tailored to individual conditions, should be encouraged as part of an integrated and personalized therapeutic approach.

KEYWORDS: Aerobic training, Fibromyalgia, Pain, Pilates, Quality of life, Resistance training, Stretching.

RESUMO

JUSTIFICATIVA E OBJETIVOS: A fibromialgia (FM) é uma doença reumática crônica caracterizada por dor generalizada. Os tratamentos comuns para fibromialgia incluem o uso de fármacos. No entanto, o tratamento farmacológico isolado não é suficiente. Uma abordagem multidimensional, incluindo exercícios físicos, é recomendada como um método não farmacológico para o tratamento da fibromialgia. O objetivo deste estudo foi identificar evidências sobre os efeitos de diferentes tipos de exercícios comumente utilizados no tratamento da FM (exercícios aeróbios, exercícios de resistência, alongamento e Pilates) na dor e na qualidade de vida desses indivíduos, com a intenção de identificar o tipo de exercício mais apropriado para o manejo dos sintomas dessa síndrome.

CONTEÚDO: Foi realizada uma revisão sistemática na literatura utilizando a base de dados online Pubmed. Após a eliminação de artigos duplicados e a verificação dos critérios de inclusão, um total de 12 estudos foram identificados para revisão e extração de dados. Os resultados deste estudo indicam que as comparações entre diferentes modalidades de exercício não permitem conclusões consistentes sobre a superioridade de uma modalidade em relação a outra. Além disso, os resultados destacam a lacuna na literatura no que diz respeito à padronização e definição do tipo ideal de exercício.

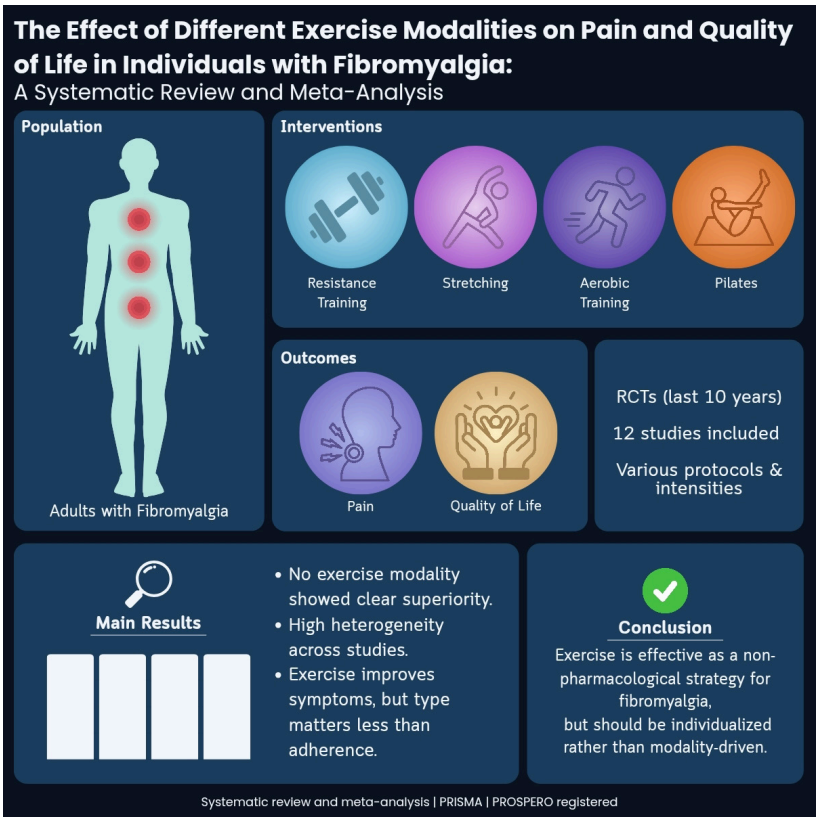
CONCLUSÃO: Os resultados não apresentaram evidência significativa de nenhuma das modalidades avaliadas na melhoria dos avanços desenvolvidos. Apesar disso, o exercício físico continua sendo amplamente recomendado como estratégia não farmacológica no tratamento da fibromialgia. A prática regular de exercícios, adaptada às condições individuais, deve ser incentivada como parte de uma abordagem terapêutica integrada e personalizada.

DESCRITORES: Alongamento, Dor, Exercício aeróbio, Exercício resistido, Fibromialgia, Pilates, Qualidade de vida.

HIGHLIGHTS

- No exercise modality showed superiority for pain or quality of life
- Physical exercise remains recommended for fibromyalgia despite heterogeneity
- Regular, individualized exercise is essential in fibromyalgia management

GRAPHICAL ABSTRACT



INTRODUCTION

Fibromyalgia (FM) is a chronic rheumatic disease of unknown cause, characterized by widespread pain, with increased responses to stimuli perceived as nociceptive and somatic symptoms, and may or may not be associated with joint stiffness[1]. It is also often accompanied by fatigue, sleep disturbances, depression, and an inability to perform normal daily activities[2].

Previous studies have evaluated altered pain perception, reporting a chronic, heightened pain response to a painful stimulus (hyperalgesia) and pain caused by a stimulus that should not normally cause pain (allodynia)[3]. These symptoms, among others, significantly affect the quality of life of the population living with the disease, resulting in physical and psychosocial disabilities with important implications for family, employment, and independence[4].

FM disrupts several systems. In the musculoskeletal system, muscle abnormalities that can result in weakness, fatigue, and muscle pain include reductions in type II fibers, abnormal muscle metabolism, excessive agonist-antagonist contraction, reduced adenosine triphosphate levels, and nerve fiber damage[5]. Another important factor is adherence to physical exercise, which is rarely observed in this population[6].

Treatment for FM generally focuses on symptom control[7]. Common treatments for FM include the use of drugs. However, pharmacological treatment alone is not sufficient for the treatment of FM[8]. A multidimensional approach, including patient education, behavioral therapy, and physical exercise, are recommended as non-pharmacological methods for the treatment of FM[9].

Previous studies have found that different types of physical exercise contribute positively to the quality of life of individuals with FM, helping to reduce pain and depression[10]. Therefore, individuals with FM can improve their overall health and moderate the risks associated with other conditions by following an exercise program[11].

Health education programs, together with non-pharmacological treatments based on physical exercise, are effective in improving and controlling FM symptoms[12,13] and quality of life[14]. Several relationships between FM and physical exercise can be found in the literature, including cross-sectional studies[15], randomized clinical trials[16], systematic reviews and meta-analyses[17], and scoping reviews[18].

Questions regarding the best type of exercise, appropriate intensity, and delivery options for interventions are still needed. Furthermore, previous studies have not reported or analyzed exercise-related variables such as frequency, volume, or duration[19], which could increase the risk of adverse effects and/or misleading conclusions[20].

Therefore, this systematic review and meta-analysis aimed to verify the evidence on the effects of different types of exercise commonly used in the treatment of FM (aerobic exercise, resistance exercise, stretching and Pilates) on the pain and quality

of life of these individuals, with the intention of identifying the most appropriate type of exercise for managing the symptoms of this syndrome.

CONTENTS

To prepare for this study, a review of scientific literature was conducted following the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) declaration guidelines[21]. The protocol for this systematic review was initially registered with the International Prospective Register of Systematic Reviews (PROSPERO) under number CRD42025649704.

Study search and selection strategy

A systematic literature search was conducted using the online database Pubmed (Medline) during February 2025 to identify original research. The keywords used for the search were: "Fibromyalgia", "Aerobic Exercise", "Resistance Training", "Stretching" and "Pilates". These terms were combined with the Boolean operators "AND" and "OR". There was no language restriction, and only original research articles published in journals were selected. Titles and abstracts were checked and analyzed, and after full-text analysis, articles that did not fit the objectives of this study were excluded.

Inclusion and exclusion criteria

Inclusion and exclusion criteria were determined using the PICOS (population, interventions, comparisons, objective, study type) criteria. Population: Individuals of both genders, aged 18 years or older; Interventions: Practice of aerobic, resistance, stretching, and Pilates exercises; Comparisons: Standard care or other intervention; Objective: To evaluate the effect of different types of exercise on pain and quality of life in individuals with FM; Study type: Studies conducted in the last 10 years using a Randomized Clinical Trial (RCT) design. Exclusion criteria were defined based on differences in objectives between the selected articles and this study, as well as duplicate articles in the database. After eliminating duplicate articles and screening for inclusion criteria, 12 studies were identified for review and data extraction.

Assessment of methodological quality

The methodological quality of the included studies was assessed using the PEDro scale, a checklist for assessing the methodological quality of randomized clinical trials. The scale consists of 11 criteria scored as yes or no, with the first being related to external validity, and the remaining criteria (2nd to 11th) used to calculate the final score, which ranges from 0 to 10. The cutoff scores for interpreting the scale are as follows: scores of 0 to 4 are interpreted as low quality; 5 points as fair quality; 6 to 8 points as good quality; and 9 to 10 are considered excellent methodological quality[22].

Risk of bias assessment

Risk of bias was assessed according to the Cochrane Collaboration guidelines using Risk of Bias Version 2 (RoB2, The Cochrane Collaboration, 2019). This software provides a framework for assessing the risk of bias in study findings across five domains: (1) bias resulting from the randomization process; (2) bias due to deviations from intended interventions; (3) bias due to missing outcome data; (4) bias in outcome measurement; (5) bias in selection of the reported outcome.

Meta-analysis

The random-effects model was chosen for this meta-analysis based on the assessment of heterogeneity among the included studies. Cochran's Q test and the I^2 index were used as statistical measures for this assessment. A p-value <0.10 in the Q test was considered indicative of significant heterogeneity, and I^2 values greater than 50% were considered evidence of substantial heterogeneity. Although the p-value did not indicate statistical significance in some cases, the random-effects model was chosen because it is more conservative and takes into account methodological and clinical variability among studies. This approach is recommended when studies are expected to share a distribution of true effects rather than a single effect[23].

RESULTS

Study selection

After the search and screening, a total of 12 articles were selected according to the eligibility criteria. The study selection process is shown in Figure 1.

Summary and characteristics of the studies

Table 1 addresses the summary and characteristics of the selected studies. Regarding the objective of the studies, there were those that compared interventions to assess their effects on FM symptoms[8,24,26,28,29,32-34], studies that sought to determine the local and systemic effect of their intervention[27,30,31] and one study that compared the effect of Pilates performed in a group with mat Pilates[25].

The outcomes addressed involved the effect of the intervention on pain and quality of life[8,24-26,28-32,34], physical function[24,26,27,29-31,33] memory[33], depressive symptoms[8,26,29,32,33], anxiety[8,25,26,29], sleep quality[8,28], and pain catastrophizing[28,31].

Regarding the characteristics of the participants, it is possible to observe that 10 studies chose to include only women[24-33] while only two studies included both genders in their participants[8,34]. The priority for including females is possibly due to the fact that the syndrome is more common in women[35].

Participants' ages ranged from a minimum of 18 to a maximum of 75. Some studies also focused more on middle-aged

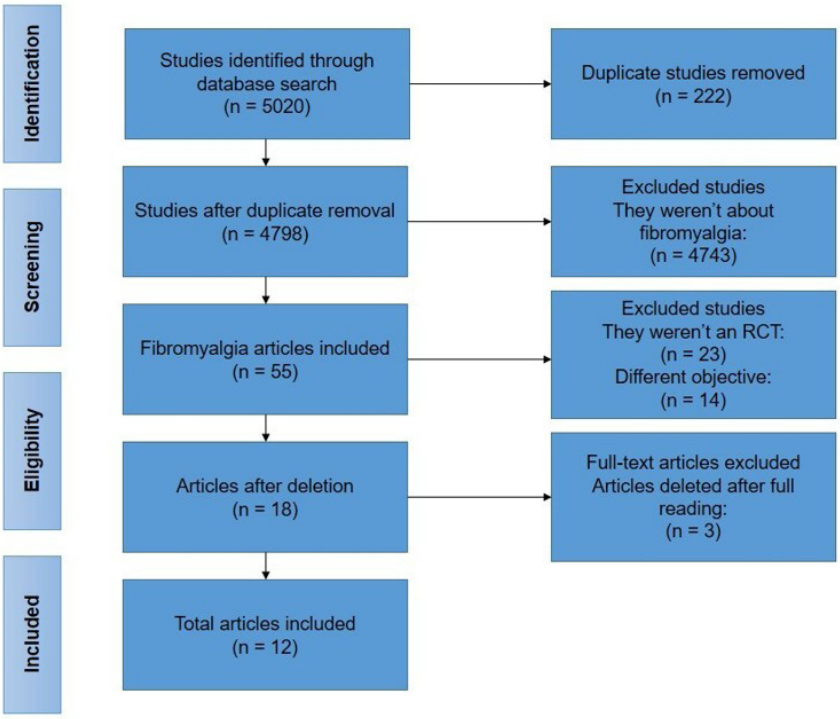


Figure 1. Selection process based on the Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) flowchart.

Table 1. Summary of selected studies of aerobic, resistance, stretching and Pilates training for individuals with fibromyalgia.

Authors	Interventions	Intensity	Number of Individuals Studied	Results
Park et al.[24]	4 weeks; 2x per week; 30 min per workout; 3 reps x 30s per exercise.	Tender point on the widespread pain index (WPI).	IG1: Resistance Exercise (n = 20)	Both exercises could improve fibromyalgia symptoms but did not show significantly better efficiency with the intergroup analysis.
			IG2: Stretching (n = 20)	
Wang et al.[8]	24 weeks; 2 times per week; 60 min per workout.	IG1: Not mentioned.	IG1: Tai Chi (n = 151)	The effects favor the Tai-Chi groups but are not statistically significant.
		IG2: 1st Week: 50-60% of estimated maximum HR; 10-12th Week: 60-70% of estimated maximum HR.	IG2: Aerobic Exercise (n = 75)	
Caglayan et al.[25]	6 weeks; 2 times per week; 60 minutes per workout; 8 to 10 reps per exercise.	Until the correct posture was achieved in different positions according to the key elements taught on day 1.	IG1: Individual Pilates (n = 16)	Both exercise groups had moderate to high effect levels for all parameters.
			IG2: Group Pilates (n = 26)	Comparing the two groups, only the FIQ was significantly favorable to IG1.
Eseoğlu et al.[26]	8 weeks; 2 times per week; 20 min per workout; 2 sets of 30s per exercise	Until the end of the 30s time.	IG1: Pilates (n = 15)	Significant differences for BAI, BDI and FIQ in both groups.
			IG2: Electrical Muscle Stimulation (n = 15)	
Berardi et al.[27]	2 sessions; 10 min per session.	Submaximal intermittent isometric and concentric muscle contractions were matched for intensity (20% of maximal voluntary isometric contraction).	IG1: Participants with Fibromyalgia (n = 47)	IG1 and IG2 did not experience detrimental changes in experimental pain sensitivity after clinically appropriate isometric or concentric exercise.
			IG2: Participants without Fibromyalgia (n = 47)	Pressure pain thresholds were similar in the exercising muscle (locally) and remotely.

IG: Intervention Group; HR: Heart Rate; 1RM: One Repetition Maximum; VAS: Visual Analog Scale; FIQ: Fibromyalgia Impact Questionnaire; SS: Symptom Severity; BDI: Beck Depression Inventory; BAI: Beck Anxiety Inventory; SF-36: Short Form-36 Health Survey; PSQI: Pittsburgh Sleep Quality Index; PRCTS: Catastrophic Thoughts on Pain Scale; FABQ: Fear Avoidance Beliefs Questionnaire; FABQ-Phys: Fear Avoidance Beliefs Questionnaire on Physical Activities; MCS: Memory Complaint Scale Questionnaire; 6MWT: 6-Minute Walk Test; PCS: Pain Catastrophizing Scale.

Table 1. Continued...

Authors	Interventions	Intensity	Number of Individuals Studied	Results
de Medeiros et al.[28]	Mat Pilates: 12 weeks; 2x per week; 50min per workout	IG1: Until the end of the repetitions or the time.	IG1: Mat Pilates (n = 21)	Improvement in both groups in the FIQ and VAS.
	Aquatic aerobics: 12 weeks; 2x per week; 40min per workout.	IG2: Intensity based on the Borg scale.	IG2 Aquatic Aerobic Exercise (n = 21)	IG1 demonstrated improvement in the vitality, functional capacity, and pain domains in the SF-36. In the FABQ-Phys, there was an improvement in the activities domain. There was an improvement in the total PSQI and PRCTS for IG2.
Assumpção et al.[29]	12 weeks; 2x per week; 40 min per workout.	IG1: Intensity was adjusted until moderate discomfort was reached.	IG1: Stretching (n = 14)	IG1 had the highest SF-36 functional capacity score and the lowest pain score.
		IG2: Intensity based on the Borg scale.	IG2: Resistance Exercise (n = 16)	IG2 had the lowest FIQ depression score. IG3 had the highest FIQ fatigue and morning stiffness score and the lowest SF-36 vitality score.
			IG3: Control Group (n = 14)	
Larsson et al.[30]	15 weeks; 2x a week; 25 min per workout.	1RM was adjusted individually based on the number of repetitions performed.	IG1: Resistance Exercise (n = 67)	The total FIQ score was higher in IG1.
			IG2: Relaxing Therapy (n = 63)	There was a significant improvement in the VAS, SF-36, and MCS for IG1.
Glasgow et al.[31]	8 weeks; 2x a week; 30min per workout.	Initial training: 50% 1RM (upper limbs) and 60% 1RM (lower limbs).	IG1: participants with fibromyalgia (n = 25)	There was no change in pain catastrophizing or autonomic modulation at rest, however, there was an increase in maximum strength, a decrease in the impact of the disease and an improvement in quality of life.
		After participants completed 2 consecutive days of training, endurance increased by 2-10%.	IG2: Participants without Fibromyalgia (n = 9)	
Sevimli et al.[32]	Aerobic gymnastics: 3 months; 2x per week; 40min (1st month), 45min (2nd month), 50min (3rd month).	60-80% of maximum HR.	IG1: Isometric and Stretching Exercises at Home (n = 25)	VAS and BDI had significant differences in all three groups, while FIQ, 6MWT, MCS and PCS values had no significant differences in IG1.
	Isometric strength stretching: 3 months; 15 min per day.		IG2: Aerobic Gymnastics (n = 25)	
	Aquatic exercises: 3 months; 2x per week; 40 min (1st month), 45 min (2nd month), 50 min (3rd month).		IG3: Aquatic Aerobic Exercise (n = 25)	
Norouzi et al.[33]	12 weeks; 3x per week; 60min per workout.	60-75% of maximum HR.	IG1: Zumba (n = 20)	Significant improvement in memory and motor function in IG1 and IG2 compared to IG3.
			IG2: Aerobic Exercise (n = 20)	Improvement in depressive symptoms in IG1 and IG2, but much more so in IG2.
			IG3: Control Group (n = 20)	Although motor function improved in both intervention groups, the effects did not reach clinical relevance.
Franco et al.[34]	8 weeks; 2x per week; 60 min per session.	Unidentified.	IG1: Pilates (n = 48)	There was no significant difference between the groups regarding the impact of fibromyalgia. Pilates was not cost-effective compared to aerobic exercise for the impact of fibromyalgia.
			IG2: Aerobic Exercise (n = 49)	

IG: Intervention Group; HR: Heart Rate; 1RM: One Repetition Maximum; VAS: Visual Analog Scale; FIQ: Fibromyalgia Impact Questionnaire; SS: Symptom Severity; BDI: Beck Depression Inventory; BAI: Beck Anxiety Inventory; SF-36: Short Form-36 Health Survey; PSQI: Pittsburgh Sleep Quality Index; PRCTS: Catastrophic Thoughts on Pain Scale; FABQ: Fear Avoidance Beliefs Questionnaire; FABQ-Phys: Fear Avoidance Beliefs Questionnaire on Physical Activities; MCS: Memory Complaint Scale Questionnaire; 6MWT: 6-Minute Walk Test; PCS: Pain Catastrophizing Scale.

participants[25,29,33]. This wide range of ages is likely due to the fact that FM can develop at any age[36].

Intervention protocols

The duration of the interventions varied as follows: lasting 4 weeks[24], 6 weeks[25], 8 weeks[26,31,34], 12 weeks or 3 months[28,29,32,33] and 15 weeks[30]. According to the findings of Sosa-Reina et al.[37] combined exercise programs of aerobic, resistance, or stretching exercises lasting 3-6 months appear to be more effective in improving depressive symptoms, and resistance exercise programs lasting 4-6 months appear to be more effective in reducing pain and the severity of FM symptoms. While in Pilates, there is still no consensus on the ideal intervention period.

Regarding weekly frequency, 10 studies defined its frequency as twice a week[8,24-26,28-32,34] and one study defined the weekly frequency as 3 times[33]. The duration of the sessions varied from a minimum of 10 minutes to 60 minutes in all studies. In addition, one study carried out its intervention in two sessions, of 10 minutes each[27]. Although there is still no total consensus, a previous meta-analysis found that 2 or 3 weekly physical exercise sessions lasting 30 to 45 minutes would be effective for this population[37].

Regarding the intensity of physical exercise, it is possible to observe that there were interventions that performed the exercise with light intensity[24-29] and others that performed it with moderate intensity[8,30-33]. For Pilates, although its effect is well documented in the literature, there is still no agreement regarding the intensity that should be used[38]. When aerobic, resistance or stretching exercises are addressed, there is evidence that light to moderate intensities would be more ideal for this population[37].

Assessment of methodological quality

The methodological quality scores of the included studies using the PEDro scale ranged from a minimum of 4 to a total of 10 points, as shown in Table 2. Only one study[27], which obtained a total score of 4, was classified as low quality. No studies were classified as of fair quality. Nine studies[8,24-26,29,31-34] were classified as having good methodological quality. Only two studies[28, 30] were classified as having excellent methodological quality based on their total scores.

In general, all studies specified their eligibility criteria (Item No. 1), all subjects for whom outcome measures were available received the treatment or control condition as allocated, and where this did not occur, data for at least one primary outcome were analyzed by "intention to treat" (Item No. 9), all included studies reported the results of statistical comparisons between groups for at least one primary outcome (Item No. 10), and all studies provided point and variability measures for at least one primary outcome (Item No. 11).

All studies, except one[27], randomly allocated subjects to their groups (Item No. 2) and the allocation was concealed (Item No. 3).

Table 2. Assessment of methodological quality using the PEDro scale in the included studies.

	Park et al.[24]	Wang et al.[8]	Caglayan et al.[25]	Eseoğlu et al.[26]	Berardi et al.[27]	de Medeiros et al.[28]	Assumpção et al.[29]	Larsson et al.[30]	Glasgow et al.[31]	Sevimli et al.[32]	Norouzi et al.[33]	Franco et al.[34]
Item No. 1	+	+	+	+	+	+	+	+	+	+	+	+
Item No. 2	+	+	+	+	-	+	+	+	+	+	+	+
Item No. 3	+	+	+	+	-	+	+	+	+	+	+	+
Item No. 4	+	+	+	+	-	+	+	+	-	+	+	+
Item No. 5	-	-	-	-	-	+	+	+	-	-	-	-
Item No. 6	-	-	-	-	-	+	-	-	-	-	-	-
Item No. 7	+	+	+	+	-	+	-	+	-	-	-	+
Item No. 8	-	-	-	+	+	_+	-	+	+	+	+	+
Item No. 9	+	+	+	+	+	+	+	+	+	+	+	+
Item No. 10	+	+	+	+	+	+	+	+	+	+	+	+
Item No. 11	+	+	+	+	+	+	+	+	+	+	+	+
Total score	7	7	7	8	4	10	7	9	6	7	7	8

With the exception of the studies[27,31] all studies had subjects at the beginning of the studies similar in relation to the most important prognostic indicators.

The most consistent methodological flaws were the blinding of study participants[8,24-27,31-34] and the blinding of all therapists who administered the therapy.

Internal validity and risk of bias

There was no disagreement between reviewers in classifying studies using RoB 2. As shown in Figure 2, of the 12 articles selected for the present study, two were classified as having "low risk" of bias[29,30], seven were classified as having "some concerns"[8,26-28,31-33], and three studies were classified as having "high risk" of bias[24,25,34].

META-ANALYSIS

Aerobic training

A total of three studies[28,32,34] were included to evaluate the effect of aerobic training on the pain variable. The studies included 189 participants in total, 95 in the experimental group and 94 in the control group.

The estimated mean difference was (MD -6.99; 95% CI [-21.57; 7.60]). High heterogeneity was observed between studies ($I^2 = 96.5\%$, $\tau 2 = 162.8121$, $p<0.0001$), indicating that 96.5% of the total variability between studies is due to real differences rather than chance. Figure 3 shows the forest plot for the present meta-analysis.

There was a total of three studies[28,32,34] that were incorporated into this analysis with the aim of evaluating the effects of aerobic training on the quality of life variable, totaling 189 participants, 95 in the experimental group and 94 in the control group.

A pooled mean difference of (MD 4.70; 95% CI [-27.26; 17.87]) was revealed, not indicating great statistical significance. High heterogeneity was observed between studies ($I^2 = 95.7\%$, $\tau 2 = 380.3739$, $p < 0.0001$), indicating great variability between individual results (Figure 3).

Stretching

Two studies were included in the present analysis[24,29], totaling a sample of 70 participants, 34 in the experimental group and 36 in the control group. The objective of the current meta-analysis was to evaluate the effect of stretching on the pain variable.

The pooled estimate between the experimental and control groups was (MD 0.18; 95% CI [-1.80; 2.16]). Heterogeneity analysis indicated no substantial variability among the studies analyzed ($I^2 = 0.0\%$; $\tau^2 = 0$; $p = 0.9144$), supporting the consistency of the findings.

Figure 3 represents the forest plot graph corresponding to the current meta-analysis.

To evaluate the effect of stretching on the quality of life variable, the same two studies were included in the meta-analysis[24,29], with a total of 70 participants, 34 from the experimental group and 36 from the control group.

The pooled analysis indicated a mean difference of: (MD 1.93; 95% CI [-13.86; 17.73]), identifying no statistically significant effect.

Substantial heterogeneity was identified between the studies ($I^2 = 82.4\%$; $\tau^2 = 109.53$; $p = 0.017$), which supports the adoption of the random effects model to interpret the results.

The results of the current analysis are represented in the forest plot in Figure 3.

Pilates

To estimate the effects of Pilates on the pain variable in individuals with FM, a total of four studies were included in the meta-analysis[25,26,28,34], totaling 211 participants, 100 in the experimental group and 111 in the control group.

A pooled mean difference of (MD 0.05; 95% CI [-2.34; 2.44]) was indicated, thus not representing any statistical significance regarding the improvement of pain through Pilates in individuals with FM.

Figure 2. Summary of risk of bias in five domains for the 12 included studies.

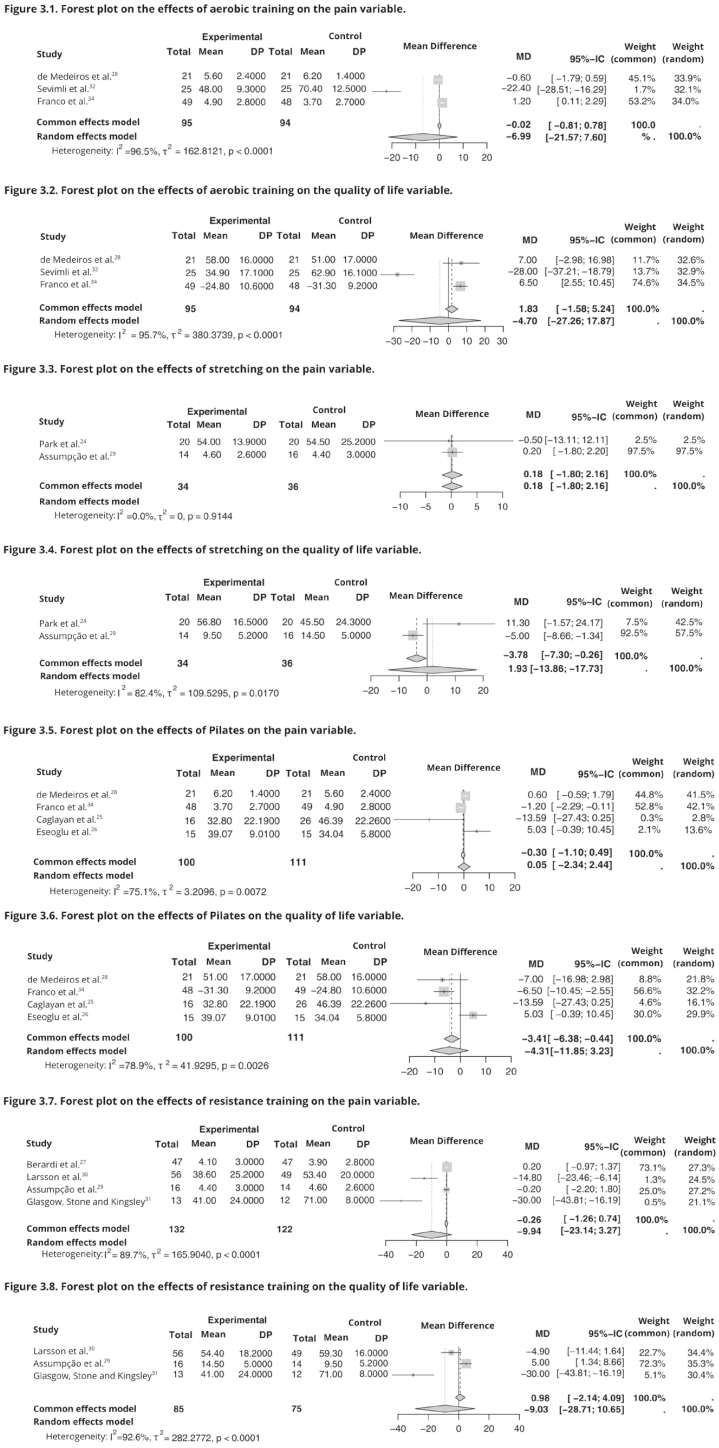


Figure 3. Forest plot on the effects of aerobic training, stretching, Pilates and resistance training on the pain and quality of life variables.

There was significant heterogeneity between studies ($I^2 = 75.1\%$; $\tau^2 = 3.2096$; $p = 0.0072$), indicating substantial variability not attributed to chance.

The forest plot graph that corresponds to the present analysis is represented in Figure 3.

The present meta-analysis, which aimed to estimate the effect of Pilates on the quality of life variable in individuals with FM, included a total of four studies[25,26,28,34] comparing groups undergoing intervention and control groups, totaling 211 participants, 100 in the experimental group and 111 in the control group.

A combined mean of (MD -4.31; 95% CI [-11.85; 3.23]) was observed, which indicates an absence of significant effect of the Pilates intervention on the quality of life variable, and this result is added to the heterogeneity found between the studies ($I^2 = 78.9\%$, $\tau^2 = 41.93$, $p = 0.0026$).

Figure 3 displays the corresponding forest plot for the present analysis.

Resistance training

To analyze the effects of resistance training on the pain variable in individuals with FM, a total of four studies were included in the meta-analysis[27,29-31], totaling 254 participants in both groups, 132 participants in the experimental group and 122 in the control group.

The combined analysis of the studies did not demonstrate a statistically significant overall effect (MD -9.94; 95% CI [-23.14; 3.27]), which suggests that, overall, there is no robust evidence that the intervention has a significant effect on the pain variable. Furthermore, substantial heterogeneity was observed between the studies ($I^2 = 89.7\%$, $\tau^2 = 165.90$, $p < 0.0001$).

Figure 3 visually presents the results of the meta-analysis using a forest plot.

To estimate the effects of resistance training on the quality of life variable in individuals with FM, a total of three studies were included[29-31] totaling 160 participants, 85 for the experimental group and 75 for the control group.

Pooled analysis revealed a pooled mean difference of (MD -9.03; 95% CI [-28.71; 10.65]) with no statistical significance. High heterogeneity between studies was identified ($I^2 = 92.6\%$, $\tau^2 = 282.28$; $p < 0.0001$), indicating substantial variations in the observed effects.

Figure 3 expresses the forest plot graph for the current meta-analysis.

DISCUSSION

This article aimed to assess the evidence on the effects of different types of exercise (aerobic and resistance training, stretching, and Pilates) on pain and quality of life in people with FM. The results revealed high heterogeneity among the included studies, both in terms of the methodologies used and the outcomes assessed, which limited the robustness of the conclusions.

Despite the widespread recommendation of physical exercise as part of the non-pharmacological treatment for fibromyalgia, the data presented herein indicate that comparisons among different exercise modalities do not allow consistent conclusions regarding the superiority of one modality over another. In this context, it is important to emphasize that the absence of statistically significant differences between modalities should not be interpreted as a lack of efficacy of physical exercise, but rather as a limitation inherent to comparative analyses of heterogeneous interventions.

Analysis of the study profiles revealed a high predominance of samples composed exclusively of women[24-33], which reflects the higher prevalence of FM in this population[35]. However, this fact limits the generalization of the findings to males. Furthermore, the wide variability in the age range of study participants and in exercise prescription parameters may have diluted potential effects in pooled analyses, hindering more precise comparisons and the establishment of practical guidelines, as well as masking benefits that might be observed under more homogeneous conditions.

Another critical point was the risk of bias identified in some of the included studies, which could compromise the internal validity of the findings. Of the 12 studies selected, only two were classified as low risk[29,30], reinforcing the need for more rigorous randomized clinical trials with greater methodological control.

Based on the assessment of the methodological quality of the included studies using the PEDro scale, it was observed that most studies[8,24-26,28-34] obtained scores equal to or greater than 7, which is attributed as good methodological quality, although it is important to consider the variability in quality and risk of bias of the studies when interpreting the aggregate effects.

In addition to analyses involving control groups[29,33], a significant portion of the studies included in this review, 10 in total, opted for direct comparisons between different types of physical exercise, which allows to understand the relative effectiveness of each modality in managing FM. Although direct comparisons between modalities suggest similar — or superior — effects on some outcomes, such as quality of life, the findings should be interpreted with caution given the lack of statistically significant differences. One limitation is that this type of comparison limits the inference of absolute efficacy in the absence of a control group without intervention or usual care[39].

Therefore, the results of this systematic review and meta-analysis indicate that the available evidence does not allow the identification of a superior exercise modality (aerobic and resistance training, stretching, or Pilates) for improving pain and quality of life in individuals with fibromyalgia.

This limitation is largely explained by the substantial heterogeneity observed in intervention models, exercise parameters, and study designs, which restricts the ability to reach consistent comparative conclusions. In this context, comparative analyses among heterogeneous exercise modalities may obscure clinically relevant benefits of physical exercise that are already well established in the treatment of fibromyalgia. Furthermore, the results highlight the gap in the literature regarding standardization and definition of the ideal type of exercise. Future research should focus on standardizing protocols, controlling variables, and stratifying results by patient subgroups to make recommendations more accurate and applicable to clinical practice.

Limitations

This study demonstrates some limitations that should be considered when interpreting the results. First, the substantial heterogeneity among the included studies, particularly regarding duration and frequency, ultimately compromised the drawing of solid conclusions.

Additionally, most of the selected studies had predominantly female participants, which limits the generalizability of the findings to males, even though this predominance reflects the higher prevalence of FM in this population. The wide age range of participants also introduces a limitation, as different age groups may respond differently to the interventions offered.

Another significant limitation concerns the risk of bias. Although most studies presented good methodological quality according to the PEDro scale, only two studies were classified as having a low

risk of bias. The main methodological flaws identified were related to the lack of blinding of participants and therapists, a recognized limitation in studies involving physical interventions, but which can influence outcomes due to performance and detection biases.

Finally, most studies opted for comparisons between exercise modalities, with little inclusion of inactive control groups, which makes it difficult to assess the absolute effectiveness of each type of exercise.

CONCLUSION

This systematic review and meta-analysis investigated the effects of different types of physical exercise (aerobic and resistance training, stretching, and Pilates) on pain and quality of life in individuals with fibromyalgia.

The results indicate that, although exercise is widely recognized as a valuable non-pharmacological intervention for fibromyalgia, comparisons between exercise modalities with distinct characteristics do not allow consistent conclusions regarding the superiority of any specific method. The high heterogeneity among the included studies, both in methodological terms and in the characteristics of the interventions and samples, combined with the risk of bias found, hindered the robustness of the conclusions. Therefore, the absence of significant differences between modalities should not be interpreted as a lack of therapeutic value of physical exercise, but rather as a reflection of the limitations inherent to the comparison of heterogeneous interventions.

Despite this, physical exercise continues to be widely recommended as a non-pharmacological strategy for managing fibromyalgia, given the benefits described in the literature, such as improved physical fitness and overall well-being. The findings of this study reinforce the need for more well-designed clinical trials, with greater standardization of intervention protocols and better methodological control, to more clearly establish which exercise modalities, intensities, and durations are most effective for this population.

Thus, although the data presented here do not allow to affirm the superior effectiveness of a specific type of exercise on pain and quality of life in individuals with fibromyalgia, the regular practice of exercises, adapted to individual conditions, should be encouraged as part of an integrated and personalized therapeutic approach.

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AUTHORS' CONTRIBUTIONS

Ana Luiza Alves de Lima e Silva: Statistical analysis, Data collection, Conceptualization, Research, Writing - preparation of the original, Visualization
Henrique Silva Sacramento: Project management, Methodology, Writing - review and editing, Supervision, Validation