




The use of Pilates for pain control in patients with fibromyalgia

O método Pilates no controle da dor em pacientes com fibromialgia

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Abstract

Introduction: Although the Pilates method is commonly used to treat fibromyalgia (FM) in clinical practice, research is scarce, and little is known about its real effectiveness in pain management. **Objective:** Systematically review the literature to determine whether Pilates affects pain control in FM patients. **Methods:** The PubMed, Science Direct, PEDro and Cochrane databases were searched to identify randomized controlled trials that investigated the effects of Pilates in individuals diagnosed with FM. The descriptors used were: "pilates based exercise" OR "pilates training" OR "pilates exercise" OR "pilates" AND "fibromyalgia." Independent reviewers performed abstract/full-text screening, data extraction, and methodological quality assessments using the PEDro scale. **Results:** The search identified 646 potential articles, four of which were used in the analysis. The Pilates method had positive effects on pain control, physical function, quality of life and biopsychosocial factors such as stress and depression in individuals with FM in four studies. However, improvement in these parameters did not differ between intervention groups in three studies. Additionally, the control group showed no significant improvement for the same parameters in one study. The PEDro scale scores of the studies ranged from 6 to 8 points. **Conclusion:** Evidence suggests that Pilates influences pain control in individuals with FM, and is more effective than no intervention or minimal intervention in the treatment of FM.

Keywords: Chronic pain. Exercise therapy. Fibromyalgia. Pilates.

Resumo

Introdução: Apesar de o método Pilates ser comumente utilizado para o tratamento da fibromialgia (FM) na prática clínica, o número de estudos é escasso e pouco se sabe a respeito da sua real eficácia no manejo da dor. **Objetivo:** Revisar sistematicamente a literatura para determinar se o Pilates afeta o controle da dor em pacientes com FM. **Métodos:** A busca nas bases de dados PubMed, Science Direct, PEDro e Cochrane foi realizada para identificar ensaios clínicos randomizados que investigaram os efeitos do Pilates na FM. Os descritores utilizados foram: "pilates based exercise" OR "pilates training" OR "pilates exercise" OR "pilates" AND "fibromyalgia". Revisores independentes realizaram triagem de resumo/texto completo, extração dos dados e avaliações da qualidade metodológica utilizando a escala PEDro. **Resultados:** A pesquisa identificou 646 artigos potenciais; quatro foram usados na análise. O Pilates teve efeitos positivos no controle da dor, na melhora da função física, da qualidade de vida e de fatores biopsicossociais como o estresse e a depressão em indivíduos com FM nos quatro estudos analisados. A melhora destes parâmetros não foi diferente entre os grupos de intervenção em três estudos. O grupo controle não apresentou melhora significativa para os mesmos parâmetros em um estudo. As pontuações na escala PEDro variaram de 6 a 8 pontos. **Conclusão:** As evidências sugerem que o Pilates tem influência no controle da dor em indivíduos com FM e que é mais efetivo do que a não intervenção ou a intervenção mínima no tratamento da FM.

Palavras-chave: Dor crônica. Exercício terapêutico. Fibromialgia. Pilates.

Introduction

Fibromyalgia (FM) is a syndrome characterized by diffuse chronic pain, fatigue, anxiety, sleep disorders, cognition and mood. It occurs in 2 to 5% of the general population, particularly in women aged between 50 and 80 years.¹⁻³

The diagnosis is purely clinical and confirmed by the Widespread Pain Index (WPI) and the Symptom Severity Scale (SSS) (score 2A and 2B), including assessment of fatigue, sleep quality, cognitive state and the presence of other associated symptoms.³ Moreover, the presence of symptoms and absence of other pathologies were

assessed for three months. Complementary laboratory and radiographic examinations should be prescribed with the clinical investigation criteria of the patient and FM-associated comorbidities.¹

Its pathology, far from being completely elucidated, has been related to neuroendocrine abnormalities involving the body's main stress modulating system, the hypothalamic-pituitary-adrenal axis (HPA), and deficits in the pain modulation endogenous systems.^{4,5}

FM symptoms have been directly related to the inability of the HPA axis to modulate acute and chronic stress.⁶ Stress causes the hypothalamus to release the corticotrophin-releasing hormone (CRH) which, in turn, stimulates the pituitary gland to secrete the adrenocorticotrophic hormone (ACTH).⁷ The increase in ACTH plasma concentrations stimulates the adrenal gland to release cortisol. High serum cortisol concentrations seem to exacerbate musculoskeletal pain in patients with FM.^{4,6}

With respect to changes in endogenous pain modulation systems, low brain serotonin concentrations and high P substance, inhibitory and excitatory neurotransmitter concentrations in the central nervous system (CNS) may be directly related to central sensitization and hyperalgesia in patients with FM.^{4,8}

In this respect, pain and comorbidities are currently the focus for FM treatment. According to Heymann et al.,⁹ pharmacological treatment of FM involves the administration of muscle relaxants, analgesics, anti-inflammatories and antidepressants. However, non-pharmacological therapies have also been recommended as coadjuvants for FM treatment.

Musculoskeletal exercises (strength, aerobic and flexibility) promote a series of physiological and biochemical changes with the release of neurotransmitters (ex: noradrenaline, serotonin) and activation of specific receptors, helping reduce pain, depression and anxiety scores.^{3,9-11}

The Pilates method, for example, has been recommended to treat FM because it results in less muscle fatigue and reduces pain.^{1,12} The Pilates method, for example, has been recommended to treat FM because it results in less muscle fatigue and reduces pain.¹³⁻¹⁵ According to Komatsu et al.,¹⁶ Pilates improves physical fitness, functional capacity, flexibility and dynamic equilibrium, thereby avoiding positions that require unnecessary muscle recruitment and early fatigue.

However, although Pilates is commonly used to treat FM in clinical practice, research is scarce, and little is known about its real effectiveness in FM. In this respect, the present systematic review aims to investigate the scientific evidence regarding the influence of Pilates in controlling pain in patients with FM.

Methods

The present study complied with PRISMA guidelines for systematic reviews and meta-analyses¹⁷ (PROSPERO: CRD42021251035). The literature was systematically reviewed to examine the Pilates method as a determining factor in controlling pain in patients with FM.

The search to identify studies was conducted on the PubMed, Science Direct, Plataforma PEDro and Cochrane databases, for articles published between January 2000 and May 2022. Classic articles on the topic and others resulting from a search of studies published before this period were also selected. The following descriptors were used: "pilates based exercise" OR "pilates training" OR "pilates exercise" OR "pilates" AND "fibromyalgia", in the search for randomized clinical trials related to the influence of Pilates in controlling pain in patients with FM. For the search in PubMed the following filters were applied: Title; articles published between 2000 and 2022; full text; abstract; humans; written in English and intervention studies. Advanced search methods were used for the PEDro, Science Direct and Cochrane databases, cross referencing the descriptors listed above and pre-selecting all the randomized clinical trials.

Potentially relevant articles were identified independently by two authors who screened the titles and abstracts. They also screened full texts to determine whether the studies met the inclusion and exclusion criteria, by mutual consensus. Discrepancies were resolved through discussions among all the authors. Following article selection, a backward citation search was conducted to find other relevant studies. Next, all the articles were read in their entirety and those that met eligibility criteria for title and abstract were selected.

Included in this systematic review were randomized clinical trials (RCTs) whose participants were 18 years or older and diagnosed with FM, established according to American College of Rheumatology (ACR) criteria.³ Studies on the use of drugs, those whose participants

exhibited other associated pathologies, as well as studies with associations unrelated to the topic were excluded. Also excluded were observational and case studies, systematic reviews, letters to the editor, posters, meta-analyses and duplicate articles on the databases.

The data were extracted and compiled on an Excel spreadsheet by two authors. The following information was collected to characterize the articles: principal author, year of publication and country where the study was performed; study design; participants, sample size and characteristics; estimated indices and results.

The methodological quality of each article was assessed according to PEDro scale criteria.¹⁸ This checklist contains 11 criteria (criterion 1 is not scored), which enables rapid identification of which randomized or quasi-randomized clinical trials display internal and external validity and enough statistical information for their results to be interpreted. Article quality was classified according to the score obtained, which can vary between 0 and 10 points.

Results

A total of 646 articles were initially identified, 32 of which were excluded for being duplicates on the databases. After titles/abstracts were analyzed and the articles read in their entirety, four studies met the eligibility criteria and were included in qualitative analysis, as described in Figure 1. Participant characteristics, parameters assessed, and the interventions of each study were summarized and described in Table 1.

The four randomized clinical trials included in this review were conducted in Brazil ($n = 2$)^{16,19} and Turkey ($n = 2$).^{12,20} All participants were women, diagnosed with FM according to ACR criteria and aged between 45 and 60 years. The interventions assessed were the Pilates method versus home-based stretching and relaxation exercises, the Pilates method versus a control group with no physiotherapy intervention and the Pilates method versus aerobic exercises. Only one study compared individual and group Pilates methods.

With respect to the pain indicators assessed, three studies used the visual analog scale (VAS) of pain,^{12,16,19} four the fibromyalgia impact questionnaire (FIQ),^{12,16,19,20} two tender point palpation^{12,16} and only one algometric analysis to quantify pain intensity.¹²

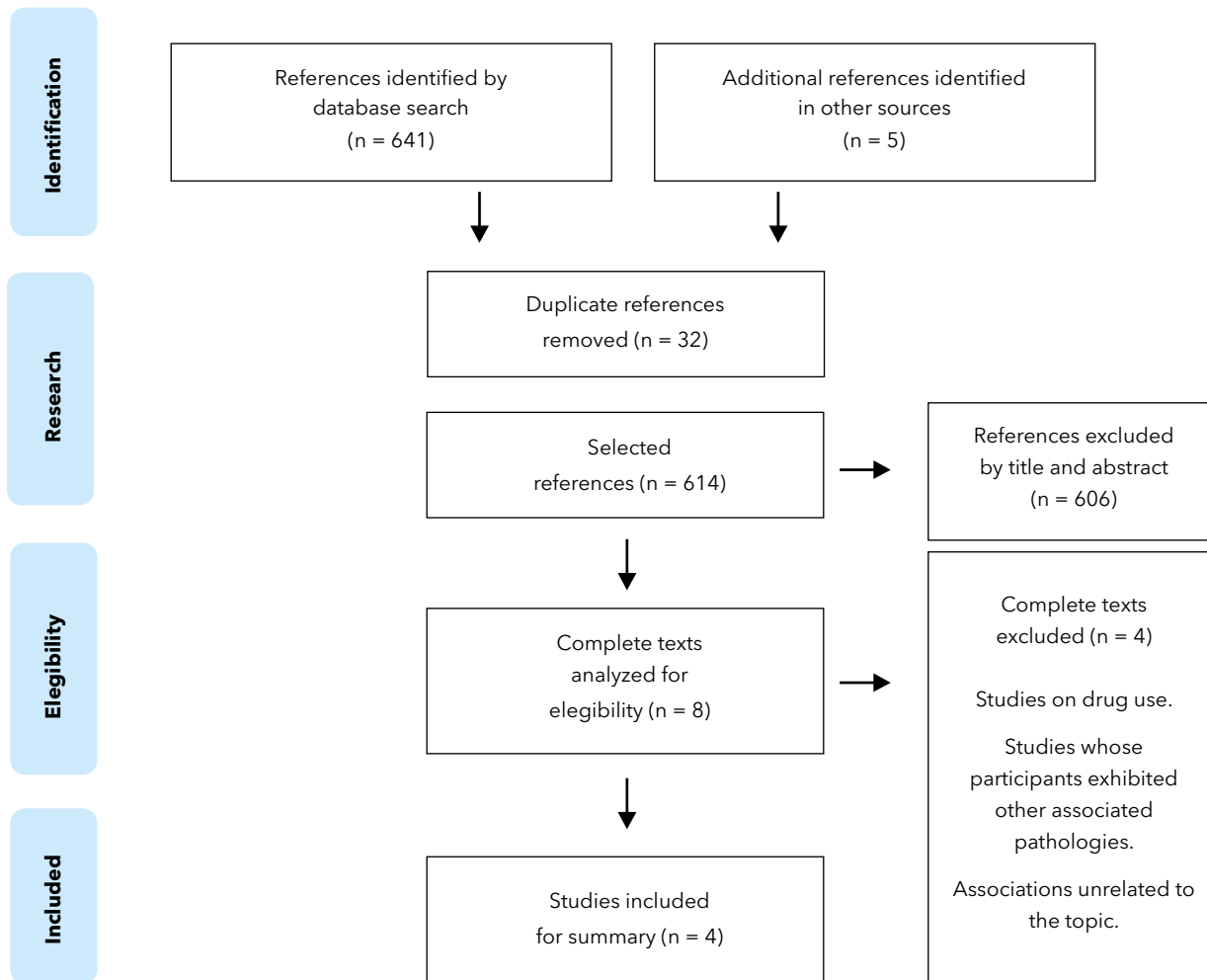


Figure 1 - Flowchart of the assessment process for study inclusion and exclusion. PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses).

The other indicators assessed physical function, quality of life and biopsychosocial factors, as follows: Nottingham Health Profile (NHP);¹² Beck Anxiety Inventory (BAI);^{16,20} Beck Depression Inventory (BDI);¹⁶ Health Assessment Questionnaire (HAQ);²⁰ Short Form Survey (SF-36);^{19,20} Biopsychosocial Questionnaire (BETY);²⁰ Pittsburg Sleep Quality Index (PSQI);¹⁹ Fear-Avoidance Beliefs Questionnaire (FABQ-BR);¹⁹ and Pain-Related Catastrophic Thoughts Scale (PRCTS).¹⁹

Considering pain indicators, the groups that used Pilates as intervention significantly improved pain intensity (VAS) in three studies,^{12,16,19} tender points in two,^{12,16} algometry in one,¹² and FIQ in four studies after the intervention.^{12,16,19,20} Pilates was significantly better in improving pain intensity (VAS), tender points,

algometry and FIQ when compared to home-based stretching/relaxation exercises in only one study.¹² When compared to aquatic aerobic exercises, Pilates showed no significant differences in terms of pain intensity in one study.¹⁹ Similarly, the improvement in pain intensity did not differ between the groups that underwent individualized or group-based Pilates sessions.²⁰

A statistically significant improvement was observed in pain intensity and the number of tender points in the Pilates group in one study,¹⁶ while the control group, which did not receive physiotherapy for FM, showed no significant improvement for the same parameters. In this case, the intergroup differences pre- and post-intervention were not significant.¹⁶

Table 1 - Study characteristics

Author/Location	Population characteristics	Interventions	Indicators	Results
Altan, et al. ¹² Turquia	Group I: n = 25, FM, age 48.20 ± 6.5 years. Group II: n = 24, FM, age 50.0 ± 8.4 years.	Group I: Pilates method for 1 hour, 3 x week for 12 weeks. Group II: home-based stretching/relaxation exercise program 3x week for 12 weeks.	VAS; FIQ; tender points; Algometry (kg/cm ²); NHP.	Group 1 improved significantly in the VAS, tender points, algometry, FIQ and NHP after 12 weeks. Group II showed no significant improvement in VAS, FIQ and NHP after 12 weeks. Group I showed significant improvement in VAS and FIQ when compared to Group II after 12 weeks.
Komatsu et al. ¹⁶ Brasil	CG: n = 7, FM, age 53.29 ± 12.27 years. TG: n = 13, FM, age 47.85 ± 9.82 years.	CG: Received no interventions for 8 weeks. Afterwards they resumed treatments prescribed before the study with no changes. TG: 60 min of the Pilates method, 2x week for 8 weeks. Exercise intensity progression.	VAS; tender points; FIQ; BAI; BDI.	A statistically significant improvement was observed in pain intensity (VAS) and number of tender points (p < 0.05) in the TG, while there were no statistically significant differences for other variables (p > 0.05) or the CG (p > 0.05).
Medeiros et al. ¹⁹ Brasil	PMG: n = 21, FM, age: 45.5 ± 10.6 years. AAEG: n = 21, FM, age: 50.7 ± 9.7 years.	PMG: 50 min of the Pilates method in a group, 2x week for 12 weeks. AAEG: 40 min of aquatic aerobic exercises in a group, 2x week for 12 weeks.	VAS; FIQ; PSQI; SF-36; FABQ-BR. PRCTS.	Both groups improved in terms of pain and function (p < 0.05). The PMG showed no significant differences in relation to the AAEG for the variables analyzed.
Caglayan et al. ²⁰ Turquia	Group I: n = 16, FM, age 55.93 ± 8.03 years. Group II: n = 26, FM, age 47.80 ± 5.87 years.	Group 1: Individual supervised Pilates method. Group II: Pilates method in a supervised group. *Both received 60-min intervention (10-min warm-up, 40 min of the Pilates method and a 10-min cool-down) 2x week for 6 weeks.	FIQ; HAQ; BAI; SF-36; BETY.	Both groups improved significantly in FIQ, SF36 and BETY. Group II improved in the HAQ and BAI (p < 0.05). Intergroup comparison showed a statistically significant difference in Group II (p < 0.05) for FIQ. However, no statistical differences were found in other results.

Note: *All participants were women. FM = fibromyalgia; CG = control group; TG = training group; PMG = Pilates method group; AAEG = aquatic aerobic exercise group; VAS = Visual Analog Scale of Pain; FIQ = Fibromyalgia Impact Scale; NHP = Nottingham Health Profile; BAI = Beck Anxiety Inventory; BDI = Beck Depression Inventory; HAQ = Health Assessment Questionnaire; SF-36 = 36-Item Short Form Survey; BETY = Biopsychosocial Questionnaire; PSQI = Pittsburg Sleep Quality Index; FABQ-BR = Fear-Avoidance Beliefs Questionnaire; PRCTS = Pain-Related Catastrophic Thoughts Scale.

Considering physical function, quality of life and biopsychosocial factors, the Pilates group demonstrated a significant improvement in the NHP,¹² FIQ,^{12,16,19,20} BAI,^{16,20} BDI,¹⁶ SF36,^{19,20} BETY,²⁰ FABQ-BR,¹⁹ PRCTS¹⁹ and HAQ.²⁰ Pilates was significantly better in improving function and quality of life in FIQ analysis when compared to stretching/relaxation exercises in only one study.¹² Group-based Pilates also exhibited a significant improvement in the HAQ and FIQ when compared to individual Pilates.²⁰ Most studies (n = 3) found no statistically significant differences between the Pilates group and the other groups for the other variables analyzed.^{16,19,20}

In relation to the assessment of methodological quality, the score obtained by the studies on the PEDro Scale varied between 6 and 8 points, with an average of 7 on the 10-point scale. Each article was assigned a score from 0 to 10, according to the criteria described in Table 2. In regard to specification of eligibility criteria and the random allocation of subjects to groups, all the studies scored positively. However, most of the studies obtained a low score in allocation concealment and participant and therapy blinding. In addition, Komatsu et al.¹⁶ and Altan et al.¹² showed low scores in result measurement (items 8 and 9 respectively), limiting factors in relation to external validity.

Table 2 - Assessment of methodological quality

Question	Altan et al. ¹²	Komatsu et al. ¹⁶	Medeiros et al. ¹⁹	Caglayan et al. ²⁰
1. Eligibility criteria were specified.	x	x	x	x
2. Subjects were randomly allocated to groups (in a cross-reference study, subjects were randomly placed in groups, according to the treatment received).	x	x	x	x
3. Subject allocation was concealed.	-	x	x	-
4. The groups were initially similar in terms of the most important prognosis indicators.	x	x	x	x
5. All the subjects were blinded in the study.	-	-	-	-
6. All the therapists were blinded.	-	x	-	-
7. All the evaluators that measured at least one key result were blinded.	x	x	x	-
8. Measures of at least one key result were obtained in more than 85% of subjects initially allocated to the groups.	x	-	x	x
9. All the subjects whose results were presented received the treatment or were controls, according to allocation, and when this was not the case, intention-to-treat analysis was used for at least one of the key results.	-	x	x	x
10. The results of intergroup statistical comparisons were described for at least one key result.	x	x	x	x
11. The study shows both accuracy and variability measures of at least one key result.	x	x	x	x
TOTAL	6	8	8	6

Note: Criterion 1 is not scored on the PEDro scale; - (not scored); x (score).

Discussion

The results of this systematic review show that the Pilates method has positive effects on controlling pain intensity and tender points/regions, thereby improving physical function, quality of life and biopsychosocial factors such as stress and depression in people with FM.

Pilates training is based on flexibility associated with trunk and limb strengthening exercises, respiratory, postural and motor coordination exercises.¹³ Recent studies have shown that Pilates can effectively relieve pain and reduce the degree of patient disability.^{14,21}

In regard to pain control, several studies have demonstrated that musculoskeletal exercises seem to increase

parasympathetic tonus and decrease the sympathetic response.^{10,22,23} Central interactions between the neurovegetative system and the motor cortex, limbic system, hypothalamus, pituitary gland and base ganglia have been linked to the release of neurotransmitters with an analgesic function, such as serotonin, noradrenalin and endogenous opioids.²⁴ Neurotransmitter release via exercise seems to increase endogenous inhibition, with a consequent decline in diffuse pain, a common symptom in patients with FM.²⁵ In addition, the analgesic effect of exercise may help break the vicious pain-immobility-pain cycle, encouraging patients to engage in exercise program.²⁶

With respect to improved physical function and quality of life, the decline in pain and increase in muscle flexibility provided by Pilates may be associated with better overall physical fitness and a decrease in energy requirements for joint movement (mainly due to less tissue stress).¹² According to Martinez et al.,²⁷ the lower number of tender points and pain intensity (measured by the VAS) is correlated with the improved quality of life and physical function of patients with FM. In this respect, the Pilates group showed significant improvements in all the function and quality of life indicators analyzed (FIQ, HAQ, NHP and SF-36) in the studies included in this systematic review. In addition, Pilates was significantly better in improving function and quality of life in the FIQ analysis when compared to stretching/relaxation exercises.¹² Group-based Pilates also obtained a significant improvement in the HAQ and FIQ when compared to individual Pilates in one study, which, according to Caglayan et al.,²⁰ may be directly associated with social interaction factors.

In regard to the biopsychosocial effects, musculoskeletal exercise programs have demonstrated that physical exercise results in a series of physiological and biochemical changes involved with neurotransmitter release and the activation of specific receptors (serotonergic and noradrenergic receptors, for example), helping reduce depression and anxiety.^{11,28,29} In addition, exercise seems to decrease the systemic concentration of stress (cortisol) and inflammation biomarkers (cytokines).¹⁰ Similarly, the studies included in this review also exhibited a significant improvement in at least one of the stress, depression and anxiety indicators assessed, demonstrating the effectiveness and safety of Pilates in controlling biopsychosocial factors. According to Altan et al.,¹² Pilates techniques were developed to

achieve a strong mind and use it to obtain complete control over one's body. Joseph Pilates, who founded and theorized this method, repeatedly emphasized its effect on strengthening and conditioning the mind, and its importance as a physical regimen for the body, calling his methodology the "art and science of controlology".³⁰

In relation to the effectiveness of Pilates compared to other FM interventions/treatments, only one study found Pilates to be superior in all the indicators assessed.¹² However, according to the authors, controlling the execution of exercises, as well as participants at home, may not be enough for ideal adherence to the program. In addition, performing exercises under direct and constant supervision of the instructor in the Pilates group may have created a placebo effect, which could have contributed to the improvement in scores.

Medeiros et al.¹⁹ compared Pilates with aquatic aerobic exercises, concluding that both interventions were equally effective in women with FM, reducing pain and improving quality of life and biopsychosocial indicators. According to the authors, one of the explanations is that both methods favor social interaction and adherence, and are effective in improving stress indicators, pain levels, quality of life and catastrophizing in relation to the base disease. The study also shows the benefits of two different exercise modalities for women with FM and indicates that patients with the disorder may have the option of selecting Pilates or aerobic aquatic exercises to improve their symptoms. Comparison between Pilates and the control group with no intervention,¹⁶ showed a statistically significant improvement in pain intensity and the number of tender regions in the intervention group, while the same parameters did not improve in the control group, demonstrating that Pilates was more effective than no or minimum intervention in treating FM.

The safety of Pilates was attested by all the studies included in this review, with patients reporting no side effects after the treatment sessions. However, according to Wells et al.,³¹ those who engage in Pilates may experience adverse effects, such as aggravating their condition, lesions or excessive muscle stress, but these severe cases are not common.

Conclusion

The studies selected for this systematic review demonstrate that clinical intervention using the Pilates

method benefits individuals with FM in terms of pain intensity, a decline in tender points/levels and an improvement in quality of life, physical function and biopsychosocial factors such as anxiety and depression.

The results of this review clearly show that Pilates is more effective than no or minimum intervention in treating FM. Additionally, Pilates exercises are safe and should be supervised and applied individually or in groups, aimed at the therapeutic effectiveness of FM.

Authors' contributions

All the authors participated in the study design, data analysis and interpretation, manuscript writing and approved the final version.

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