Review

Efficacy of physiotherapy treatment in the medium and long term in adults with fibromyalgia: an umbrella of systematic reviews

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ABSTRACT

Objective. *To summarise the available evidence and assess the effectiveness of medium and long-term physiotherapy treatment in adults with fibromyalgia (FM).*

Methods. *This systematic review was registered in PROSPERO: CRD42023388356. The databases searched were MEDLINE, PEDro, Scopus, Cinhal, LatinIndex, and Cochrane, using the following keywords: "fibromyalgia", "physiotherapy", "treatment", "therapeutic exercise", "TENS", "laser therapy" and "manual therapy." The included articles analysed treatments with active or passive physiotherapy approaches in patients with FM. The variables included structural characteristics, such as: author, publication year, research question, and main outcome variables. The data on the findings of the articles comprised the following aspects: number of participants, intervention, follow-up, results, and principal conclusions.*

Results. *Thirty-three articles were analysed, with an overall PRISMA score of 18.63±3.36. The active treatment methods analysed were: movement and body awareness therapies (stretching, tai chi, yoga and Pilates); hydrotherapy; physical or aerobic exercise; and multidisciplinary therapy. The passive therapies analysed were: manual therapy; repetitive transcranial magnetic stimulation (rTMS); and other therapies (hyperbaric oxygen therapy, vibration therapy, virtual reality, transcutaneous electric nervous stimulation (TENS), pain neuroscience education, and acupuncture). Evidence was found on the positive effect of physiotherapy treatment on the signs and symptoms of fibromyalgia, such as pain, impairment of physical capacity and worse quality of life.*

Conclusion. *The effectiveness of the active and passive therapies analysed in the management of the symptoms and signs of the disease was positive in most of the studies. However, more specific descriptions of the treatment protocol, frequency, intensity and treatment dose are required to reach a consensus, as well as primary studies for a more extended follow-up period to better evaluate long-term effects.*

Introduction

Fibromyalgia is a chronic condition characterised by widespread pain, cognitive symptoms, non-restorative sleep, fatigue, and other somatic symptoms (1) that reduce the quality of life (2) and limit the normal development of activities of daily living (ADLs) (3, 4). The estimated worldwide prevalence in the general population is 2.7% and is more common in women (4.1%) than in men (1.4%) (5), although it could be higher, given the different percentages obtained, with 6.4% in the United States (7.7% women and 4.9% men) (6), 3.3% in Europe, and 8.3% in South America (6, 7). The peak rate is in the age range of 20-55 years, although many studies have found that the prevalence in adolescents is similar to that reported in adults (7).

The pathophysiological factors of fibromyalgia are still unclear and under extensive research (8), although it seems to be related to a pain processing problem in the brain, making patients hypersensitive to pain and hypervigilant (8). In this case, central sensitisation is the most accepted hypothesis (9). Among

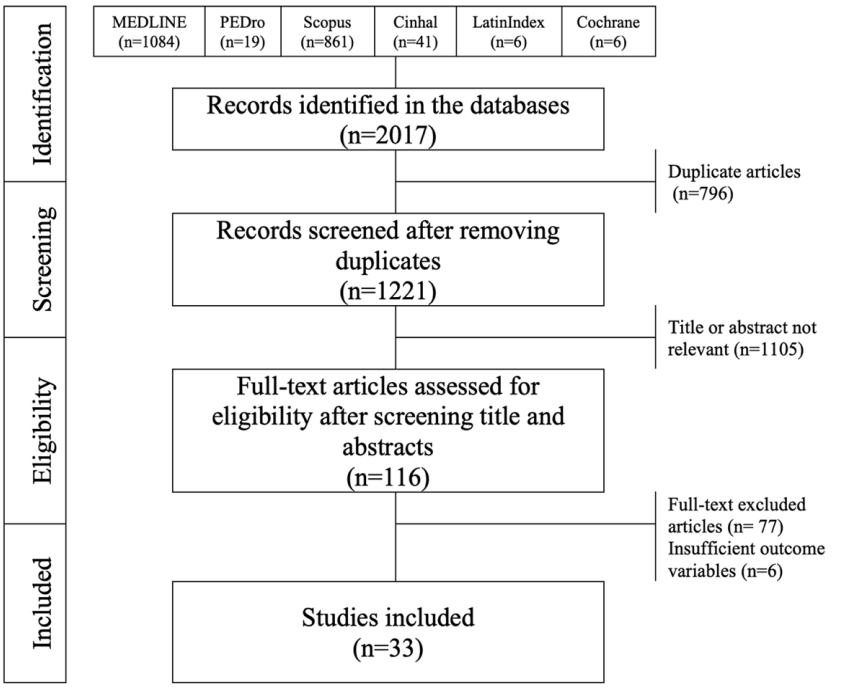

Fig. 1. Process for identifying and selecting articles to be included in the study.

patients referred to a tertiary care pain clinic, more than 40% meet the criteria for fibromyalgia (10), with the risk of developing the syndrome being more significant if the patient already has a rheumatic disease (6, 7, 10).

The main symptoms experienced by patients with fibromyalgia are cognitive impairment, chronic fatigue, sleep disturbances, intestinal irritability, interstitial cystitis, and mood alterations (11, 12). Treatment can be pharmacological or non-pharmacological, with most established guidelines advocating a multimodal approach (13).

Current clinical guidelines recommend that initial management should involve patient education and focus on non-pharmacological therapies (14), highlighting treatment techniques with a physiotherapeutic approach such as physical activity (*e.g.* aerobic, strength, aquatic, and group training), manual therapy (MT), balneotherapy, needling therapies (NT) and multimodal treatment (15).

A recent systematic review analyses determining aspects for patients with fibromyalgia, such as diagnostic methodologies, risk factors, comorbidities and objective outcome measures (16). In addition, a different recent systematic review analysed the effects of non-pharmacological treatments in patients with fibromyalgia, although, to our knowledge, no studies offer a broader view summarising these results. Therefore, the objective of this umbrella review was to summarise the evidence from systematic reviews on the medium and long-term effectiveness of non-pharmacological therapies in adults with fibromyalgia.

Methods

Study design

This systematic review was carried out following the guidelines and recommendations of Systematic Reviews and Meta-analyses (PRISMA) (17) and the Cochrane Handbook recommendations (18).

The protocol was previously registered in PROSPERO (CRD42023388356).

Bibliographic search

The present systematic review analysed documents published in the last thirteen years from January 1st 2010 to June 30th 2023 in the MEDLINE, PEDro, Scopus, Cinhal, LatinIndex, and Cochrane databases.

The keywords used in the search were: "fibromyalgia", "physiotherapy", "treatment", "therapeutic exercise", "TENS", "laser therapy" and "manual therapy." The keywords were agreed upon using the Boolean operators "AND" and "OR".

Study selection

The studies were screened by two blinded independent researchers, who analysed the articles according to title and abstract, selecting the articles that met the inclusion criteria. After sharing the selection, discrepancies were resolved by a third independent researcher with more than 15 years of experience conducting systematic reviews. Then, the two researchers analysed the full-text studies. A third researcher resolved the discrepancies that emerged between them.

The inclusion criteria for the study were: 1. Systematic reviews or meta-analysis and 2. Publications on treatment with an active or passive physiotherapy approach in fibromyalgia.

The exclusion criteria were: 1. Publications in a language other than Spanish, Portuguese, French, English, and Italian; 2. Reviews with a follow-up or treatment of less than three months in all studies; and 3. Reviews of non-physiotherapeutic treatment.

Quality assessment of the results and risk of bias

The quality evaluation of the articles was carried out by three independent evaluators using the PRISMA checklist (17). This 27-point checklist evaluates the title, abstract, methods, results, discussion, and other information such as publication registration, conflict of interest, and financial funds. If the item was described in the report, it is rated as "Yes" or "No" with a score of 1 point or 0 points, respectively. The total PRISMA score was calculated by adding each score, classifying it according to 3 categories: 1) low quality (>19.0); 2) moderate quality (19.0 to 22.5); 3) high quality (>22.5) (16).

Data collection process and synthesis of results

The information extracted from the analysed articles was grouped into:

1. Data on the structural characteristics of the articles (title, author, year of publication, objectives or research question,

Table I. Scoring of included studies according to the PRISMA scale.

Author, year	Items																											Total
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	
Algar, 2021 (19)	•	•	•	•	-	-	•	•	-	-	-	-	-	-	•	•	•	-	-	•	-	•	•	-	-	•	•	14
Andrade, 2019 (20)	•	•	•	•	•	•	•	-	•	-	•	-	-	-	-	•	•	•	-	-	-	-	•	-	-	-	-	13
Bidonde, 2014 (21)	•	•	•	•	•	•	•	•	•	•	•	•	•	-	•	•	•	-	•	•	•	•	•	-	-	•	-	22
Bidonde, 2017 (22)	•	•	•	•	•	•	•	•	•	•	•	-	•	•	•	•	•	•	•	•	•	-	•	•	-	•	-	23
Bidonde, 2019 (23)	•	•	•	•	•	•	•	•	•	-	•	-	•	•	-	•	•	•	•	•	-	-	•	-	•	•	-	20
Bravo, 2019 (24)	•	•	•	•	•	•	•	•	•	•	•	•	-	•	-	•	•	•	•	•	•	•	•	-	•	•	-	23
Busch, 2013 (25)	-	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	-	•	•	•	•	•	•	-	•	•	-	23
Cerrillo, 2015 (26)	•	•	•	•	•	•	•	•	•	-	-	-	•	-	-	•	•	-	-	•	-	-	•	-	-	•	-	15
Chan, 2012 (27)	•	•	•	•	•	•	•	•	-	-	-	-	-	-	•	•	•	-	-	-	-	-	•	-	•	•	-	14
Chen, 2023 (28)	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	-	-	-	-	•	•	•	•	•	23
Choo, 2022 (29)	•	•	•	•	•	•	•	-	•	-	•	-	•	-	-	•	•	•	•	•	-	-	•	-	•	•	-	18
Collado, 2015 (30)	•	•	•	•	•	•	•	-	•	-	-	-	-	•	•	•	•	•	•	-	-	-	•	-	-	•	-	16
Cortés, 2021 (31)	•	-	•	•	•	•	•	•	•	•	•	-	•	-	-	•	•	•	-	•	-	-	•	•	•	•	-	19
Del-Moral, 2020 (32)	•	•	•	•	•	•	•	•	•	•	•	-	•	-	-	•	•	•	-	•	•	-	•	-	•	•	-	20
Galvão, 2021 (33)	•	•	•	•	•	•	-	•	•	•	•	•	•	•	•	•	•	•	•	•	•	-	•	•	•	•	-	24
Hernando, 2022 (34)	•	•	•	•	•	•	•	•	•	•	-	-	•	-	-	•	•	•	•	-	-	-	•	•	•	•	-	19
Hou, 2016 (35)	•	•	•	•	•	•	•	•	-	-	-	-	•	•	-	•	•	-	-	•	•	-	•	-	•	•	•	18
Johnson, 2017 (36)	-	•	•	•	•	•	•	•	•	-	•	-	•	•	-	•	•	•	-	-	-	-	•	•	-	•	-	17
Kim, 2022 (37)	•	•	•	•	•	•	•	•	•	-	-	-	•	-	-	•	•	•	-	•	-	-	•	-	•	•	•	18
Knijnik, 2016 (38)	•	•	•	•	•	•	•	•	•	-	-	-	•	-	-	•	•	•	•	•	-	-	•	-	-	-	-	16
Langhorst, 2013 (39)	•	-	•	•	•	•	•	•	•	•	•	•	•	-	-	•	•	•	-	•	•	-	•	-	-	-	-	18
Li, 2014 (40)	•	•	•	•	•	•	•	-	•	-	•	-	•	-	-	•	•	•	•	•	-	-	•	•	•	•	-	19
Lima, 2013 (41)	•	•	•	•	•	•	•	•	-	-	•	-	•	-	-	•	•	-	-	•	-	-	•	-	•	•	-	16
Lorena, 2015 (42)	•	•	•	•	•	•	•	•	-	-	-	-	-	-	-	•	-	-	-	-	-	-	•	-	-	•	-	11
Mist, 2013 (43)	•	•	•	•	•	•	•	•	•	-	•	-	•	-	•	•	•	-	•	•	•	•	•	-	-	•	-	20
O'Dwyer, 2019 (44)	•	•	•	•	•	•	•	•	-	-	•	-	•	•	-	•	•	•	-	-	-	-	•	-	-	•	-	16
Saracoglu, 2022 (45)	•	-	•	•	•	•	•	•	•	-	•	-	-	-	•	•	•	•	•	•	-	-	•	-	•	•	-	18
Schulze, 2020 (46)	•	•	•	•	•	•	•	•	•	•	-	-	•	-	•	•	•	•	•	•	-	•	•	•	•	•	-	22
Su, 2021 (47)	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	-	•	•	-	25
Sun, 2022 (48)	•	•	•	•	•	•	•	•	•	-	-	-	-	-	•	•	•	•	•	•	-	-	•	•	•	•	-	19
Suso, 2022 (49)	•	•	•	•	•	•	•	•	•	-	•	-	•	-	•	•	•	•	•	•	-	-	•	•	•	•	-	21
Ughreja, 2021 (50)	•	•	•	•	•	•	•	•	•	-	•	-	•	-	-	•	•	•	•	-	-	-	•	-	-	•	-	17
Yang, 2014(51)	•	•	•	•	•	•	•	•	•	•	•	-	-	-	-	•	•	•	•	•	•	-	•	-	-	-	-	18

• = criterion satisfied; - = criterion not satisfied.

database search, included articles, and the tool used to assess the risk);
2. Data on the results of the articles (number of participants, intervention, follow-up, results, and principal conclusions).

Results

Search and study selection

The initial search identified 2,017 studies in the different databases; 796 were subsequently excluded for being duplicates and 1,105 for not meeting the inclusion criteria or not being relevant. Then, a total of 116 full-text studies were analysed. Eighty-three articles were excluded for meeting at least one of the exclusion criteria. Finally, a total of 33 articles were included. The search flowchart is summarised in Figure 1.

Methodological quality of assessment

The quality results of the 33 (19-51) studies showed that only 2 (33, 52) articles met the PRISMA domain requirements (24/27). Compliance with

Table II. Summary table for PRISMA comparison.

	PRISMA items	Yes, %
Title	1. Title	93, 93
Abstract	2. Structured summary	90, 90
Introduction	3. Rationale	100
	4. Objective	100
Methods	5. Protocol and registration	96, 96
	6. Eligibility criteria	96, 96
	7. Information sources	100
	8. Search	87, 87
	9. Study selection	81, 81
	10. Data collection process	39, 39
	11. Data item	66, 66
	12. Risk of bias in individual studies	21, 21
	13. Summary measures	72, 72
	14. Synthesis of results	34, 37
	15. Risk of bias across studies	42, 42
Results	16. Additional analyses	100
	17. Study selection	93, 93
	18. Study characteristics	75, 75
	19. Risk of bias with studies	57, 57
	20. Results of individual studies	72, 72
	21. Synthesis of results	34, 37
	22. Risk of bias across studies	21, 21
	23. Additional analyses	100
Discussion	24. Summary of evidence	30, 30
	25. Limitations	57, 57
	26. Conclusions	87, 87
Funding	27. Funding	12, 12
		Overall PRISMA score = 18.63 (3.36)

Table III. Descriptive characteristics of systematic reviews.

Author, year	Objectives or research question	Search date	Included primary studies	Risk of bias assessment tools
Algar-Ramírez 2021 (18)	To compare outcomes of manual lymph drainage and myofascial therapy in patients with FM.	November 2017	16 (11 RCTs/ 3PS/ 1 Quasi-RCT/ 1CS)	PEDro scale(53)
Andrade 2019 (19)	To evaluate the effects of physical exercise on autonomic dysfunction in patients with FM.	December 2017	12	RoB[52]
Bidonde 2014 (20)	To identify, evaluate, and synthesise systematic reviews of physical activity interventions for adults with FM.	March 2013	9 SR (60 RCTs)	AMSTAR tool
Bidonde 2017 (21)	To evaluate the benefits and harms of aerobic exercise training for adults with FM.	June 2016	13 RCTs	RoB[52]
Bidonde 2019 (22)	To evaluate the benefits and harms of mixed exercise training protocols that include two or more types of exercise for adults with FM against control, non-exercise, or other exercise interventions.	December 2017	29 RCTs	RoB(52)
Bravo 2019 (23)	To provide a summary of movement and body awareness therapies in patients with FM and to compare the different therapies in relation to outcomes.	October 2018	22 RCTs	RoB[52]
Busch 2013 (24)	To evaluate the benefits and harms of resistance exercise training in adults with FM.	March 2013	5 RCTs	Authors'judgement
Cerrillo-Urbina 2015 (25)	To summarize evidence regarding the effect of physical exercise programs on FM syndrome symptoms in peri-menopausal age women, and the characteristics of these programs.	October 2014	19 RCTs	PEDro scale[53]
Chan, 2012 (26)	To summarise and critically assess the evidence available from RCTs of qigong exercise for patients with FM.	February 2011	4 RCTs	JADAD score[54]
Chen 2023 (27)	To investigate the efficacy and safety of HBOT for FM.	October 2022	9 (3 RCTs/ 6 non-RCTs)	Cochrane Collaboration checklists[17]
Choo 2022 (28)	To evaluate the therapeutic effect of rTMS in patients with FM according to stimulation locations and follow-up time points.	August 2021	10 RCTs	Authors'judgement
Collado-Mateo 2015 (29)	To review the literature on the effects of whole-body vibration therapy in patients with FM.	January 2015	8 RCTs	PEDro scale[53]
Cortés-Pérez 2021 (30)	To assess the effect of Virtual Reality therapy to reduce the impact of FMS in outcomes such as pain, dynamic balance, aerobic capacity, fatigue, quality of life (QoL), anxiety and depression.	April 2021	11 RCTs	PEDro scale[53]
Del-Moral-García 2020 (31)	To assess the effect of ATBT to improve different balance outcomes in subjects with FMS.	September 2020	10 RCTs	RoB(52)
Galvão-Moreira 2021 (32)	To evaluate the effects of pool-based exercises on pain symptomatology among adults with fibromyalgia syndrome.		14 RCTs	RevMan 2012
Hernando-Garijo 2022 (33)	To systematically review the effects of non-pharmacological conservative therapies in fibromyalgia patients.		46 RCTs	PEDro scale[53]
Hou 2016 (34)	To investigate present evidence of using NBS as an add-on treatment in treating FM.	July 2015	16 RCTs	Authors' judgement
Johnson 2017 (35)	To assess the analgesic efficacy and adverse events of TENS alone or added to usual care compared with placebo TENS; no treatment; exercise alone; or other treatment including medication, electroacupuncture, warmth therapy, or hydrotherapy for FM in adults.	January 2017	8 (7 RCTs/ 1 Quasi-RCT)	Cochrane Handbook 5.1.0[17]
Kim 2022 (36)	To quantify the effect of repetitive transcranial magnetic stimulation (rTMS), which is recommended for the improvement of some pain-related symptoms and for antidepressant treatment, on the primary motor cortex (M1) in patients with FM.	August 2021	5 RCTs	RoB (52)
Knijnik 2016 (37)	To evaluate the efficacy of rTMS on FM.	April 2014	5 RCTs	JADAD score[54]
Langhorst 2013 (38)	To assess the efficacy of meditative movement therapies (MMT) on the key symptoms of FMS compared with controls and the safety of MMT.	December 2010	7 RCTs	Egger's (55, 56)
Li 2014 (39)	To evaluate the evidence of massage therapy for patients with FM.	June 2013	9 RCTs	RoB[52]
Lima 2013 (40)	To assess the effectiveness of aquatic physical therapy in the treatment of FM.	December 2012	25	Cochrane Handbook 5.1.0[17]
Lorena 2015 (41)	To systematize scientific evidences about the use of muscle stretching exercises in the treatment of FM.	October 2012	4 RCTs	PEDro scale[53]
Mist 2013 (42)	To extend Langhorst's work by providing a comprehensive review of a broader array of land-based complementary and alternative medicine (CAM) FM exercise studies, including early-stage research.	October 2012	16 RCTs	JADAD score[54]
O'Dwyer 2019 (43)	To appraise the effects of behaviour change interventions targeting PA in adults with FM.	July 2018	8 (7 RCTS/ 1 Quasi-RCT)	RoB(52)
Saracoglu 2022 (44)	To investigate whether adding PNE to a multimodal approach has additional benefits in patients with FM.	June 2021	4 RCTs	PEDro scale(53)
Schulze 2020 (45)	To review the scientific literature for an overview of the efficacy of manual therapy in pain, disease impact, and quality of life in patients with FM compared with control or other treatments through randomsed clinical trials.	September 2019	7 RCTs	RoB(52)
Su 2021 (46)	To investigate the efficacy of rTMS in FM.	August 2021	18 RCTs	RoB(52)
Sun 2022 (47)	To evaluate the effectiveness of rTMS for FM syndrome.	April 2021	14 RCTs	PEDro scale(53)
Suso-Martí 2022 (48)	To assess the effects of PNE on patients with FM in terms of pain intensity, FM impact, anxiety, and pain catastrophising.	October 2021	8 RCTs	Cochrane Handbook 5.1.0
Ughreja 2021 (49)	To update the evidence on the effectiveness of myofascial release on pain, sleep, and quality of life in patients with FM.	April 2021	6	RoB(52)
Yang 2014 (50)	To comprehensively evaluate the effectiveness of acupuncture as a treatment for FM.		9 (6 RCTs/ 3 CCT)	Cochrane Review Handbook 5.0

ATBT: active therapy-based training; CCT: controlled clinical trials; CS: clinical study; HBOT: hyperbaric oxygen therapy; PEDro: the physiotherapy evidence database; PS: pilot study; PNE: pain neuroscience education; Quasi-RCT: quasi-experimental; RoB: Cochrane risk of bias tool; rTMS: repetitive transcranial magnetic stimulation.

Table IV. Results of movement and body awareness therapies studies.

Author, year	Intervention	Sample	Follow-up	Main results
Bravo 2019 (23)	Movement and body awareness therapies Frequency= 1-2 d/w. Duration= 1-3 m	n=1294 Age= 20-77 (51.1) 94% women	From 6 w to 8 m	Movement and BA therapies improved pain symptom, but forest plot analysis showed heterogeneity between trials.
Chan 2012 (26)	Movement and body awareness therapies exercise Frequency= 1-3 d/w. Duration= 7 w – 3 m	n=251 G1= 128 GC= 123 Age= 8-73	From 0 to 24 w	Qigong exercise had no favorable effects on adult patients with FM, while combined with aerobic exercise had positive effects on children with FM.
Del-Moral-García 2020 (31)	Movement and body awareness therapies Frequency: 1-3 d/w. Duration: 6-32 w	n=546 Age= 52.41 (2.90) 98% women	From 8 to 24 w	ATBT had a medium effect on monopedal static balance (SMD= 0.571; 95% CI= 0.305 to 0.836; $p< 0.001$), dynamic balance (SMD= 0.618; 95% CI= 0.348 to 0.888; $p< 0.001$), and functional balance (SMD= 0.409; 95% CI= 0.044 to 0.774; $p= 0.028$), but no statistically significant differences were found for balance on unstable support.
Hernando-Garijo 2022 (33)	Movement and body awareness therapies Frequency= 10-69 d. Duration= 4-24 w	n=3384 Age= 45-55	From 12 w to 17 m	Combined exercise, aquatic exercise and other active therapies improved pain intensity, disability and physical function in the short term, while multimodal therapies reduced pain intensity and disability in the medium and long term.
Langhorst 2013 (38)	Meditative movement therapies Frequency= 8-24 d. Duration= 4-12 w	n=362 Age= 50 (13-54) 73-100% women	From 0 to 6 months	MMT reduced sleep disturbances (SMD= -0,61; 95% CI= -0,95 to -0,27; p=0,0004), fatigue (SMD=-0,66; 95% CI=-0,99 to -0,34; $p<0,0001$), depression (SMD= -0,49; 95% CI= -0,76 to 0,22; $p=0,0004$) and limitations of HRQOL (SMD=-0,59; 95% CI= -0,93 to -0,24; $p= 0,0009$), and could be maintained after 4.5 months, but not pain (SMD= -0.35; 95% CI= -0.80 to 0.11; $p=0.14$).
Lorena 2015 (41)	Stretching. Frequency= 2 d/w. Duration= 5-20 w	n=154 Age= 42-48 96,10% women	From 0 to 12 w	Pain and quality of life improved in all studies.
Mist 2013 (42)	Movement and body awareness therapies Frequency= 1-2 d/w. Duration= 8-12 w	n=832 Age= 45-57.5 Mostly women	From 0 to 6 months	The level of research has been moderately weak, but most studies report a medium-to-high effect size in pain reduction.

ATBT: active therapy-based training; BA: body awareness; d: days; HRQOL: health-related quality of life; m: months; MMT: meditative movement therapies; w: weeks.

PRISMA, in general, was medium-poor, since none of them fulfilled all the items. The highest and lowest scores were 25 (52) and 11 (42) points. Only 25 articles completed or reported more than 50% of the PRISMA items. Table I presents further information about the scores of the included studies.

The overall PRISMA score was 18.63±3.36, indicating that the average quality of the analysed articles is low. Eleven studies were concentrated in the range of 19.0-22.5 points, which means that the quality of the reports was moderate, whereas six papers obtained high scores (>22.5), and 17 of the articles presented low quality with a score below 19 points.

In the analysis of the 33 studies, the least reported item was "27", which was only fulfilled in 12.12% of the articles, followed by items "12" and "22", which were fulfilled in 21.21 % of the articles.

Five items were met by all studies (items "3 ,4, 7, 16 and 23"), followed by items "5" and "6", which were met by 96.96% of the studies. More details on the risk of bias assessment are available in Table II.

Systematic review characteristics

In the 33 studies (19-51), the treatment modality that was most widely used to answer the research question or achieve the set objective was active therapy, which was employed in 16 articles through physical exercise, resistance or movement therapies, and body awareness. Most of the analysed documents obtained data from randomised controlled trials (RCTs), in a range of 4 (45) to 46 RTCs (34). Some reviews included Quasi-RCT studies (19, 36, 44), case-control studies (CS) (19), and non-RCT studies (28, 51); three studies did not describe the typology of the analysed articles (20, 41, 50). The most used risk scales were the Cochrane risk of bias tool (RoB) (53) (11 studies) and the PEDro scale (54) (8 studies); the rest of the articles used different tools or the author's judgment. The descriptive characteristics of the systematic reviews are summarised in Table III.

The effectiveness of medium- and long-term physiotherapy treatments in adults with fibromyalgia was evaluated, dividing them into active or passive therapies. Due to the heterogeneity of the sample, a meta-analysis could not be performed. We found positive results in interventions on pain and multidimensional function (physical and psychological). No serious adverse effects were reported.

Active therapies

The following treatment methods were found and added as active:

1. Movement and body awareness therapies (stretching, tai chi, yoga, Pilates); 2. Hydrotherapy; 3. Physical or aerobic exercise; and 4. Multidisciplinary therapy.

- Movement and body awareness therapies

It was the most analysed intervention modality, with seven studies that examined its effects. The total sample of the studies that used this method was 6823 patients. No study compared the sample with healthy subjects, and only Chan *et al*. (27) compared fibromyalgia patients in two groups. The smallest sample was 154 (42), and the largest

Table V. Results of physical or aerobic exercise studies.

Author, year	Intervention	Sample	Follow-up	Main results
Bidonde 2014 (20)	Physical Exercise Frequency= 1-6 d/w. Duration= 3-24 w	n=3816	From 3 to 9 m	Exercise interventions have positive effects on pain, multidimensional function, and physical function.
Bidonde 2017 (21)	Aerobic exercise Frequency= 3-7 d/w. Duration= 6-24 w	n=839 Age= 32-56 89% women	From 24 to 208 w	Eight trials provided low-quality evidence for pain intensity, fatigue, stiffness, and physical function, and moderate-quality evidence for withdrawals and HRQL at completion of the intervention. Effects for aerobic exercise *versus* control were as follows: HRQL 56.08; pain intensity 65.31; stiffness 69; physical function 38.32; and fatigue 68. Three trials provided low-quality evidence on long-term effects and reported that benefits for pain and function persisted but did not for HRQL or fatigue.
Busch 2013 (24)	Resistance exercise training Frequency= 2-3d/w. Duration= 24 w	n=219	From 16 to 28 w	Statistically significant differences favouring the resistance training interventions over the control group were found in multidimensional function, self-reported physical function, pain, tenderness, and muscle strength. However, differences between the resistance training group(s) and the aerobic training groups were not statistically significant for multidimensional function, self-reported physical function, or tenderness.

D: days; m: months; w: weeks.

was 3384 (34) people with fibromyalgia. Most studies reported an average sample age of 50 years, ranging between 8 (27) and 77 (24) years. The articles described a sample of more than 73% (39) women, reaching 94% (24), 96.1% (42), 98% (32), and 100% (39). Mist *et al*. (43) did not provide the percentage of women, although they described that most of the participants were women, while only two articles (27, 34) did not mention data on the gender of the participants. Most of the studies collected follow-up data at the end of the treatment (27, 39, 42, 43). The maximum follow-up time was 17 months (34). Two articles (32, 33) did not provide follow-up data. The range of treatment duration varied from 1 week (27) to 32 weeks (32), with the minimum and maximum treatment frequency being one day a week and three days a week, respectively. The results are summarised in Table IV.

Bravo *et al*. (24) found positive results in the treatment of fibromyalgia symptoms through movement and body awareness therapies, showing significant improvement in pain levels (p=0.037) immediately after the test, and in functional limitation in the FIQ score (p<0.0125) at six weeks after the treatment. This is in line with the results of Hernando-Garijo *et al*. (34), who described that active therapies improved pain intensity, disability, and physical function in the short term, while multimodal therapies reduced pain intensity and disability in the medium and long term. Mist *et al*. (43) also reported a medium-to-high effect size in pain reduction.

Del-Moral-García *et al*. (32) found a medium effect in active therapy-based training (ATBT) on single-pedal static balance (SMD= 0.571; 95% CI= 0.305 to 0.836; p<0.001), dynamic balance (SMD= 0.618; 95% CI= 0.348 to 0.888; p<0.001), and functional balance (SMD= 0.409; 95% CI= 0.044 to 0.774; p=0.028), but no significant differences were found for balance on unstable support. Other therapies, such as Qigong exercise, did not demonstrate substantial favourable effects in adult patients with FM; on the other hand, combined with aerobic exercise, it had positive effects in children with FM (27). The meditative movement therapies (MMT) reduced sleep disorders (SMD= -0.61; 95% CI= -0.95 to - 0.27; p=0.0004), fatigue (SMD=-0.66; 95% CI=-0.99 to -0.34; p<0.0001), depression (SMD= -0.49; 95% CI= -0.76 to 0.22; p=0.0004) and health-related quality of life (HRQOL) (SMD=-0.59; 95% CI= -0.93 to -0.24; p=0.0009) and could be maintained at 4.5 months, but not pain (SMD= -0.35; 95% CI= -0.80 to 0.11; p=0.14) (39). Lorena *et al*. (41) found a significant improvement through stretching regarding pain, quality of life, and physical condition.

- Physical or aerobic exercise

Regarding physical or aerobic exercise, Bidonde *et al*. (21, 22) analysed the effects of physical and aerobic exercise in 3816 (21) and 839 participants (22). Busch *et al*. (25) analysed resistance exercise in 219 participants. No descriptive data of the sample were provided for physical exercise. The minimum and maximum follow-up time was three months and 208 weeks, respectively, with a treatment frequency range of 1–6 days of therapy per week and a duration of 3–24 weeks (21). For aerobic exercise, the age range of the participants was 32–56 years (89% women). The intervention period ranged from 6 to 24 weeks, with a frequency of 3-5 sessions per week. The follow-up time after the intervention ranged from 4 to 208 weeks. The data are presented in Table V.

Bidonde *et al*. found positive results of exercise interventions on pain, multidimensional function, and self-reported physical function (21). Their other study also found low-quality evidence on pain intensity, fatigue, stiffness, and physical function (22). The effects of aerobic exercise compared to the control group were as follows:

- Mean HRQL = 56.08 (-7.89; 95% CI=-13.23 to -2.55) with an absolute improvement of 8% and a relative improvement of 15%.
- Mean pain intensity = 65.31 (-11.06; 95% CI= -18.34 to -3.77) with 11% of absolute improvement and 18% of relative improvement.
- Mean stiffness = 69 (-7.96, 95% CI= -14.95 to -0.97) with a fundamental difference in the improvement of 8% (1% to 15%) and relative change in the progress of 11.4%.
- Mean physical function = 38.32 (-10.16, 95% CI= -15.39 to -4.94)

Table VI. Results of hydrotherapy studies.

Author, year	Intervention	Sample	Follow-up	Main results
Galvão-Moreira 2021 (32)	Pool-based exercise Frequency: 2.4 (1±3) d/w. Duration: 17 (12±32)	Mostly women	Short to medium	Data from 10 randomised controlled trials showed that patients who underwent pool-based exercises had a significantly lower mean VAS score for pain and FIQ score compared to controls (SMD= -0.27, 95% CI= -0.45 to -0.09). This was also seen in the group that underwent a pool-based exercise program (SM = -0.29, 95% CI= -0.49 to -0.09).
Lima 2013 (40)	Pool-based exercise Frequency= 1-3 d/w. Duration= 3-32 w	Mostly women	From 6 to 8 months	Three studies showed a mean difference of -1.35 (-2.04 to -0.67; p= 0.0001) for aquatic physical therapy versus no treatment, and two studies showed a MD of -1.58 (-2.58 to -0.58; p= 0.002) and 43.5 (3.8 to 83.2); p = 0.03) metres respectively for stiffness and the 6-minute walk test.

d= days; m= months; w= weeks.

Table VII. Results of multidisciplinary therapy studies.

Author, year	Intervention	Sample	Follow-up	Main results
Andrade 2019 (19)	Resistance training, aerobic exercise, hydrotherapy, and tai chi. Frequency= 1-2 d/w. Duration= 4-24 w	N= 271 Age= 37-58 100% women	Post intervention	Aerobic exercise is effective in reducing autonomic dysfunction by increasing heart rate variability; while resistance training is associated with reduced symptoms of anxiety and depression.
Bidonde 2019 (22)	Aerobic, stretching and water exercise (combinations) Frequency= 1-5 d/w. Duration= 3-26 w	n=2088 Age= 51 (27.5-62.3) 98% women	From 13 to 52 w	Results from mixed exercise versus control showed that mean HRQL was 56 and 49 in the control and exercise groups, respectively, with absolute improvement of 7% and relative improvement of 12%. Mean pain was 58.6 and 53 in the control and exercise groups, respectively, with absolute improvement of 5% and relative improvement of 9%. Mean fatigue was 72 and 59 points in the control and exercise groups, respectively, with absolute improvement of 13% and relative improvement of 18%. Mean stiffness was 68 and 61 in the control and exercise groups, respectively, with absolute improvement of 7% and relative improvement of 9%. Mixed exercise may improve HRQL and physical function and may decrease pain and fatigue. Mixed exercise may improve HRQL and physical function and may decrease pain and fatigue; all-cause withdrawal was similar across groups, and mixed exercises may slightly reduce stiffness. It is uncertain whether mixed versus other non-exercise or other exercise interventions improve HRQL and physical function or decrease symptoms due to the quality of evidence.
Cerrillo-Urbina 2015 (25)	Aerobic, stretching and water exercise Frequency= 1-3 d/w. Duration= 6-32 w	n=1077 Age= 45-59.3 100% women	From 0 to 52 w	Exercise programs have a positive effect on symptoms of fibromyalgia in peri-menopausal women, with combined exercise and aquatic exercises having a moderate a moderate (d = –0.63; I2=0%) and small effect (d = –0.41; I2= 30%) on functional global well-being. Short-term interventions, including two to three sessions per week, seem to improve symptoms.
O'Dwyer 2019 (43)	Multidisciplinary Frequency= 1 d/w.	n=1416 Age= 45.8 (11.2)-51.4 (9.4) Duration= 6-16 w 88.9-100% women	From 3 to 12 months	Five studies reported improvements in PA either post-intervention or at follow-up. Short-term benefits in pain, quality of life, and physical fitness were also observed.

D: days; m: months; w: weeks.

with 10% and 21.9% of absolute and relative change in improvement, respectively.

- Mean fatigue = 68 (-6.48; 95% CI= -14.33 to 1.38), with 6% and 8% absolute and relative change in progress.

Benefits persisted in the long term (24-208 weeks post-intervention) for pain and function, but not for HRQL or fatigue (22). In the long term, there is strong evidence of the effect of aerobic exercise on pain, although it is necessary to obtain further data about HRQL and fatigue.

Busch *et al*. (25) found statistically significant differences (MD; 95% CI) for resistance training interventions over the control group in: multidimensional function (-16.75 units; total FIQ), self-reported physical function (-6.29 units; 100-point scale), pain (-3.3 cm; 10 cm scale), sensitivity (-1.84; 18 tender points), and muscle strength (27.32 kg of force; bilateral concentric leg extension). The differences between the resistance and aerobic training groups were not statistically significant (25).

- Hydrotherapy

Galvão-Moreira *et al*. (33) and Lima *et al*. (41) studied the effects of hydrotherapy in a sample composed mainly of women, with a follow-up of 6 to 8 months (41) and in the short and medium term (33), respectively. The frequency of treatment was 1 to 3 days a week, with a duration of 17 days (33) and a range of 3 to 32 weeks (41). Summary data are presented in Table VI.

Galvão-Moreira *et al*. (33) found that patients with FM who performed group pool- based exercises obtained a significantly lower mean VAS score for pain compared to controls (SMD= -0.27; 95% CI = -0.45 to -0.09). Regarding FIQ scores, a lower mean score was also shown (SMD= -0.29; 95% CI= -0.49 to -0.09).

Lima *et al*. (41), on the other hand, found three studies reporting good

Table VIII. Results of manual therapy studies.

Author, year	Intervention	Sample	Follow-up	Main results
Algar-Ramírez 2021 (18)	Manual lymph drainage and myofascial therapy. Frequency: 2-5 d/w. Duration: 4-20 w	n= 637 Age= 34.5 (5.5) - 59.9 (9.2) Mostly women	From 0 to 12 months	Both therapies improved quality of life in all studies.
Li 2014 (39)	Massage therapy Frequency: 1-20 d. Duration: 1-24 w	n=404 Age= 47 (4.87)	From 0 to 24 months	Massage therapy significantly improved pain (SMD= 0.62; 95% CI= 0.05 to 1.20; p= 0.03), anxiety (SMD= 0.44; 95% CI= 0.09 to 0.78; p= 0.01), and depression (SMD= 0.49; 95% CI= 0.15 to 0.84; p = 0.005) in patients with FM, but not on sleep disturbance (SMD= 0.19; 95% CI= -0.38 to 0.75; p= 0.52).
Schulze 2020 (45)	Manual therapy Frequency: 1-5 d/w. Duration: 1-4 w	n=368 Age= 35 - 55 Mostly women	From 0 to 3 months	Myofascial release has low evidence due to inconsistency and inaccuracy. Manual therapy in FM is inconclusive, with only osteopathic treatment achieving clinically relevant pain improvement.
Ughreja 2021 (49)	Myofascial Frequency: 4-40 d.	n=279	From 1 to 6 m	Myofascial release has a moderate effect on pain posttreatment (SMD= -0.81; 95% CI= -1.15 to -0.47; p< 0.00001) and a moderate effect at 6 months post-treatment (SMD= -0.61; 95% CI= -0.95 to -0.28, p= 0.0003).

D: days; m: months; w: weeks.

results for the aquatic physiotherapy group versus the no-treatment group. One of these three studies obtained a mean difference (MD) of -1.35 (-2.04 to -0.67; p=0.0001) for functional capacity (FIQ), another study showed a MD of -1.58 (-2.58 to -0.58; p=0.002) for stiffness, and the other presented 43.5 (3.8 to 83.2; p=0.03) metres for the 6-minute walk test.

- Multidisciplinary therapy

Four studies (20, 23, 26, 44) analysed multidisciplinary or multimodal active therapy treatment in people with fibromyalgia. Bidonde *et al*. (23) described the articles related to resistance training and movement and body awareness therapies, while Andrade *et al*. (20) and Cerrillo-Urbina *et al*. (26) explored the literature on hydrotherapy, and O'Dwyer *et al*. (44) analysed multidisciplinary treatment. The multidisciplinary and multimodal treatment analysed a total population of 4852 patients aged between 27 and 62 years. More than 88.9% were women (44), although in most studies the sample was 100% female (20, 26, 44). The follow-up was carried out after finishing the treatment (20, 26) or after three months (44), and the maximum follow-up date was 12 months (44). The minimum frequency of treatment was one session per week and a maximum of 5 sessions per week, with a minimum duration of 4 weeks and a maximum of 32 weeks. The data are presented in Table VII.

Andrade *et al*. (20) concluded that the most analysed exercise modalities were aerobic and resistance exercises; moderate to high-intensity aerobic exercise twice a week increases heart rate and decreases autonomic dysfunction, while resistance training was associated with a reduction in symptoms of anxiety and depression, as well as an increase in muscle strength; however, it did not reduce autonomic dysfunction in the short or long term. This is supported by the analysis of Cerrillo-Urbina *et al*. (26), who concluded that exercise programmes positively affected FM symptoms in women of perimenopausal age. The meta-analysis showed that the combined exercise and aquatic exercise programmes had a moderate (d= –0.63; I2= 0%) and small effect (d= –0.41; I2= 30%), respectively, on global functional well-being [FIQ]. Short-term interventions may improve symptoms in perimenopausal women with fibromyalgia. O'Dwyer *et al*. (44) also found improvements after active interventions or follow-up, with short-term benefits in pain, quality of life, and fitness.

Bidonde *et al*. compared mixed exercise interventions *versus* control, no exercise, and other exercise interventions (23), with a scale of 0 to 100 (the lowest values are the best, and negative mean differences indicate improvement); the results of mixed exercise *versus* control show good results of HRQL in the control (SMD=56) and exercise (SMD= 49) groups, with an absolute improvement of 7% and a relative improvement of 12%; SM pain = 58.6 and 53 in the control and exercise groups, respectively with an absolute improvement of 5% and a relative improvement of 9%; fatigue SM = 72 and 59 in the control and exercise groups, respectively, with absolute improvement of 13% and relative improvement of 18%; SM stiffness = 68 and 61 in the control and exercise groups, respectively, with an absolute improvement of 7% and a relative improvement of 9%; physical function SM = 49 and 38 in the control and exercise groups, respectively, with an absolute improvement of 11% and a relative improvement of 22%.

Passive therapies

For passive therapies, the studies found were classified as: 1. Manual Therapy; 2. Repetitive transcranial magnetic stimulation (rTMS); 3. Other therapies (hyperbaric oxygen therapy, vibration therapy, virtual reality, TENS, pain neuroscience education, and acupuncture).

- Manual therapy

Four studies (19, 40, 46, 50) analysed the effects of manual therapy in a population of 1688 fibromyalgia patients aged between 29 and 70 years (Ughreja *et al*. (50) did not mention the age of the sample), who were mainly women. Most of the authors gathered follow-up data right after the treatment, except Ughreja *et al*. (50), who collected data from the first follow-up one month after the treatment. The maximum follow-up time varied from 3 months (46) to 24 months (40). Regarding the frequency of treatment, a minimum of one session per week (46) or two sessions per week (19) were carried out, up to a maximum of 5 sessions per week (46); Li *et al*. (40) and Ughreja *et al*. (50) did not

Table IX. Results of repetitive transcranial magnetic stimulation (rTMS) studies.

Author, year	Intervention	Sample	Follow-up	Main results
Choo 2022 (28)	rTMS	n=299 G1 = 154 GC = 145 Age = 42.8 (8.8) - 51.67 (18.19)	From 0 to 3 months	High-frequency rTMS on the left primary motor cortex (Lt. M1) had a significant effect on pain reduction and quality of life. In contrast, high-frequency rTMS on the left dorsolateral prefrontal cortex (Lt. DLPFC) did not reduce pain from fibromyalgia.
Hou 2016 (34)	rTMS and tDCS rTMS= 12000-45000 pulses tDCS= 100242 min Frequency: intervals of treatment ranged from 5 days to 22 weeks. Duration: - w	n=572 Age= 40.7 (6.7) -55. 3 (8.9) 81.6% women	From 2 d to 25 w	Effect sizes of rTMS and primary motor cortex (M1) stimulation on pain 0.667 (95% CI= 0.446 to 0.889), depression 0.667 (95% CI= 0.446 to 0.889), fatigue 0.511 (95% CI= 0.24 to 0.774), sleep disturbance 0.682 (95% CI= 0.350 to 1.014), tender points 0.867 (95% CI= 0.310 to 1.425), and general health/function 0.473 (95% CI= 0.285 to 0.661).
Kim 2022 (36)	rTMS rTMS= 1 or 10 Hz Frequency: 10-16 d. Duration:2-12 w	n=170	Short to long follow-up time	High-frequency rTMS on the M1 improved quality of life (MD= -2.50; 95% CI= -3.99 to -1.01), while low-frequency rTMS improved health status (MD= 15.02; 95% CI= 5.59 to 24.45).
Knijnik 2016 (37)	rTMS rTMS= 1 or 10 Hz Frequency: 5-7 d/w. Duration: 2-10 w	n=143	From 10 to 12 w	rTMS improved QoL (Pooled SMD= -0.472; 95% CI= -0.80 to -0.14), pain intensity (SMD= -0.64 95%CI = -0.31 to 0.017), but not depressive symptoms.
Su 2021 (46)	rTMS Duration: 2-21 w	n=643 Age= 47.5 (5.7) -54.2 (8.28) 90% women	From 0 to 40 w	A significant reduction the FIQ (SMD= -0.700; 95% CI= -1.173 to -0.228), and the reduction was larger in older patients (β= -0.1327; *p*= 0.008). The effect persisted at least two weeks after the final treatment session (SMD= -0.784; 95% CI= -1.136 to -0.432). Reductions in pain, depression, and anxiety were discovered, which persisted for at least two weeks after the last intervention.
Sun 2022 (47)	rTMS Frequency: 1-5 d/w. Duration: 2-21 w rTMS= 1 or 10 Hz rTMS= 1 or 10 Hz	n=433 Age= 18 - 70	From 0 to 11 w	rTMS exerted more favorable effects than sham rTMS after treatment on the NPRS (SMD= -0.49; 95% CI= -0.86 to -0.13; *p*= 0.008; I2= 68%) and the FIQ (SMD= -0.50; 95% CI= -0.75 to -0.25; *p*= 0.0001; I2= 28%). However, the BDI, FSS, PCS, mood index, and HADS scores showed no significant difference compared with sham rTMS after treatment.

D: days; tDCS= transcranial direct current stimulation; m: months; w: weeks.

describe the frequency of treatment but described a total of 1 to 20 sessions and 4 to 40 sessions, respectively. The minimum and maximum treatment duration was one week and 24 weeks (Ughreja *et al*. (50) did not mention treatment duration). The results are summarised in Table VIII.

Choo *et al*. (29) reported that high-frequency rTMS on the left primary motor cortex (Lt. M1) significantly affected pain reduction immediately after treatment and 1 to 4 weeks after the treatment, but not 5-12 weeks after the treatment. Quality of life improved between 5 and 12 weeks of follow-up. Hou *et al*. (35) also found that the primary motor cortex (M1) produced a more significant effect size in pain reduction compared to that of the dorsolateral prefrontal cortex (effect size 0.709 and 0.693, respectively; $p<0.0001$). They also observed a weighted mean effect in pain reduction (0.667) (95% CI= 0.446 to 0.889), depression (0.667) (95% CI=0.446 to 0.889), fatigue (0.511) (95% CI= 0.24 to 0.774), sleep disturbance (0.682) (95 % CI=0.350 to 1.014), tender points (0.867) (95% CI= 0.310 to 1.425), and general health/function (0.473) (95% CI= 0.285 to 0.661). Stimulation with rTMS produced a more significant effect size compared to that of transcranial direct current stimulation (TDCS) (0.698 and 0.568, respectively; $p<0.0001$).

Kim *et al*. (37), in his meta-analysis on rTMS in M1, found that high-frequency therapy significantly improved quality of life (MD= -2.50; 95% CI= -3.99 to -1.01) compared to sham treatment. On the other hand, low-frequency rTMS significantly improved health status (MD= 15.02; 95% CI= 5.59 to 24.45). Knijnik *et al*. (38) found an improvement in QoL (Pooled SMD= -0.472; 95% CI= -0.80 to -0.14), and pain intensity (SMD = -0.64 95%CI = -0.31 to 0.017), but not in depression.

Her *et al*. (47) detected a significant reduction in the Fibromyalgia Impact Questionnaire (SMD = -0.700; 95% CI = -1.173 to -0.228), and the reduction was larger in older patients (β = -0.1327; $p=0.008$). The effect persisted at least two weeks after the final treatment session (SMD= -0.784; 95% CI= -1.136 to -0.432). The effects on pain and depression remained significant up to 90 days after the last session.

Moreover, Sun *et al*. (48) indicated more benefits than the sham rTMS (SMD= -0.49; 95% CI= - 0.86 to -0.13; $p=0.008$; I2 = 68%) and the FIQ (SMD= -0.50; 95% CI= -0.75 to -0.25; $p=0.0001$; I2= 28%). However, the BDI, FSS, PCS, mood index and HADS scores showed no significant difference compared with sham rTMS after treatment. The average PEDro methodological quality was 8.5.

No pain reduction was observed with high-frequency rTMS on the left dorsolateral prefrontal cortex (Lt. DLPFC) (29). No linear relationship was found between effect size and treatment regimens or doses (35).

- Other therapies

The rest of the therapies (hyperbaric oxygen therapy, vibration therapy, virtual reality, TENS, pain neuroscience education, and acupuncture) are grouped and summarised in Table X.

Table X. Results of studies of passive therapies as primary intervention.

Author, year	Intervention	Sample	Follow-up	Main results
Chen 2023 (27)	Hyperbaric oxygen therapy 90 min, 1.4 - 2.4ATA, <<3-5d/w Sessions: 15 - 60. Duration: 4-12 w	n=288 G1= 185 HC= 103	3 months	HBOT can relieve pain of FM patients compared to the control intervention (SMD= –1.56; 95% CI= –2.18 to –0.93); p<0.001; I2= 51%), with most studies reporting improvement in tender points, fatigue, multidimensional function and sleep disturbance.
Collado-Mateo 2015 (29)	Whole-Body Vibration Therapy Frequency: 2-3 d/w. Duration: 6-12 w Number of series= 3-10 Lasted= 30-60 s with a rest interval of 45-180 s.	n=345 Age= 41 - 59 100% women	Post intervention	Whole-body vibration improved balance and disability outcomes.
Cortés-Pérez 2021 (30)	Virtual Reality Frequency: 2-3 d/w. Duration: 3-24 w	n=535 G1= 279 GC= 256 Age= 51.11 (4.2) 100% women	Post intervention	VRBT has a positive effect on FMS (SMD= -0.62; 95%CI= -0.93 to -0.31); pain (SMD= -0.45; 95% CI -0.69 to -0.21); dynamic balance (SMD= -0.76; 95%CI= -1.12 to -0.39); aerobic capacity (SMD= 0.32; 95%CI= 0.004 to 0.63); fatigue (SMD= -0.58; 95%CI= -1.02 to -0.14); QoL (SMD= 0.55; 95%CI= 0.3 to 0.81); anxiety (SMD= -0.47; 95%CI= -0.91 to -0.03) and depression (SMD= -0.46; 95%CI= -0.76 to -0.16). The PEDro scale was moderate (6.63 ± 0.51).
Johnson 2017 (35)	TENS Frequency: 3-7 d/w. Duration: 3-6 w	n=315 Age= 18 - 75 94,92 % women	From 0 to 24 months	Only one study achieved 30% or more pain reduction in 30% with TENS and exercise, compared to 13% with exercise alone. Another study reported that 10/28 participants achieved pain relief of 25% or more with TENS compared to 10/24 participants using superficial heat (42°C). Found clinically important improvements in Fibromyalgia Impact Questionnaire (FIQ) subscales for work performance, fatigue, stiffness, anxiety, and depression for TENS with exercise compared with exercise alone, but no additional improvements in FIQ scores when TENS was added to the first three weeks of a 12-week supervised exercise programme.
Saracoglu 2022 (44)	PNE Frequency: 1-3 d/w. Duration: 1-12 w	n=612 G1= 305 GC= 307	From 3 to 12 months	PNE groups were statistically more effective than interventions applied in control groups on severity of FM (SMD= -1.051; 95% CI= -1.309 to -0.793; p< .000), pain intensity (SMD= -1.049; 95% CI= -1.400 to -0.698; P< .000), catastrophising (SMD = -0.893; 95% CI = -1.437, -0.348; p= .001), depression (SMD= -0.686; 95% CI= -0.849 to -0.523; p< .000) and anxiety (SMD= -0.711; 95% CI= -0.869 to -0.552; p< .000).
Suso-Martí 2022 (48)	PNE Frequency: 2-3 d/w. Duration: 1-10 w	n=738 Age> 18	From 12 w to 12 m	Meta-analysis showed significant differences in pain intensity (SMD= -0.76; 95% CI= -1.33 to -0.19; p< 0.05) with evidence of significant heterogeneity (p< 0.05; I2= 92%), but it did not show statistically significant differences in fibromyalgia impact, anxiety, and pain catastrophising (p> 0.05). After sensitivity analysis, pain intensity decreased with moderate clinical effect.
Yang 2014 (50)	Acupuncture Duration: 3 w - 24 m	n= -	From 0 to 24 months	Acupuncture compared to sham acupuncture showed a significant difference in visual analogue scale and the fibromyalgia impact questionnaire. Additionally, a difference in the multidisciplinary pain inventory and in the number of tender points was observed.

d: days; m: months; w: weeks.

- Hyperbaric oxygen (HBOT)

Chen *et al*. (28) studied the effects of hyperbaric oxygen therapy in 288 people. They compared 185 fibromyalgia patients with 103 healthy subjects, with a follow-up of three months after carrying out the treatment, a duration 4-12 weeks, and 15-60 sessions. The results are presented in Table IX.

The results show that HBOT could relieve the pain of FM patients compared to the control intervention (SMD= -1.56; 95% CI= -2.18 to -0.93); p<0.001; I2= 51%), with most studies reporting improvement in tender points, fatigue, multidimensional function, and sleep disturbance. Low pressure (less than 2.0 atmospheric absolute) could be beneficial to reduce the effects of FM.

- Whole-body vibration therapy

Collado-Mateo *et al*. (30) studied the effects of whole-body vibration therapy in 345 affected women aged between 41 and 59 years. Follow-up results were only collected after treatment, with a minimum frequency of 2 days per week and a maximum frequency of 3 days per week, for a duration of 6-12 weeks. Whole-body vibration appeared to improve balance and disability rates and may positively affect quality of life, fatigue, and pain.

- Virtual reality therapy (VRBT)

Regarding virtual reality therapy, Cortés-Pérez *et al*. (31) analysed 535 women (256 in the control group) with a mean age of 51.11 years (4.2), gathering follow-up data after treatment, which had a frequency of 2-3 days per week, and a duration of 3-24 weeks. Eleven RCTs with 535 women with FMS showed an effect of VRBT on: the impact of FMS (SMD= -0.62; 95% CI= -0.93 to - 0.31); pain (SMD= -0.45; 95% CI -0.69 to -0.21); dynamic balance (SMD= -0.76; 95% CI= -1.12 to -0.39); aerobic capacity (SMD= 0.32; 95% CI= 0.004 to 0.63); fatigue (SMD= -0.58; 95% CI= -1.02 to -0.14); QoL (SMD= 0.55; 95% CI= 0.3 to 0.81); anxiety (SMD= -0.47; 95% CI= -0.91 to -0.03) and depression (SMD= -0.46; 95% CI= -0.76 to -0.16). The PEDro scale was moderate (6.63 ± 0.51).

- TENS

TENS therapy was analysed by Johnson *et al*. (36) in a population of 315 pa-

tients (94.92% women), aged between 18 and 75 years. The follow-up was carried out after the treatment and at 24 months, with a treatment frequency of 3-7 sessions per week, and a duration of 3-6 weeks. Only one study (14 participants) achieved a pain reduction of 30% or more with TENS and exercise, compared to 13% with exercise alone. TENS reported over 25% pain relief compared with superficial heat (42°C). Moreover, a mean decrease was found in pain intensity (CI= 95%) on VAS (100 mm) during a 30-minute treatment of 11.1 mm (95% CI= 5.9 to 16.3) and 2.3 mm (95% CI= 2.4 to 7.7) for TENS placebo. A parallel-group study of 39 participants found that mean pain intensity (VAS) with dual- site TENS treatment decreased from 85±20 mm to 43±20 mm after a week; single-site TENS from 85±10 mm at baseline to 60±10 mm and placebo TENS decreased from 82±20 mm to 80±20 mm after one week. Another study found no additional improvements in FIQ when using TENS in the first three weeks of an exercise programme (follow-up 12 weeks).

- Pain neuroscience education (PNE)

Two studies (45, 49) analysed pain neuroscience education (PNE) in a population of 1350 subjects, of whom 307 (45) were in the control group, with a minimum follow-up of 12 weeks and a maximum of 12 months. Saracoglu *et al*. (45) carried out the treatment together with a multimodal intervention, and the treatment lasted from 1 to 12 weeks, while Suso-Martí *et al*. (49) only carried out the treatment from 1 to 10 weeks, specifying a minimum and maximum frequency of 2 and 3 sessions per week. The meta-analysis by Saracoglu *et al*. (45) showed a statistical difference between the PNE groups and the control groups on the severity of FM in the Fibromyalgia Impact Questionnaire (SMD= -1.051; 95% CI= -1.309 to -0.793; $p<0.000$), pain intensity (SMD= -1.049; 95% CI= -1.400 to -0.698; $p<0.000$), catastrophising (SMD = -0.893; 95% CI= -1.437, -0.348; $p=0.001$), depression (SMD= - 00.686; 95% CI= -0.849 to -0.523; $p<0.000$) and anxiety (SMD= -0.711; 95% CI= -0.869 to -0.552; $p<0.000$). The meta-analysis by Suso-Martí *et al*. (49) showed statistically significant differences in pain intensity in the evaluation after the intervention (SMD= - 0.76; 95% CI= -1.33 to -0.19; $p<0.05$) with evidence of heterogeneity ($p<0.05$; I2=92%), but not in the impact of fibromyalgia, anxiety and pain catastrophising ($p>0.05$). Regarding the follow-up evaluation, only the effect of fibromyalgia showed significant improvements (SMD = -0.44; 95% CI = -0.73 to -0.14; $p<0.05$) and evidence of significant heterogeneity ($p<0.05$; I2= 80%). A sensitivity analysis with in-person PNE interventions showed a significant decrease in pain intensity, with a moderate clinical effect in post-treatment and follow-up assessments, and no evidence of significant heterogeneity ($p<0.05$; I2=10%).

- Acupuncture

Yang *et al*. (51) analysed the effects of acupuncture without specifying data on the sample. They found that the follow-up had been carried out immediately after the treatment and in a maximum period of 24 months, with a treatment duration range between 3 weeks and 24 months. There was a significant difference in VAS but not in pressure pain threshold compared to sham acupuncture. Furthermore, differences were found in the FIQ and the multidisciplinary pain inventory after four weeks of treatment, but none after seven weeks. It was also found that acupuncture combined with multidisciplinary treatment showed differences at 3 and 6 months, but there was no difference between the two comparison groups after follow-up visits at 12 and 24 months.

Discussion

The purpose of this umbrella review was to summarise and assess in the current literature the effectiveness of medium- and long-term physiotherapy treatment in adults with fibromyalgia. After analysing 33 studies (which included 406 primary studies), evidence was found on the positive effect of physiotherapy treatment on the signs and symptoms of fibromyalgia, such as pain, impairment of physical capacity and poor quality of life (25, 39, 42, 43).

Active intervention

The active treatment that was most widely analysed and used was movement and body awareness therapies, which showed significant improvements in pain levels and functional limitation in the FIQ score in the medium and long term (24, 34). Impairment of balance (32) and gait (58) are common FM disorders, which increase the risk of falls and affect the quality of life (32), indicating that training based on active therapies to improve balance in women with FMS can be a great option to alleviate these problems. A moderate effect was also found in physical or aerobic exercise, improving multidimensional pain and physical function (21) in the long term. Active therapies are cheaper treatment options than pharmacological therapies, are easy to implement in daily clinical practice (24), and are complementary to usual care (25). Furthermore, given the lack of adverse events, there is little risk in recommending these modalities for the management of fibromyalgia (43).

Hydrotherapy has shown a significant positive effect on pain management and FIQ. Although the sample size was small, dropout rates were moderate (33), and methodological rigour was low (41). Multidisciplinary or multimodal treatment positively affected symptoms, physical function, pain, fatigue, and quality of life, but was not analysed critically.

Although whole-body vibration therapy also had a positive effect on quality of life, fatigue, pain, improvement of balance and disability index, there is a remarkable lack of trials and heterogeneity in the treatment and intervention protocol, as well as in the measurement tools used (29). Therefore, the results observed in the selected studies are not conclusive regarding the effectiveness of WBWT for the treatment of the symptoms of patients with FM.

Passive treatment

Myofascial release therapy was found to be the most used modality in terms of manual therapies (46), together with lymphatic drainage. The observed results identify it as an effective intervention strategy in the treatment of the

signs and symptoms of FM (19), such as pain (19, 50) and quality of life (anxiety, depression, sleep disorders...). Ughreja *et al*. (50) showed a good result of myofascial release for reducing pain after treatment and moderate in the long term, also when compared with other therapies (TENS, stretching, mobilisation, …...). Similarly, better results were also observed for myofascial therapy, except in exercise interventions (19). Although the results are positive, the authors insist that further data are required to assess the available evidence (19, 50).

The effects of HBOT showed that low pressure (less than 2.0 atmospheric absolute) could be beneficial in reducing FM effects, such as trigger points, fatigue, sleep disturbance, and multidimensional function (28). Regarding rTMS therapy, when working on the primary motor cortex (M1), it showed a more significant effect size in reducing pain compared to that of the dorsolateral prefrontal cortex (29), TDCS (35) and sham treatment (37). High-frequency rTMS on the left primary motor cortex showed a significant effect in reducing pain in the short and medium term (29, 47) and improving quality of life in the medium and long term (29). rTMS also showed positive effects FM symptoms, such as depression, fatigue, sleep disturbance, tender points, and general health/function (35). No pain reduction was observed with high-frequency rTMS on the left dorsolateral prefrontal cortex (Lt. DLPFC) (29). No linear relationship was found between effect size and treatment regimens or doses (35).

Virtual Reality therapy (VRBT) also showed positive effects in treating FM symptoms such as pain, dynamic balance, aerobic capacity, fatigue, QoL, anxiety, and depression. TENS therapy showed improvement in short-term pain, but the quality of the evidence was poor, mainly due to a lack of data. Statistical grouping or extraction of secondary data was not possible due to the scarcity and low homogeneity of the data. Furthermore, there were no significant differences between TENS and placebo for pain at rest (36). PNE showed substantial effects on fibromyalgia impact, pain intensity, catastrophising, depression, and anxiety, with moderate clinical effects in post-treatment evaluations. Acupuncture showed positive effects in the short term but not in the long term (51). The scarcity of data made the analysis difficult.

- The patients who receive it undergo active treatment as an intervention strategy to reduce the symptoms of the pathology, achieving significant results in the short, medium and long term.
- Patients who receive passive treatment to reduce the symptoms of fibromyalgia manage to reduce it significantly in the short and medium term.
- There is a high heterogeneity in the type of intervention proposed, both active and passive, for the treatment of FM symptoms.
- Based on the results analysed in the present study, the combination of active and passive therapy for the symptomatic treatment of FM could reduce the negative effects of the pathology, but it would be necessary to develop solid evidence to support this hypothesis.

Fig. 2. Take home messages.

Clinical recommendations based on the observed results

To identify the best intervention strategies in patients with fibromyalgia, it was observed that there is high heterogeneity among the different studies. It is essential to consider what primary outcome variable will be tackled, as well as the development time of the intervention protocol. These two premises are important, since they determine the therapeutic option to be selected. In this sense, it was detected that active interventions present, in general, positive results in the short, medium, and long term. However, the difference in the effect of the intervention varies among studies. Furthermore, it was identified that specific passive interventions achieved different effects depending on both the outcome variable analysed and the intervention time.

In this sense, it seems that the preferred therapeutic option could be a multimodal intervention in which an active intervention part is integrated, which must modify the intervention parameters as the patient's abilities evolve, complemented by a passive intervention that must change, perhaps the parameters or perhaps directly the selected treatment methodology itself, since passive interventions have shown good short-term results, which progressively decrease over time; the opposite has also been reported, that is, passive interventions where the best outcomes were obtained in the medium and long term. Notwithstanding this reflection on the part of the authors based on the results analysed in this study, it would be advisable to design and develop randomised clinical trials that allow testing the stated hypothesis.

Furthermore, it would be interesting to analyse the methodology for implementing active therapy, since a document suggested that the web-based daily exercise programme managed to generate significant improvements in the level of severity of the patients who performed this protocol (59). Therefore, future lines of study could compare exercises with in-person or virtual programming/supervision.

Strengths and weaknesses

Figure 2 summarises the main findings of this study, considering that this is the first review of reviews to analyse the short-, medium-, and long-term effects on the symptomatology and outcome variables of the different interventions performed in patients with fibromyalgia. The results presented in this study allow identifying which interventions show the best results and, therefore, should be preferred choices for treating patients with FM. However, some weaknesses must be taken into account when interpreting the results. One of the limitations of this umbrella review is that, although the search was carried out in the primary international databases, there could be other documents collected in other databases that were not included in this study. On the other hand, the search included five of the most spoken languages in the world. There could be other documents published in different languages that, for

this reason, were not selected for this study, and, therefore, their results were not taken into account.

Finally, although it is not a weakness of this study, it is worth pointing out that, even though almost all treatments showed improvement in the symptoms of fibromyalgia, the heterogeneity and quality of the studies made it difficult to obtain results.

Conclusion

The findings of the present umbrella review summarise the available evidence and assess the effectiveness of medium and long-term physiotherapy treatment in adults with fibromyalgia. Regarding clinical results, there is poor-to-strong evidence for active and passive therapies. Concerning the findings of the analysed studies, the management of FM still needs to be more conclusive. However, the effectiveness of the active and passive therapies analysed in the management of the symptoms and signs of the disease was positive in most of the studies. More specific descriptions of the treatment protocol, frequency, intensity, or treatment dose are required to reach a consensus, as well as primary studies for a more extended follow-up period to evaluate long-term effects more accurately. The study's main limitation is the heterogeneity and variability of the designs, instruments, and interventions, which make it difficult to compare the outcome variables and perform meta-analyses. Therefore, more quality primary studies are required to evaluate the effects of physiotherapy treatments in managing FM. Another limitation was language, since studies published in languages other than Spanish, Portuguese, French, English, or Italian were not considered, and relevant information may have yet to be included. Professionals should consider the clinical evidence to choose the most appropriate therapy for each treatment and guide future lines of research.

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