Journal of Bodywork & Movement Therapies 47 (2026) 144–153

Contents lists available at ScienceDirect

Journal of Bodywork & Movement Therapies

journal homepage: www.elsevier.com/jbmt

Beyond pain: Impact of movement-based mindful exercises in fibromyalgia. A systematic review with meta-analysis

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ARTICLE INFO

Keywords:
Exercise movement techniques
Fibromyalgia
Mind-body therapies
Qigong
Tai ji
Yoga

ABSTRACT

Background and objective: Current literature supports exercise for the management of fibromyalgia (FM), although the optimal type of exercise remains unclear. This systematic review aims to summarize the effectiveness of qigong, yoga, and tai chi for FM-related symptoms beyond pain.
Methods: Searches were conducted in CINAHL (via EBSCOhost), Embase, PsycINFO, PubMed, SPORTDiscus (via EBSCOhost), and the Cochrane Library from inception to September 2023 (updated in February 2026). Randomized controlled trials (RCTs) including measures of fatigue, anxiety, depression, health status, sleep quality, and overall quality of life were included. The Cochrane Risk of Bias tool 2 (ROB-2) was used to assess the risk of bias in primary studies. The Grading of Recommendations, Assessment, Development, and Evaluations (GRADE) approach judged the certainty of the evidence. Sensitivity analyses and meta-regressions were performed.
Results: Twenty-three RCTs with 1734 participants were included. Meta-analyses showed that mindful exercises were more effective than control interventions (active and inactive) across all measures, i.e., fatigue (standard mean difference [SMD]: 0.63, 95% confidence interval [CI]: 0.08 to 1.17; P = 0.04), except for sleep quality and overall quality of life. Subgroup analyses demonstrated that the type of intervention may influence the results. Most RCTs had a high risk of bias, and the certainty of the evidence was very low.
Discussion: Qigong, tai chi, and yoga positively impact FM-related symptoms beyond pain, including fatigue, mental health, and health status. However, given the very low certainty of the evidence, these findings should be interpreted with considerable caution in clinical practice.

1. Introduction

Around 2% of the general population, mostly women, are diagnosed with fibromyalgia syndrome (FM) (Heidari et al., 2017), with a higher estimated prevalence and incidence among those with a preexisting medical condition (Creed, 2020; Heidari et al., 2017). FM is a form of chronic primary pain characterized by increased pain sensitivity and widespread pain (Wolfe et al., 2016). However, pain alone does not fully explain the impact of the syndrome (Pérez-Aranda et al., 2019), nor is it the major determinant of quality of life (Offenbaecher et al., 2021). FM has been traditionally understood as a solely pain-based condition, but increasing attention is now directed to other common associated symptoms, such as fatigue (McToal et al., 2023), poor sleep (Wu et al., 2017), anxiety, and depression (Janssens et al., 2015; Løge-Hagen et al., 2019). All these factors play a major role in determining quality of life (Galvez-Sánchez et al., 2019; Offenbaecher et al., 2021), and contribute

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https://doi.org/10.1016/j.jbmt.2026.03.019
Received 13 January 2025; Received in revised form 16 March 2026; Accepted 17 March 2026
Available online 24 March 2026
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to a considerable socioeconomic burden (D'Onghia et al., 2022). Current literature advocates for non-pharmacological therapies in the management of FM (Macfarlane et al., 2017). Among these, exercise is probably the only intervention with strong positive recommendations across evidence-based guidelines (Thieme et al., 2017), although the optimal type of exercise and exercise dosage remain unclear (Macfarlane et al., 2017).

Movement-based mindful exercises, i.e., qigong, yoga, and tai chi, represent low-intensity physical activities that integrate body awareness, physical postures, and breathing control (Vergeer, 2019) and can enhance patient adherence to exercise even in individuals with low exercise tolerance (Shi et al., 2022). Recently, international experts have recommended to include mindful exercises within a multimodal treatment approach for FM (Kundakci et al., 2022a). Mind-body practices have demonstrated high acceptance and safety in various chronic conditions (Casuso-Holgado et al., 2022), and promising results in alleviating FM-related symptoms, e.g., pain, anxiety, and quality of life (Lauche et al., 2015; Neelapala et al., 2023; Wang et al., 2018; Wood, 2020). Several comprehensive reviews have examined so far the impact of mindful exercises on FM (Bravo et al., 2019; Cheng et al., 2019; Du et al., 2023; Kundakci et al., 2022b; Steen et al., 2024; Vasileios et al., 2022; Zhang et al., 2022). However, most of these reviews were primarily focused on pain-related measures or examine mindful exercises alongside other forms of physical activity. Additionally, three critical aspects necessary to translate research findings into well-informed clinical decisions have been overlooked in these reviews: a) the certainty of the evidence, often assessed using the Grading of Recommendations, Assessment, Development, and Evaluations (GRADE) framework (Hultcrantz et al., 2017); b) the completeness of intervention descriptions, which is essential for replicability (Slade et al., 2016); and c) the quality, accuracy, and transparency of the information presented in primary studies, i.e., the spin of information (Nascimento et al., 2021). This systematic review with meta-analysis aimed to summarize the quality and certainty of the evidence regarding the effects of qigong, yoga, and tai chi, on fatigue, anxiety and depressive symptoms, health status, sleep quality, and overall quality of life (both physical and mental), in adults diagnosed with FM.

2. Methods

2.1. Design

The review protocol followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) 2020 statement and was prospectively registered at Open Science Framework in September 2023: https://doi.org/10.17605/OSF.IO/RQBWZ. There were no deviations from the intended protocol. Findings about pain-related measures, e.g., pain intensity, pain acceptance, pain self-efficacy, and pain catastrophizing and tenderness, have been reported elsewhere.

2.2. Searching strategy and data sources

An external reviewer (JM-C) searched the following databases: CINAHL (via EBSCOhost), Embase, PsycINFO, PubMed, SPORTDiscus (via EBSCOhost), and the Cochrane Library, from inception to September 2023. All searches were updated in February 2026 to ensure that the review reflected the most current available evidence. The type of publication/document and language restrictions (English or Spanish) were applied as search filters. Manual searches were conducted on the list of references of systematic reviews of interest retrieved by electronic databases. The complete strategies are detailed in **Supplementary File 1**.

2.3. Eligibility criteria

The eligibility criteria were structured according to the PICOs (population, intervention, comparator, outcomes, study design) framework. Randomized clinical trials (RTCs) that evaluated the effects of qigong, tai chi, and yoga-based exercises in individuals diagnosed with FM (no age limits) were included. All types of comparison groups (no intervention, waitlist, or active controls) were considered, except studies where qigong, tai chi, or yoga were used as a control intervention. No restrictions were imposed for outcome measures. The primary outcome was the severity of fatigue. Secondary measures included anxiety and depressive symptoms, health status, sleep quality, and overall quality of life. Studies where participants with FM were analyzed together with other clinical or non-clinical populations, theses dissertations, cluster analysis, and conference abstracts were excluded.

2.4. Study selection

A single reviewer (JM-S) conducted the primary selection process using Mendeley Desktop, version 1.19.8. Duplicated records were removed automatically, and this step was manually double-checked for accuracy. The same reviewer subsequently screened the remaining records by title and abstract. Full texts of potentially eligible studies and those without an abstract were then assessed in detail. Although the entire selection process was not independently duplicated by a second reviewer, two additional reviewers (AMH-R and CG-M) were consulted whenever uncertainties arose in order to reach consensus.

2.5. Risk of bias assessment

Two independent reviewers (JM-S and PM-M) evaluated the risk of bias in primary studies using the revised Cochrane Risk of Bias tool version 2 (RoB-2). This tool assesses five domains, bias arising from the randomization process (D1), bias due to deviations from intended interventions (D2), bias due to missing outcome data (D3), bias in measurement of the outcome (D4), and bias in selection of the reported result (D5). The RoB-2 tool provides an overall score of 'low', 'some concerns' or 'high' risk of bias (Sterne et al., 2019). Inter-rater agreement was calculated.

2.6. Completeness of intervention descriptions

One researcher (HF–C) employed the Consensus on Exercise Reporting Template (CERT) (Slade et al., 2016) to assess whether movement-based mindful interventions were reported in enough detail in primary studies to ensure replicability.

2.7. Spin of information

Two independent reviewers (AMH-R and HF–C) evaluated the extent of spin of information presented in the abstracts of the included RCTs using a 7-item checklist (Nascimento et al., 2021), that assesses aspects such as omission of the primary outcome, selective reporting of positive findings, and failure to mention adverse events. An overall score was provided, and inter-rater agreement was calculated.

2.8. Certainty of the evidence

Two independent researchers (CG-M and AMH-R) graded the certainty of the evidence on five domains: risk of bias, imprecision, inconsistency, indirectness, and publication bias, using the GRADE approach (Schünemann et al., 2013). RCTs start with high quality of evidence that can be downgraded to moderate, low, or very low (Schünemann et al., 2013). Inter-rater agreement was calculated.

2.9. Data extraction and synthesis

A single reviewer (AMH-R) extracted the following information from RCTs, when possible, using a standardized table: first author, year of

publication, and country; number of participants, mean age, sex, diagnostic criteria for FM, time since diagnosis, and symptoms duration; race/ethnicity and family status; interventions in the mindful exercise and comparison groups; completion rate, as the number of participants who completed the intervention from those initially randomized; outcomes and assessment points; and main findings. Some corresponding authors (Calandre et al., 2009; Jiao et al., 2019; Jones et al., 2012; Liu et al., 2012; Sari et al., 2025; Wang et al., 2010) were contacted via email to request information or clarify details of interest. A reminder was sent between 7 and 10 days after the first message. Only two of them responded (Calandre et al., 2009; Jiao et al., 2019).

Information for both narrative and quantitative analyses was collected using a standard table and an Excel spreadsheet (v.2207). Meta-analyses were performed using the R studio software (v. 4.1.1), with the meta (v.5.1-1), metafor (v.3.0-2), and dmetar (v.0.0.9000) packages. A random-effects model was applied to all meta-analyses to account for heterogeneity among clinical trials. Data were pooled using the inverse variance weighting method, and standard mean differences (SMD) were estimated using Cohen's d method. Effect sizes were interpreted as small (scores ≈ 0.2), medium (≈0.5) or high (≈0.8) (Khan, 2020). All results were visualized through forest plots. Heterogeneity among RCTs was assessed using the I^2 statistic, with $I^2 > 50\%$ denoting high heterogeneity. Subgroups meta-analysis and mixed-model effects meta-regressions were conducted to identify potential sources of heterogeneity and moderators of treatment response. Subgroups meta-analysis were performed only when at least two RCTs included the same predictor, while meta-regressions were conducted with at least three RCTs. Potential predictors were participants' mean age, intervention duration, completion rate, type of mindful exercise, number and duration of sessions, sex distribution, risk of bias, sample size, and measurement tools. Sensitivity analyses were conducted to evaluate the robustness of the pooled estimates and detect potential outliers using influence analysis, leave-one-out method, and exploratory data analysis. When highly influential outlier studies were identified, the primary results were reported both with and without the outlier to assess its impact on the overall effect size and statistical heterogeneity. Sensitivity analyses were performed when at least three RCTs were included in the meta-analysis. Publication bias was assessed with the Egger test ($p < 0.05$) and visualized with funnel plots when a minimum of three RCTs were available.

3. Results

3.1. Study characteristics

A total of four hundred and eighty-two records were retrieved from electronic and manual searches. Twenty-three RCTs (comprising 22 original studies) were finally included (Astin et al., 2003; Bongi et al., 2012; Calandre et al., 2009; Carson et al., 2010, 2012; Haak and Scott, 2008; Hammond and Freeman, 2006; Jiao et al., 2019; Jones et al., 2012; Liu et al., 2012; Lynch et al., 2012; Maddali Bongi et al., 2016; Mannerkorpi and Arndorw, 2004; Manzaneque et al., 2025; Rodríguez-Mansilla et al., 2021; Saeed Ali et al., 2024; Sari et al., 2025; Sarmento et al., 2020; Schmidt et al., 2011; Şevgin et al., 2025; Wang et al., 2010, 2018; Wong et al., 2018) (Fig. 1). **Supplementary Files 2 and 3** list all references excluded after full-text reading (n = 42), along with reasons for exclusion. A total of 1734 participants were involved (1538 females, 88.7%). Two RCTs did not report sex distribution (Bongi et al., 2012; Maddali Bongi et al., 2016), and one study did not specify the diagnostic criteria for FM (Haak and Scott, 2008). Eleven RCTs evaluated the effects of qigong exercises, compared with usual therapy (Jiao et al., 2019), educational support (Astin et al., 2003), waitlist/no intervention (Haak and Scott, 2008; Lynch et al., 2012; Mannerkorpi and Arndorw, 2004; Manzaneque et al., 2025; Rodríguez-Mansilla et al., 2021), "sham" qigong (Liu et al., 2012; Sarmento et al., 2020), or an active form of exercise (Bongi et al., 2012; Rodríguez-Mansilla et al., 2021; Saeed Ali et al., 2024), with interventions duration ranging from 4 to 24 weeks. The impact of yoga, compared with waitlist/no intervention (Carson et al., 2010, 2012; Sari et al., 2025; Schmidt et al., 2011), or active exercises (Schmidt et al., 2011; Şevgin et al., 2025), was assessed in five RCTs involving four different samples, with interventions lasting from 4 to 12 weeks. Additionally, seven RCTs explored the effects of tai chi, compared with no treatment (Wong et al., 2018), education (Jones et al., 2012; Maddali Bongi et al., 2016), or an active intervention, e.g. stretching, relaxation, or aerobic exercises (Calandre et al., 2009; Hammond and Freeman, 2006; Wang et al., 2010, 2018).

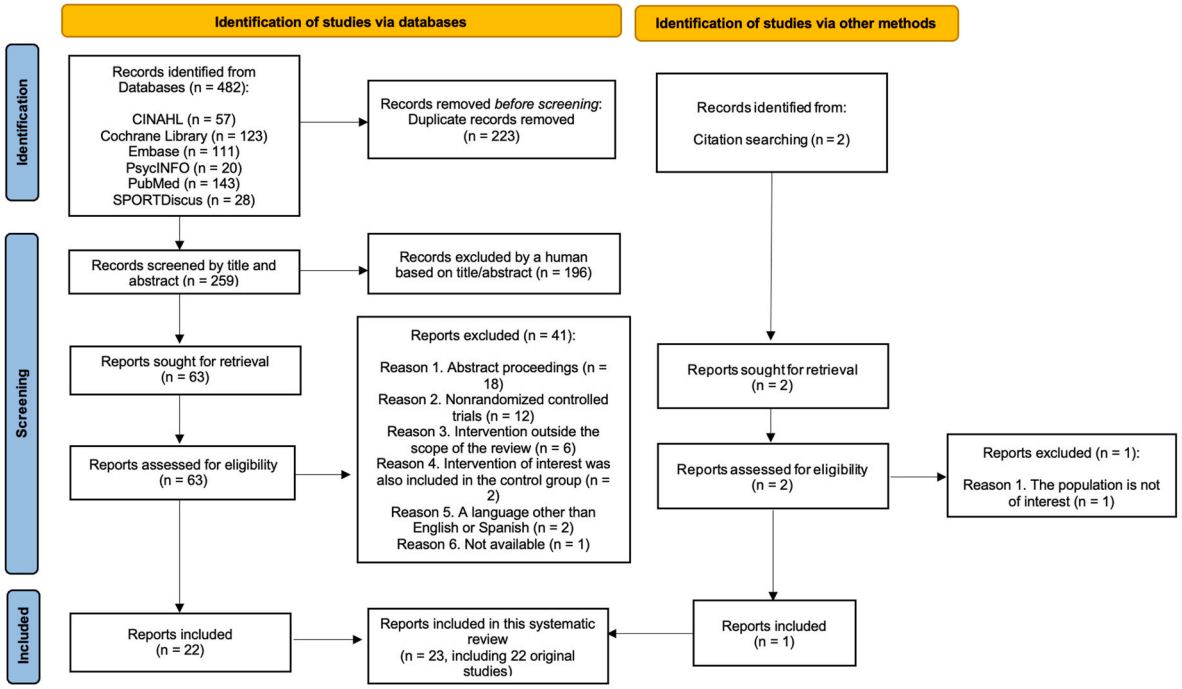

Fig. 1. PRISMA flow diagram.

Supplementary File 4 provides a comprehensive overview of the main characteristics of the included studies.

3.2. Risk of bias

Thirteen RCTs (59.1%) were rated as having an overall high risk of bias (inter-rater reliability, 95%). High risk of bias was identified predominantly in the domain of missing outcome data (D3). The domains related to deviations from intended interventions (D2), outcome measurement (D4), and selective reporting (D5) were mostly rated as presenting some concerns, mainly due to limited reporting of blinding procedures, adherence to interventions, and the absence of publicly available protocols. (Figs. 2 and 3).

3.3. Spin of information

The total spin-abstract score was 55, mean value of 2.39 ± 1.59 points (inter-rater reliability, 92%). Three abstracts showed no form of spin (Jones et al., 2012; Wang et al., 2010, 2018). Most common types of spin were 'omission of primary outcomes' (n = 12, 52%), and 'failure to mention adverse events of interventions' (n = 19, 82%) (**Supplementary File 5**).

3.4. The completeness of intervention descriptions

Regarding the reporting of interventions in the primary studies, Item 16b of the CERT (to what extent the intervention was conducted as planned) was not reported in any study. Items 1 (detailed description of the exercise equipment used), 7a and 7b (detailed description of progression or increase in training variables), 14b (detailed description of how the individualization is carried out), 15 (rationale to determine at what level participants start the intervention) and 16a (how they measured the fidelity with which the teaching of the exercise is transmitted) were absent in more than 70% of the included studies

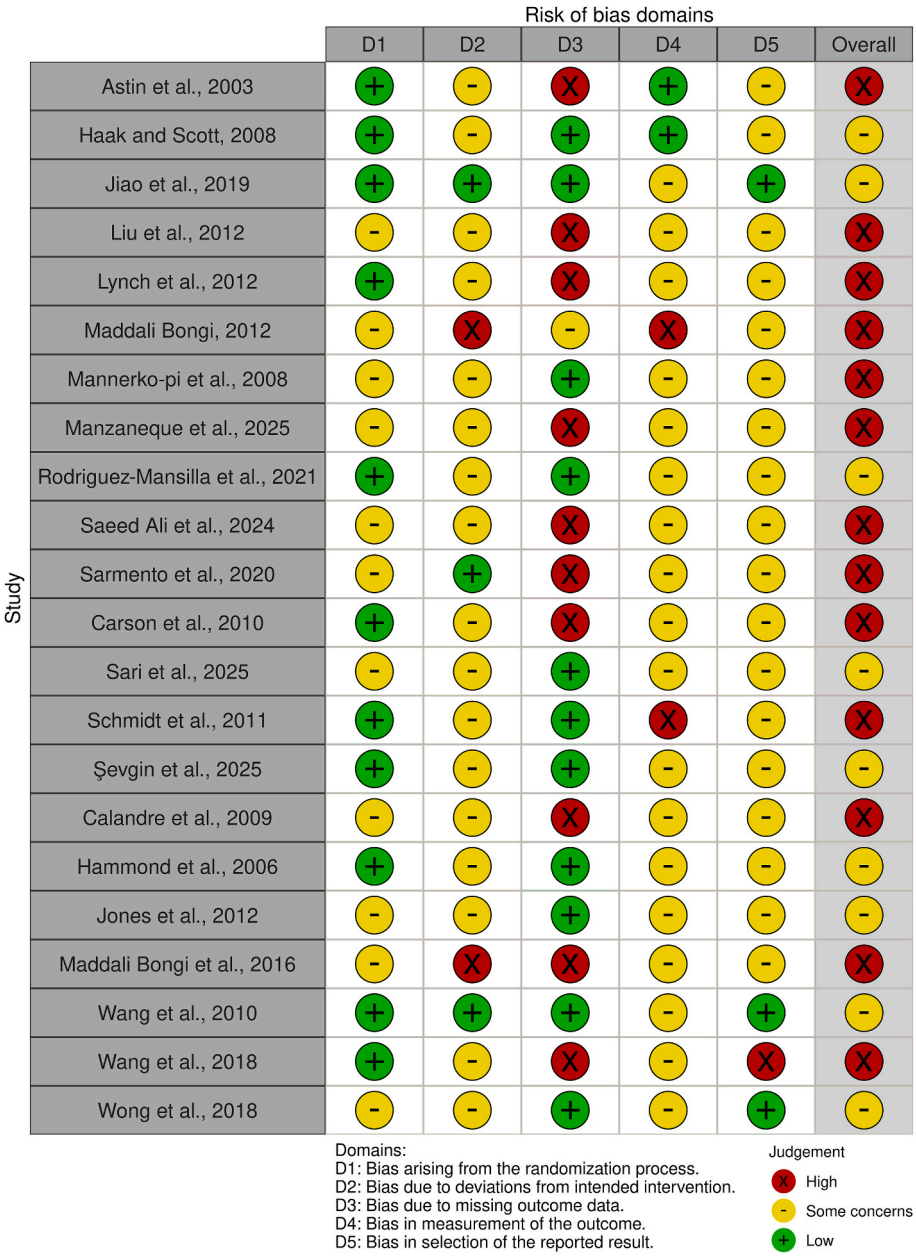

Fig. 2. Risk of bias summary. Green circles indicate a low risk of bias; yellow circles indicate an unclear risk of bias; red circles indicate a high risk of bias. (For interpretation of the references to colour in this figure legend, the reader is referred to the Web version of this article.)

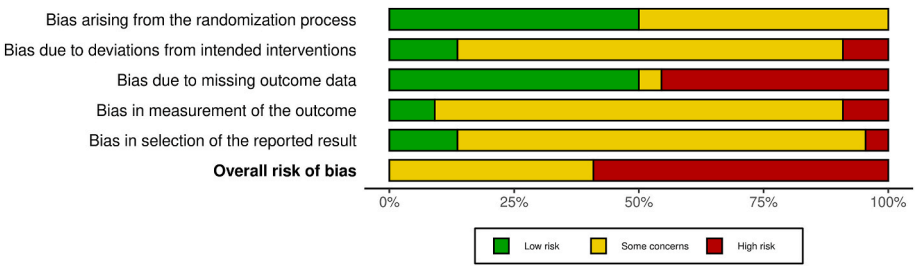

Fig. 3. Risk of bias graph.

(**Supplementary File 6**).

3.5. Data synthesis and certainty in the evidence (GRADE)

Nine meta-analyses, comprising thirteen RCTs, were conducted. Study variables associated with functional mobility or balance could not be meta-analyzed due to the high heterogeneity among measurement tools. Even when studies used the same tool, such as the 6-min walk test (Astin et al., 2003; Wang et al., 2010, 2018), the findings were reported in different ways, e.g., number of steps or distance in meters, which made impossible to pool data consistently. Using the GRADE approach, serious and very serious concerns were identified regarding risk of bias, inconsistency, indirectness, and imprecision of the results (Table 1, inter-rater reliability, 97%). Therefore, the certainty in the evidence was judged as very low for all outcomes (Table 1).

3.6. Fatigue (GRADE: very low)

A meta-analysis comprising five RCTs (Carson et al., 2010; Hammond and Freeman, 2006; Maddali Bongi et al., 2016; Sarmento et al., 2020; Wong et al., 2018) showed no significant effect of mindful exercises, compared to control interventions, to reduce the level of fatigue: total SMD: 2.52, 95% confidence interval (CI): 3.26 to 8.31, P = 0.29, I^2 = 91%. After excluding one outlier (Wong et al., 2018), the results were statistically significant in favor of the mindful exercise groups: total SMD = 0.63, 95% CI: 0.08 to 1.17, P = 0.04, I^2 = 0% (Fig. 4). No publication bias was observed (Egger's test = 0.20) (Fig. 5).

3.7. Anxiety symptoms (GRADE: very low)

A meta-analysis including seven RCTs (Bongi et al., 2012; Carson et al., 2010; Haak and Scott, 2008; Hammond and Freeman, 2006; Maddali Bongi et al., 2016; Sarmento et al., 2020; Schmidt et al., 2011) demonstrated that mindful exercises reduced the severity of anxiety symptoms compared to control interventions (active or not): total SMD = 0.33, 95% CI: 0.20 to 0.46, P < 0.01, I^2 = 0% (**Supplementary File 7**). The Egger's test revealed publication bias (**Supplementary File 8**).

3.8. Depressive symptoms (GRADE: very low)

Eight RCTs (Astin et al., 2003; Bongi et al., 2012; Carson et al., 2010; Haak and Scott, 2008; Hammond and Freeman, 2006; Maddali Bongi et al., 2016; Sarmento et al., 2020; Schmidt et al., 2011) were included in the meta-analysis. The results showed no significant effect of mindful exercises compared to active controls or a waitlist to reduce depressive symptoms: total SMD = −0.40, 95% CI: 1.62 to 0.81, P = 0.47, I^2 = 91%. After excluding one outlier (Schmidt et al., 2011), the findings were statistically significant: total SMD = 0.31, 95% CI: 0.03 to 0.59, P = 0.03, I^2 = 0% (**Supplementary File 9**). No publication bias was detected (Egger's test = 0.31) (**Supplementary File 10**).

3.9. Health status (GRADE: very low)

The meta-analysis included eleven RCTs (Astin et al., 2003; Bongi et al., 2012; Carson et al., 2010; Hammond and Freeman, 2006; Maddali

Table 1
Certainty in the evidence in the included studies: GRADE.

Summary of findings			Certainty in evidence based on the GRADE approach						
Outcome	Studies, n (k)	Participants	Risk of bias	Inconsistency	Indirectness	Imprecision	Publication bias	Level of evidence	Importance
Fatigue	5 (5)	345	Very serious (−2)[a]	Undetected after sensitivity analysis	Very serious (−2)[b]	Serious (−1)[d]	Undetected	Very low	Critical
Anxiety symptoms	7 (8)	572	Very serious (−2)[a]	Undetected	Very serious (−2)[b]	Undetected	Serious (−1)[c]	Very low	Critical
Depressive symptoms	8 (9)	700	Very serious (−2)[a]	Undetected after sensitivity analysis	Very serious (−2)[b]	Undetected	Undetected	Very low	Critical
Health status	11 (14)	914	Very serious (−2)[a]	Undetected	Very serious (−2)[b]	Undetected	Undetected	Very low	Critical
Sleep quality	9 (10)	643	Very serious (−2)[a]	Undetected	Very serious (−2)[b]	Undetected	Undetected	Very low	Critical
Quality of life - physical	3 (3)	131	Very serious (−2)[a]	Undetected	Very serious (−2)[b]	Serious (−1)[d]	Undetected	Very low	Critical
Quality of life - mental	2 (2)	87	Very serious (−2)[a]	Undetected	Very serious (−2)[b]	Serious (−1)[d]	Undetected	Very low	Critical

Note: GRADE = Grading of Recommendations Assessment, Development and Evaluation. N: sample of primary studies in meta-analysis considering the multi-arm; n: number of studies; k: number of arms of studies included in meta-analysis. The results of GRADE were based on the meta-analyses findings.
e)Inconsistency: one level was downgraded if source of heterogeneity (I2 > 50%) could not be detected, or heterogeneity remained high after sensitivity analysis.
[a] Risk of bias: two levels were downgraded if at least 50% of the included studies reported high risk of bias.
[b] Indirectness: one level was downgraded if there were differences in the mindful exercise groups, and two levels were downgraded when there were differences in the intervention and control groups.
[c] Publication bias: one level was downgraded if the Egger's test shows presence of publication of bias.
[d] Imprecision: one level was downgraded if the sample size was less than 400 participants.

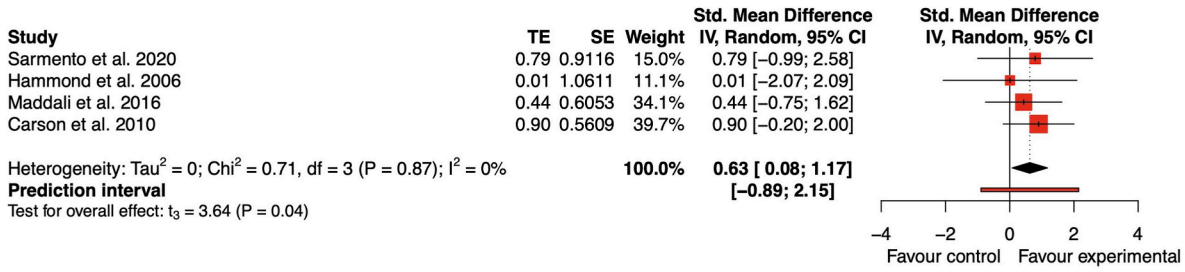

Fig. 4. Forest plot of treatment effect for fatigue after excluding the outlier.

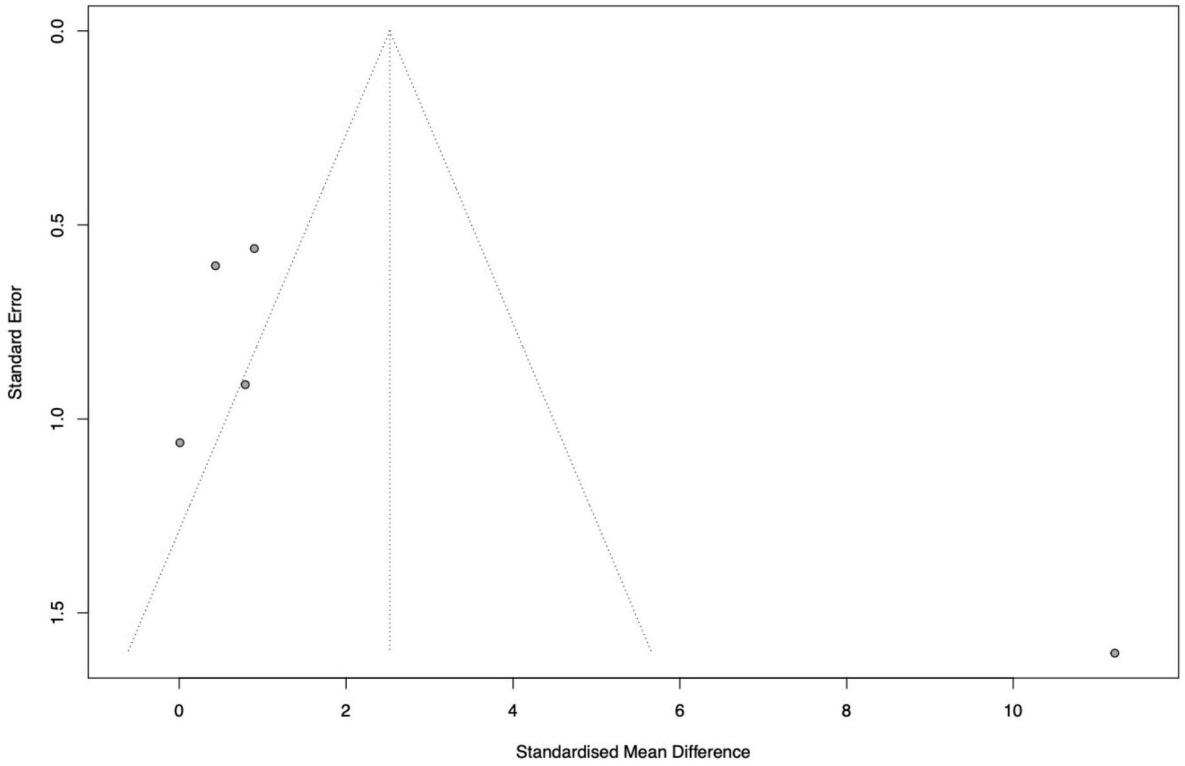

Fig. 5. Funnel plot of the included studies in the fatigue analysis.

Bongi et al., 2016; Mannerkorpi and Arndorw, 2004; Rodríguez-Mansilla et al., 2021; Saeed Ali et al., 2024; Sarmento et al., 2020; Schmidt et al., 2011; Şevgin et al., 2025). After removing the outlier (comparison between the experimental arm and the control group receiving an active resistance exercise program) (Şevgin et al., 2025), the meta-analysis showed mindful exercises were more effective than control interventions (active or inactive) to improve the patients' health status: total SMD = 0.40, 95% CI: 0.06 to 0.74, P = 0.02, I^2 = 14% (**Supplementary File 11**). No publication bias was detected (Egger's test = 0.85) (**Supplementary File 12**).

3.10. Sleep quality (GRADE: very low)

A meta-analysis including nine RCTs (Bongi et al., 2012; Carson et al., 2010; Haak and Scott, 2008; Hammond and Freeman, 2006; Maddali Bongi et al., 2016; Saeed Ali et al., 2024; Sarmento et al., 2020; Schmidt et al., 2011; Wong et al., 2018) found no significant differences in sleep quality between mindful exercises and active controls, waitlist, education or sham interventions: total SMD = 0.21, 95% CI: 0.01 to 0.43, P = 0.06, I^2 = 0% (**Supplementary File 13**). No publication bias was observed (Egger's test = 0.75) (**Supplementary File 14**).

3.11. Overall quality of life (GRADE: very low)

Three studies were included in the meta-analysis (Bongi et al., 2012; Haak and Scott, 2008; Maddali Bongi et al., 2016). There were no significant differences between mindful exercises, compared to active or inactive controls, to improve the overall quality of life, whether physical: total SMD = −0.18, 95% CI: 1.31 to 0.94, P = 0.56, I^2 = 0%; or mental: total SMD = −0.37, 95% CI: 1.25 to 0.50, P = 0.12, I^2 = 0% (**Supplementary Files 15 and 16**). There was no publication bias (Egger's test, physical quality of life = 0.69) (**Supplementary Files 17 and 18**).

3.12. Subgroups meta-analyses and meta-regression analyses

The subgroups meta-analysis explored potential sources of heterogeneity within and between subgroups. Based on the study outcome, we found the following: a) *fatigue*: differences within groups when sorted by control/experimental interventions, risk of bias, and sex, and differences between groups when sorted by measurement tool; b) *anxiety*: differences between groups when sorted by measurement tool; c) *depressive symptoms*: differences within groups when sorted by control/experimental intervention, risk of bias, and sex, and differences between

groups when sorted by sex and measurement tool; d) *health status*: differences between groups when sorted by sex; e) *sleep quality*: differences between groups when sorted by measurement tool (**Supplementary File 19**).

Based on the study measure, the univariate meta-regression analysis identified potential moderators of treatment response: a) *fatigue*: the duration of intervention sessions (in minutes); b) *anxiety*: qigong as the mindful exercise intervention, high risk of bias, and sample size; c) *depressive symptoms*: yoga as the mindful exercise intervention, duration of sessions (in minutes), number of female participants, and sample size; and d) *health status*: age (**Supplementary File 20**).

4. Discussion

This systematic review with meta-analysis aimed to synthesize and comprehend the quality of evidence on the effects of three specific movement-based mindful exercises (qigong, tai chi, and yoga) on fatigue, severity of anxiety and depressive symptoms, health status, sleep quality, and overall quality of life in patients diagnosed with FM. Our findings revealed that mindful exercises were more effective than control interventions (both active and inactive) on all measures, except for sleep quality and overall quality of life. These results are consistent with most reviews in the field (Bravo et al., 2019; Cheng et al., 2019; Du et al., 2023; Kundakci et al., 2022b; Steen et al., 2024; Vasileios et al., 2022; Zhang et al., 2022), though direct comparisons are challenging due to differences in the mind-body interventions assessed, patient-reported outcome measures, and the statistical methods used for meta-analyses. In addition, we conducted subgroup analyses to explore the varying effects of qigong, tai chi, and yoga, and to identify potential moderators of treatment response. Surprisingly, only five of the included RCTs assessed the efficacy of yoga, despite yoga's widespread use in clinical and non-clinical settings (Wieland et al., 2021).

In line with findings from Cheng et al. (2019) and Kundakci et al. (2022b), qigong, tai chi, and yoga exerted positive effects on FM by reducing the level of fatigue. However, the primary meta-analysis for this outcome initially showed substantial heterogeneity (I^2 = 91%), largely driven by the study by Wong et al. (2018), which behaved as a highly influential outlier. Although a random-effects model was applied to account for between-study heterogeneity, this study exerted a disproportionate influence on the pooled estimate. Therefore, a sensitivity analysis excluding this trial was conducted to assess the robustness of the findings. This divergence may be explained by methodological and clinical differences, including the use of a single-item visual analogue scale to assess fatigue and a higher intervention intensity compared with the other trials. Fatigue, along with pain, can trigger symptom flares and limit the ability to exercise in patients with FM (Lucini et al., 2024). Therefore, exercise prescription should begin with low-intensity forms of physical activity and gentle doses tailored to the individual's needs and clinical status, especially for those presenting high disease severity (Lucini et al., 2024). Individualized exercise tailoring is crucial in conditions such as fibromyalgia, characterized by heterogeneous clinical profiles (Macfarlane et al., 2017). However, incorporating this level of personalization into research trials remains challenging, as traditional explanatory designs often prioritize strict standardization of intervention delivery to ensure replicability. Consequently, future studies should move toward more pragmatic designs (Caballol Angelats et al., 2024), while establishing clear algorithms and specific criteria to guide exercise individualization, adaptation, and progression. This approach may facilitate implementation in real-world clinical settings for chronic patients with diverse clinical presentations. Regarding the impact of qigong, tai chi, and yoga on mental health, our results reinforce the current understanding that mindful exercises can effectively reduce the severity of symptoms of anxiety (Zhang et al., 2022), and depression (Cheng et al., 2019; Du et al., 2023; Kundakci et al., 2022b; Zhang et al., 2022) in adults with FM. In fact, positive outcomes have been demonstrated following exercise therapy regardless of the physical activity intervention, whether resistance training (Vilarino et al., 2021), aerobic training (Couto et al., 2022), and combined aerobic and strengthening exercises (Correyero-León et al., 2024). This suggests that selecting a preferred form of exercise may be more important than the specific type of physical activity when seeking the psychological benefits of exercise, as patients are more likely to adhere to the recommended dosage and maintain long-term adherence when they are intrinsically motivated (Andrade et al., 2020). Digital health solutions may represent a promising strategy to support treatment adherence in patients with severe fatigue or reduced mobility, which are common challenges in FM. These tools can enhance accessibility, promote self-management, and ensure continuity of care when they are tailored to the individual needs and preferences (De Thurah et al., 2022). Indeed, the delivery of mindful exercise programs via telerehabilitation has shown clinical outcomes comparable to those of traditional face-to-face treatment modalities (Tahran et al., 2025). Therefore, telehealth options may be considered to optimize adherence and accessibility, provided that the specific patient is an appropriate candidate for remote care. Movement-based mindful exercises also showed better results than control interventions (both active and inactive) to improve the patients' health status by reducing the total score of the Fibromyalgia Impact Questionnaire (FIQ), consistent with conclusions of previous systematic reviews (Bravo et al., 2019; Cheng et al., 2019; Kundakci et al., 2022b; Vasileios et al., 2022; Zhang et al., 2022). However, it has been suggested that these improvements may be only maintained up to 24 weeks after intervention (Cheng et al., 2019), thus future studies should investigate the lasting beneficial effects in the long-term. Our lack of positive findings for overall quality of life and sleep quality contrasts with most previous evidence (Cuenca-Martínez et al., 2023; Estévez-López et al., 2021; Sieczkowska et al., 2020; Zhang et al., 2022), and may be explained by differences in control interventions, measurement tools, and the various forms of exercise therapy assessed across studies.

4.1. Methodological and clinical considerations

A key distinction in the methodological quality and clinical applicability of our results, compared to previous reviews in the field, is the use of the GRADE approach to judge the certainty of evidence. To date, only Zhang et al. (2022) has used the GRADE framework, though their review included a broader spectrum of exercise interventions and incorporated practices like Pilates under the umbrella of mind-body exercises. In addition, we employed the CERT and SPIN tools to assess the quality of intervention reporting, and the accuracy of the information provided in the abstracts of the included studies, making this the first review to incorporate all three tools. More than half of the RCTs (n = 13, 59.1%) were rated as having a high overall risk of bias, which negatively impacted the certainty of the evidence. Common sources of bias included how missing outcomes were handled, the assessment of outcome measures, and the reporting of results. Consequently, the certainty of the evidence was downgraded by one or two levels, leading to very low certainty across all outcomes. Additionally, the small sample sizes in most primary studies contributed to the imprecision in the results. Only 13 out of 23 RCTs were included in the meta-analysis due to missing essential information, such as mean and standard deviation values. Although all corresponding authors were contacted to address this issue, they either did not respond or were unable to provide the required data. Another significant concern was the inadequate reporting of the mindful exercise interventions. Over half of the primary studies failed to meet at least 50% of the items on the CERT checklist. This is critical from a clinical perspective, as inadequate reporting limits the information available to clinicians to replicate these interventions in practice. Accordingly, and in light of the very low certainty of the evidence (GRADE), we advise clinicians to interpret the findings of this systematic review with great caution. Overall, movement-based mindful exercises appear to be more effective than usual care, waitlist, or other

active interventions, including various forms of exercise therapy, to improve symptoms beyond pain in adults with FM. However, despite the subgroup analyses conducted, we were unable to establish clear recommendations regarding the most effective form of exercise or the optimal exercise dosage. Consequently, future randomized controlled trials with higher methodological quality are needed to strengthen the existing evidence base before robust clinical recommendations can be made.

4.2. Study limitations

Only RCTs published in English or Spanish were included. This criterion may have introduced language bias and led to the omission of relevant studies published in other languages. The Cochrane recommendations to involve two independent reviewers to conduct study selection and data extraction were not followed (Li et al., 2024), potentially increasing the risk of methodological bias. Due to the very low quality of the evidence, our results need to be interpreted with care when translated to clinical practice. Challenges in participant recruitment and retention in primary studies may have influenced the quality of the evidence, preventing more robust conclusions. Finally, precise descriptions of the movement-based mindful interventions are essential to ensure replicability and applicability, and this aspect was poorly reported in most studies.

5. Conclusions

Overall, the results of this systematic review with meta-analysis and meta-regressions suggest that movement-based mindful exercises (qigong, yoga, and tai chi) may be associated with greater improvements than control interventions (both active and inactive) in fatigue, anxiety, depression, and health status among individuals with FM, whereas no clear benefit was observed for sleep quality and overall quality of life. However, confidence in these estimates is limited by the very low certainty of the evidence, substantial heterogeneity, and methodological limitations of the included primary studies. Accordingly, these results should be considered preliminary and should not be interpreted as definitive evidence to support routine clinical recommendations. Additional studies with higher sample sizes and good methodological quality are needed to build a strong field of evidence and support further validation.

6. Clinical relevance

- Symptoms associated to fibromyalgia, different to pain, play a major role in determining quality of life.
- Qigong, yoga, and tai chi seem to be better than control interventions to relieve fatigue, anxiety, and depression in FM.
- Qigong, yoga, and tai chi do not seem to improve health status in individuals with FM.
- Findings are weakened by methodological concerns of primary studies, precluding sound clinical recommendations.
- Additional studies with higher sample sizes and good methodological quality are needed to support further validation.

Patient consent

The article is a systematic review with meta-analysis, thus no patient consent was needed to conduct this study.

Employment

- All authors certify that they have no affiliations with or involvement in any organization or entity with any financial interest or non-financial interest in the subject matter or materials discussed in this manuscript.

Financial interests

- The authors have no relevant financial interests to disclose.
- The authors have no competing interests to declare that are relevant to the content of this article.
- The authors have no financial or proprietary interests in any material discussed in this article.

Non-financial interests

- The authors have no relevant non-financial interests (such as professional interests, personal relationships or personal beliefs) to disclose.

Fundings

- The authors did not receive support from any organization for the submitted work.
- No funding was received for conducting this study.
- No funds, grants, or other support was received.

CRediT authorship contribution statement

Hermann Fricke-Comellas: Methodology, Project administration, Supervision, Validation, Writing – original draft, Writing – review & editing. **Alberto Marcos Heredia-Rizo:** Conceptualization, Project administration, Supervision, Validation, Visualization, Writing – original draft, Writing – review & editing. **Javier Matías-Soto:** Data curation, Methodology, Resources, Writing – review & editing. **Patricia Martínez-Miranda:** Data curation, Methodology, Resources, Writing – review & editing. **Cristina García-Muñoz:** Data curation, Formal analysis, Methodology, Software, Writing – review & editing.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Acknowledgments

Special acknowledgment is extended to the VII Research and Knowledge Transfer Program of the Universidad de Sevilla (VII Plan Propio de Investigación de la Universidad de Sevilla, PPIT-US) for supporting Hermann Fricke-Comellas predoctoral contract. This support has been instrumental in advancing this research, although the program did not provide direct funding for the study itself.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.jbmt.2026.03.019.

List of abbreviations used

FM	Fibromyalgia Syndrome
GRADE	Grading of Recommendations, Assessment, Development, and Evaluations
PRISMA	Preferred Reporting Items for Systematic Reviews and Meta-Analyses
PICOs	Population, Intervention, Comparator, Outcomes, Study design
RCTs	Randomized Controlled Trials
RoB-2	Cochrane Risk of Bias tool version 2
CERT	Consensus on Exercise Reporting Template
SMD	Standard Mean Differences

CI Confidence Interval
FIQ Fibromyalgia Impact Questionnaire

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