Mind-body therapy for treating fibromyalgia: a systematic review

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Abstract

Objective: Fibromyalgia is a chronic and disabling condition that presents management challenges for both patients and healthcare providers. The objective of this systematic review was to summarize current evidence on the effectiveness and safety of mind-body therapies in the treatment and/or management of fibromyalgia.

Methods: We searched MEDLINE, EMBASE, PsycINFO, AMED, and CINAHL databases from their inception to December 2023. Eligible articles included adults diagnosed with fibromyalgia participating in a mind-body therapy intervention and were published from the beginning of 2012 onwards. We assessed the quality of the studies using the Joanna Briggs Institute Critical Appraisal Checklists.

Results: Of 3866 records screened, 27 studies (30 articles) met our inclusion criteria, in which 22 were randomized controlled trials and 5 were quasi-experimental studies. Mind-body therapies included guided imagery (n = 5), mindfulness-based stress reduction (n = 5), qi gong (n = 5), tai chi (n = 5), biofeedback (n = 3), yoga (n = 2), mindfulness awareness training (n = 1), and progressive muscle relaxation (n = 1). With the exception of mindfulness-based stress reduction, all therapies had at least one study showing significant improvements in pain at the end of treatment. Multiple studies on guided imagery, qi gong, and tai chi observed significant improvements in pain, fatigue, multidimensional function, and sleep. Approximately one-third of the studies reported on adverse events.

Conclusions: This review suggests that mind-body therapies are potentially beneficial for adults with fibromyalgia. Further research is necessary to determine if the positive effects observed post-intervention are sustained.
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Keywords: systematic review; fibromyalgia; mind-body therapy; mind-body interventions; meditation; chronic pain.
Introduction

Fibromyalgia (FM) is a complex, chronic condition, characterized by widespread pain, functional impairment, fatigue, and sleep disturbances.\(^1\) The condition’s estimated prevalence ranges from 0.2% to 6.6% in the general population,\(^2\) with a notable female predominance and higher percentages observed in specific risk groups.\(^3\) According to the American College of Rheumatology, FM is defined as the presence of generalized pain in at least 4 of 5 regions, lasting for a minimum of 3 months, and accompanied by widespread pain and sufficient symptom severity.\(^4\) Conventional treatments include the use of medications such as gabapentin and pregabalin,\(^5,6\) which are frequently used in epilepsy treatment; however, adverse events (AEs) are common and disability often persists.\(^7,8\) Recent studies have suggested that the treatment of FM should involve a comprehensive approach that integrates both pharmacological and non-pharmacological therapies.\(^9\)

Mind-body therapies have been broadly defined as a group of therapies that target “interactions among the brain, mind, body, and behavior, with the intent to use the mind to affect physical functioning and promote health.”\(^10\) Examples of Mind-body therapies include mindfulness (aims to cultivate a conscious and present-centered awareness as well as a non-judgmental perspective towards the world such as mindfulness-based stress reduction (MBSR) and meditation awareness training (MAT));\(^11\) biofeedback (use of technology to provide auditory or visual feedback on physiological processes, such as breathing, heart rate or brain waves, assisting individuals with heightened control over their bodily functions);\(^12\) movement therapies (practices that primarily operate by influencing the harmony and circulation of the body’s subtle energy system, as well as the biomechanical aspects of flexibility, coordination, balance, and strength, such as yoga, tai chi, and qi gong);\(^13,14\) relaxation therapy (techniques that are aimed at inducing the body’s...
relaxation response such as autogenic training, guided imagery, and progressive muscle relaxation (PMR).\textsuperscript{15}

While several reviews examining the effects of mind-body therapy for the treatment of FM have been published,\textsuperscript{16-18} these reviews have certain limitations. Firstly, two of the reviews did not formally assess the methodological quality of their included studies,\textsuperscript{16,17} a critical aspect for contextualizing findings and generating recommendations.\textsuperscript{19,20} The third review\textsuperscript{18} is outdated due to the rapid expansion of research in this field in recent years, with numerous new trials and primary studies being published. Consequently, the body of evidence has evolved substantially, necessitating a fresh examination to incorporate the latest findings and ensure that recommendations and insights remain current and relevant to the ever-advancing landscape of FM treatment/management through the use mind-body therapies.

Our systematic review aimed to (1) summarize existing evidence on the efficacy and safety of mind-body therapy for adults with FM and (2) to identify gaps in the published evidence to guide potential avenues for future intervention work. Our work improved upon the limitations of previous reviews by addressing a comprehensive list of patient important outcomes, including pain, fatigue, patient-rated global, multidimensional function, sleep disturbance, depression, anxiety, and AEs. Additionally, our review used an approved method to appraise the methodological quality of eligible studies, culminating in a more current and comprehensive overview of the field.\textsuperscript{21}

**Methods**

The present systematic review was conducted using the Joanna Briggs Institute (JBI) systematic review process.\textsuperscript{21-23} We followed the Preferred Reporting Items for Systematic Reviews and
Meta-Analyses (PRISMA 2020) guidelines and pre-registered our review on the Open Science Framework (registration DOI: 10.17605/osf.io/6w7ac) prior to conducting the search. We initially planned to conduct a scoping review on the use of mind-body therapy for the treatment of FM. However, after performing literature searches and assessing the objectives and intentions of our review, we decided a systematic review was more appropriate for two main reasons. First, our review aims to inform clinical decision-making by determining the effectiveness and safety of mind-body therapy for FM, making a systematic review more suitable. Second, the topic of mind-body therapy for FM is well-established, with a considerable number of primary studies already available. Thus, an update on the evidence from these primary studies is necessary, and a systematic review provides a more appropriate methodological framework to achieve this purpose.

Eligibility criteria

Participants

The target population was adults (≥18 years of age) with a clinical diagnosis of FM (as defined by any recognized diagnostic criteria).4,26-28

Intervention

We included interventions that incorporated at least one type of mind-body therapy. Following the criteria established by the NCCIH,15 we decided a priori to include the following types of mind-body therapy: autogenic training, biofeedback, MBSR, MAT, guided imagery, PMR, tai chi, qi gong, and yoga. We excluded interventions delivered manually by a therapist to a participant (such as massage, acupuncture, physiotherapy) as participants are not actively engaged in the treatment, a key criterion of mind-body interventions according to the NCCIH.
Studies on psychological therapies were excluded to prevent overlap with several systematic reviews focusing on specific forms of psychological therapy for the treatment of FM (e.g., group psychotherapy, cognitive-behavioral therapy). We also excluded interventions incorporating spiritual prayer, as well as art or dance therapy. Furthermore, we excluded patient educational programs, such as FM self-management programs, as they are generally accepted within the biomedical system of care.

Outcomes of interest

To inform our choice of outcomes, we consulted the Initiative on Outcome Measures in Rheumatology Clinical Trials (OMERACT) core outcome set. Subsequently, we assessed the frequency of reporting across eligible trials to determine the most patient-important outcomes based on Grading of Recommendations Assessment, Development and Evaluation (GRADE) guidance. Outcomes of interest included (1) pain, (2) fatigue, (3) patient global impression of change (PGIC), (4) multidimensional function, (5) sleep disturbance, (6) depression, (7) anxiety, and (8) AEs. As we anticipated that eligible studies would also report on other important health-related outcomes (e.g., self-efficacy, perceived stress, tender points/tenderness, laboratory findings, and physical function), we presented data on other health-related outcomes in a supplemental table.

Types of studies

We included primary studies published in the past 12 years (i.e., 2012 through December 2023) to prevent overlap with a systematic review on CBT and mind-body therapies for FM, which included studies published up to October 2013. Studies were limited to those published in peer-reviewed journals and available in the English language. We excluded editorials, commentaries, case reports, case series, abstracts, letters, and protocols.
Search strategy and information sources

As per the JBI three-step search strategy, an initial search was conducted across MEDLINE and EMBASE to identify keywords and index terms from titles and abstracts. An experienced medical researcher (JYN) specializing in knowledge synthesis was consulted during this process to ensure that a comprehensive list was obtained. All identified keywords and indexing terms were then used to tailor the search for each academic database, including MEDLINE, EMBASE, PsycINFO, AMED, and CINAHL. Reference lists of existing scoping and systematic reviews pertaining to the research topic were also searched to identify any additional relevant studies. The literature was searched from inception until December 29, 2023. Our full search strategy is available at https://osf.io/quxtc.

Study selection

Three reviewers (JPS, VK, AZ) screened titles and abstracts for initial eligibility and reviewed the full text of potentially eligible studies, independently and in duplicate. Reviewers resolved disagreements by discussion and third-party adjudication if needed.

Data extraction and quality assessment

Using standardized, piloted forms, three reviewers (JPS, VK, AZ) conducted calibration exercises and independently extracted information on study design, objective(s), FM definition, participant characteristics, interventions, comparators (if present), and outcomes of interest and resolved disagreements by discussion or, if necessary, third-party adjudication. The primary assessment for outcomes occurred post-intervention, directly following the end of treatment. This time point was chosen to maximize the likelihood of detecting any treatment effects, as they were expected to be most pronounced immediately after the mind-body therapy intervention.
Additionally, outcomes were assessed at follow-up (after the end of the treatment period) if such data were available.

Three reviewers (JPS, VK, AZ), independently and in duplicate, assessed the methodological quality of eligible studies using the JBI Critical Appraisal Checklist for RCTs and quasi-experimental studies. The Critical Appraisal Checklists consists of 13 domains for RCTs and 9 domains for quasi-experimental studies. Each domain was rated as yes, no, unclear or not applicable. We resolved any disagreements by discussion or, if necessary, third-party adjudication. The results of the quality assessment were reported in narrative form and a table.

Data synthesis and analysis

The main findings were summarized and presented using tables and a qualitative analysis of descriptive data. For the qualitative analysis, three reviewers (JPS, VK, AZ) identified codes for the descriptive data based on the main topics discussed in the articles and organized the articles into thematic groups. Subsequently, the three reviewers created a narrative discussing how the findings connected to the research question and identified knowledge gaps in the existing literature.

Results

Search results

Searches retrieved 3866 items following deduplication, of which 3745 titles and abstracts were eliminated, leaving 121 full-text articles to be considered. Of those, 91 were considered ineligible for various reasons. This left 27 studies (31 publications) for inclusion in this systematic review. In Figure 1, a PRISMA diagram can be found depicting this process.
Eligible article characteristics

Twenty-seven studies that met the inclusion criteria were published between 2012 to 2022 and were conducted across 10 countries. These countries included Spain (n=9), United States (n=7), Canada (n=2), Germany (n=2), South Korea (n=2), England (n=1), Israel (n=1), Italy (n=1), Taiwan (n=1), and the Netherlands (n=1). Of the 27 studies included in this review, 5 were quasi-experimental trials and the remaining 22 were RCTs. The types of comparison groups included in the RCTs were attention control intervention (sham/peer group support) (n=10), usual care (n=7), or wait-list condition (n=5). Several types of mind-body therapies were encompassed among the eligible studies, including 5 that used guided imagery, 5 that used MBSR, 5 that used qigong, 5 that used tai chi, 3 that used biofeedback, 2 that used yoga, 1 that used MAT, and 1 that used PMR.

The studies included in this review had a treatment length that ranged from 2 to 48 weeks, with an average duration of 12 weeks. Over half (n=7) of the studies included only female participants. Participants in the eligible studies were recruited from a diverse range of settings, including primary care clinics (n=7), FM self-help and/or support groups (n=5), hospital electronic medical record (n=3), and a tertiary care center (n=1). Additionally, 4 studies recruited participants from both primary care clinics and FM self-help and/or support groups. In the 7 remaining studies, the recruitment setting was unclear. Table 1 presents general characteristics of the eligible studies, including the first author, year of publication, study design, country, recruitment setting, sample size, age, and definition of FM.

Quality assessment
Tables 2 and 3 present summaries of the methodological quality assessment of the 22 RCTs and 5 quasi-experimental studies, respectively, according to the JBI Critical Appraisal Checklist.

Among the RCTs, the average number of “yes” answers was 7.9 out of the 13 questions. Eighteen of the 22 RCTs used true randomization, while in the remaining four trials, the process of randomization was not clearly described. Concealment of group allocation occurred in approximately one-third of the RCTs and was unclear in the remaining two-thirds. In many of the included trials, blinding did not occur due to practical difficulties. Among the quasi-experimental studies, the average number of “yes” answers was 6.8 out of 9 questions.

Analysis of findings

Within the subsequent paragraphs, we provide a narrative depiction of outcomes pertaining to pain, fatigue, PGIC, multidimensional function, sleep disturbance, depression, anxiety, and adverse events across the Mind-body therapies. A detailed summary of our findings related to these patient-important outcomes is presented in Table 4. Additionally, Table 5 offers a comprehensive summary of all other health-related outcomes reported in the included studies.

Pain

Mind-body therapies versus no control

All 5 studies (n=137) investigating mind-body therapy without control groups reported significant improvement in pain post-intervention. Four of these 5 trials consisted of movement therapy, including yoga, tai chi and qi gong, while the remaining was neurofeedback. One of the 5 trials included a follow-up assessment in which significant improvement in pain levels was sustained after the 12-week detraining period on the 36-item Short-Form Health Survey (SF-36) but not on the Visual Analog Scale (VAS) following the 12-week detraining
period. One trial on tai chi revealed a significant improvement in pain from the 16th week, but not during the first 12 weeks. The most employed measurement tool was the VAS, used by 3 out of the 5 trials, while 1 trial reported their findings using the Brief Pain Inventory (BPI).

**Mind-body therapies versus no specific treatment**

Among 9 trials comparing mind-body therapy to no specific therapy, 5 trials (n=287) demonstrated significant improvement in pain post-intervention. Three used movement therapy, including qi gong and tai chi, and two used guided imagery. A retrospective analysis drew from qualitative comments of participants from an original trial on qi gong. Overall, participants reported pain relief within the first 8 weeks and some continued to experience reduced pain levels after 4-6 months of qi-gong practice. The 4 remaining trials yielded insignificant reductions in pain post-intervention. The most commonly used measurement scale was the VAS, employed by 4 out of the 9 trials. This was followed by the SF-36 Pain subscale and the BPI, each used by 2 trials.

**Mind-body therapies versus attention control interventions**

Out of the 10 trials investigating mind-body therapy compared to an attention control group, 9 trials (n=471) on movement therapy, including tai chi and qi gong, neurofeedback, MAT, guided imagery, and PMR demonstrated significant improvement in pain post-intervention. One did not. One of these 9 trials reported that a significant pain reduction was sustained at the 6-month follow-up. The most employed measurement scales used were the VAS and MPQ, which were used by 6 trials.

**Fatigue**
Mind-body therapies versus no control

Out of 3 studies\textsuperscript{51,61,63} investigating mind-body therapy without control groups, 1 study (n=23) on tai chi\textsuperscript{61} demonstrated significant improvements in fatigue directly post-intervention. However, this study conducted a follow-up assessment 12 weeks after the completion of the 28-week intervention and found that improvements were not sustained.\textsuperscript{61} A variety of measurement tools were used to assess fatigue including daily dairies and the FIQ Fatigue subscale.

Mind-body therapies versus no specific treatment

Among the 8 trials\textsuperscript{45-47,50,56,60,64,70} comparing mind-body therapy to no specific therapy, 3 trials (n=185) on guided imagery, tai chi and MBSR demonstrated significant improvements in fatigue post-intervention.\textsuperscript{47,56,70} Among the 5 remaining trials, 3 reported insignificant reductions in fatigue,\textsuperscript{45,46,60} one\textsuperscript{50} reported only within group differences, and one\textsuperscript{64} relied solely on qualitative narrative comments to assess fatigue symptoms. Various measurement scales were used, including the VAS and FIQ fatigue subscales, Fatigue Symptom Inventory (FSI), and SF-36 Energy/Fatigue subscale.

Mind-body therapies versus attention control interventions

Of 7 trials\textsuperscript{49,52,54,58,62,67,72} that compared mind-body therapies to an attention control group, 6 trials (n=268) on movement therapy, including tai chi and qi gong,\textsuperscript{49,52,54,62} guided imagery,\textsuperscript{58} and PMR\textsuperscript{72} showed significant improvement in fatigue post-intervention. The remaining study found no significant differences in fatigue scores following neurofeedback training.\textsuperscript{67} The most commonly used measurement scales were the FIQ fatigue and SF-36 Vitality subscales.

Patient global impression of change
Mind-body therapies versus no control

One trial without a control group assessed patient global impression of change over a 24-week yoga intervention, revealing no significant improvement.

Mind-body therapies versus no specific treatment

Among 3 trials comparing mind-body therapy to no specific therapy, only 1 trial (n=113) on MBSR observed significant improvements in PGIC. In this trial, a significant advantage was observed for MBSR both post-intervention and at 12 months follow-up. In contrast, two trials on yoga and electromyogram (EMG) biofeedback observed no significant improvement in PGIC scores at the end of intervention.

Multidimensional function

Mind-body therapies versus no control

Out of the 4 studies investigating mind-body therapy without control groups, 3 trials (n=73) on neurofeedback, tai chi, and qi gong showed significant improvements in multidimensional function post-intervention. However, the study on tai chi observed that improvements were not sustained at a 12-week follow-up assessment after completion of the intervention. All the studies used total FIQ or FIQR scores to assess multidimensional function.

Mind-body therapies versus no specific treatment

Among the 8 trials comparing mind-body therapy to no specific therapy, 4 trials (n=339) on MBSR and qi gong demonstrated significant improvements in multidimensional function post-intervention. One trial reported improvements were sustained at
48 weeks follow-up in response to the continuance of the MBSR intervention.\textsuperscript{59} The remaining four trials showed no significant improvements in multidimensional function post-intervention.\textsuperscript{45,46,48,55,66} Outcome measures that were used to assess multidimensional function included the FIQR, Spanish version of FIQ (S-FIQ), and the Quality of Life Profile for the Chronically Ill (PLC).

**Mind-body therapies versus attention control interventions**

Among the 9 trials\textsuperscript{49,52,54,58,62,67,68,69,71} comparing mind-body therapy to attention control interventions, 6 trials (n=362) on movement therapy, including tai chi and qi gong,\textsuperscript{49,52,54,62} MAT,\textsuperscript{68} and neurofeedback\textsuperscript{71} observed significant improvements in multidimensional function post-intervention. The trial on MAT reported that significant improvements were evident up to 6 months post-intervention.\textsuperscript{68} The most common measurement scales used were the FIQ and a variation of the FIQR.

**Sleep disturbance**

**Mind-body therapies versus no control**

Two studies\textsuperscript{51,63} (n=49) conducted without control groups explored movement therapies, including yoga and qi gong, and demonstrated significant post-intervention improvements in sleep quality and disturbances. Both measured this outcome using the Pittsburgh Sleep Quality Index (PSQI).

**Mind-body therapies versus no specific treatment**

Out of 5 trials\textsuperscript{46,47,50,53,70} comparing mind-body therapy to no specific therapy, 3 trials (n=222) on qi gong,\textsuperscript{53} guided imagery,\textsuperscript{50} and MBSR\textsuperscript{47} demonstrated significant improvements in sleep
disturbance post-intervention. However, the trial on MBSR observed that improvements were no longer significant when excluding participants that were lost to follow-up. A retrospective analysis was performed on the qualitative data from the original RCT on qi gong and noted that very few participants expressed improvement in sleep. Various measurement scales were used including the PSQI, FIQR poor sleep subscale, Stanford Sleep Questionnaire (SSQ), and BPI sleep subscale.

**Mind-body therapies versus attention control interventions**

Among the 7 eligible trials comparing mind-body therapies to attention control interventions, 6 trials (n=403) on movement therapy, including tai chi and qi gong, guided imagery, MAT, and neurofeedback demonstrated significant improvements in sleep disturbance post-intervention. One did not. The trial on MAT reported that significant improvements were evident up to 24 weeks post-intervention. The most commonly used measurement scale was the PSQI.

**Depression**

**Mind-body therapies versus no control**

Two studies (n=60) conducted without control groups investigated the effects of tai chi and neurofeedback on depression and observed significant improvements post-intervention. In one study, it was noted that the positive effects on depression scores did not persist following a 12-week period without tai chi practice, indicating a decline in benefits during detraining.

Assessment tools used included the VAS and HADS depression scales, and the General Health Questionnaire (GHQ-28).

**Mind-body therapies versus no specific therapy**
Among 6 trials\(^{43,45,46,55,56,59}\) comparing mind-body therapy to no specific therapy, 3 trials (n=243) on guided imagery\(^{56}\) and MBSR\(^{43,59}\) showed significant improvements in depression post-intervention. The trial on guided imagery\(^{56}\) only demonstrated a significant reduction when the intervention duration was at least 10 weeks. One trial on MBSR\(^{59}\) only reported combined depression and anxiety scores using the HADS-Total score yet noted significantly greater improvements in depression specifically among individuals practicing MBSR for two or more days per week. The remaining 3 trials\(^{45,46,55}\) noted insignificant changes in depression post-intervention. The most common measurement tool was the HADS-Depression score, used by 3 trials.\(^{43,55,59}\)

**Mind-body therapies versus attention control interventions**

Out of 4 trials\(^{49,54,57,62}\) investigating mind-body therapy compared to an attention control group, 3 trials (n=173) on movement therapy, including tai chi and qi gong,\(^{49,62}\) and guided imagery\(^{57}\) reported significant improvements in depression post-intervention. One did not.\(^{54}\) The trial on guided imagery\(^{57}\) observed significant improvements using the Beck Depression Inventory (BDI), but not using the VAS (depression). The most employed measurement scale was the HADS-Depression score, used by 2 trials.\(^{54,62}\)

**Anxiety**

**Mind-body therapies versus no control**

Out of the 3 studies\(^{44,51,61}\) investigating mind-body therapy without control groups, 2 trials (n=60) on tai chi\(^{61}\) and neurofeedback\(^{44}\) demonstrated significant improvements in anxiety post-intervention. One did not.\(^{51}\) The study on tai chi\(^{61}\) reported that this positive effect was not
sustained following a 12-week period after the intervention, indicating a decline in benefits during detraining.

**Mind-body therapies versus no specific treatment**

Among 3 trials\(^43,46,55\) comparing mind-body therapy to no specific treatment, none reported a significant improvement in anxiety post-intervention. These trials involved MBSR\(^43,55\) and yoga.\(^46\) The measurement scales used included the HADS-Anxiety score and the FIQR Anxiety subscale.

**Mind-body therapies versus attention control interventions**

Out of the 5 trials\(^49,54,58,62,67\) investigating mind-body therapy compared to an attention control group, 4 trials (n=217) on movement therapy, including tai chi and qi gong,\(^49,54,62\) and guided imagery\(^58\) demonstrated significant improvements in anxiety post-intervention. One did not. The trial on guided imagery\(^58\) observed significant improvements in trait anxiety, but not in state anxiety. The most employed measurement scales were the State-Trait Anxiety Inventory (STAI) and HADS-Anxiety score, used by 4 of the trials.\(^54,58,62,67\)

**Adverse events**

**Mind-body therapies versus no control**

Out of the 3 trials\(^61,63,65\) investigating mind-body therapy without control groups that reported AEs (whether any occurred or not), one trial (n=10) on qi gong\(^63\) observed adverse effects. This included pain, headache, cooler body, discolored hands and feet, increased stress, and occasional cough.\(^63\) The remaining 2 trials on tai chi\(^61,65\) observed no AEs during the interventions, with 1
trial also noting no occurrence of AEs during the detraining period. The remaining 2 trials did not report any data on occurrence or absence of AEs.

**Mind-body therapies versus no specific treatment**

One trial on tai chi reported that no AEs occurred. Another trial on qi gong reported two potentially intervention-related AEs, including plantar fasciitis (n=1) and shoulder pain (n=1), which resolved gradually. One trial on MBSR reported that 3 participants reported having experienced adverse effects during and/or after the intervention, with considerable frequency. Adverse symptoms included mild fatigue, intense palpitations, tension, dizziness, headaches, loss of sexual desire, weight gain and somnolence. Five participants also reported experiencing adverse effects after MBSR but at a very low frequency and intensity. The remaining 9 trials did not report any data on occurrence or absence of AEs.

**Mind-body therapies versus attention control interventions**

All 4 trials that reported data on AEs observed no occurrences of AEs. The mind-body interventions for these trials included tai chi and qi gong. The remaining 6 trials did not report any data on occurrence or absence of AEs.

**Discussion**

The objective of the present systematic review was to synthesize the existing evidence on the efficacy and safety of mind-body therapy for FM and provide recommendations for future research directions. Our findings highlight the varied efficacy of mind-body therapies across different patient-important outcomes and the lack of emphasis on safety assessments within these trials. Although this review focused on adults with FM, the findings may have relevance to other clinical conditions that share common neurophysiological mechanisms involving various organ
systems. Similar to FM, tension-type headache, chronic whiplash associated disorder, and irritable bowel syndrome share a predominant pain mechanism known as nociplastic pain.\textsuperscript{73,74} This distinctive source of pain arises from the altered function of pain-related sensory pathways in the periphery and central nervous system, causing increased sensitivity.\textsuperscript{75}

Comparison with previous work

Pain

Among the eligible studies, pain emerged as the predominant outcome, being reported in 23 out of 27 studies. This could be attributed to the observation that both FM experts and individuals with FM consider pain to be the foremost symptom domain requiring assessment in clinical trials.\textsuperscript{39,76} All mind-body therapies, excluding MBSR, exhibited significant pain relief in some or all studies by the conclusion of the treatment. Particularly noteworthy were movement therapies, including qi gong and tai chi, in which all 5 studies on each therapy documented significant improvements compared to control groups. This underscores the effectiveness of movement therapies and suggests that qi gong and tai chi may have a superior impact on pain management for individuals with FM, as evidenced by their larger relative effect size. Existing reviews on movement therapies have demonstrated conflicting findings. One systematic review and meta-analysis on the efficacy of movement therapies in FM published in 2012 reported no significant reduction in pain compared to controls at the end of treatment.\textsuperscript{77} On the contrary, a more recent systematic review and meta-analysis published in 2015 observed an advantage for movement therapy over both usual care and attention control in reducing pain post-intervention.\textsuperscript{18} There is a need for high-quality studies with larger sample sizes to confirm findings.

Among relaxation therapies, we only identified one trial on PMR and none on autogenic training compared to 5 on guided imagery. A previous systematic review on relaxation therapy for FM...
observed similar findings. Moreover, within the current review, biofeedback demonstrated a significant reduction in pain compared to control groups in the majority of eligible studies (2 out of 3), aligning with findings from a 2013 systematic review and meta-analysis.

**Fatigue & sleep disturbance**

Fatigue was reported in over half of our eligible studies (16 out of 27). Of the mind-body therapies, tai chi (4 out of 4) and guided imagery (3 out of 3) displayed the most evidence for a reduction in fatigue at the end of treatment, followed by qi gong (3 out of 4) and yoga (1 out of 2). For sleep disturbance, guided imagery (3 out of 3) and qi gong (3 out of 4) showed the most evidence, followed by tai chi (2 out of 3), yoga (1 out of 2), and PMR (1 out of 1). Consistent with our findings, a recent meta-analysis revealed that tai chi exerts significant positive effects on relieving fatigue and improving sleep quality among people with FM, as compared to usual care. A possible explanation for the efficacy of tai chi in improving these patient outcomes may involve its incorporation of slow and controlled movements, which promote muscle relaxation and enhance overall muscle function.

**Multidimensional function**

Multidimensional function-related outcome measures were included in 21 out of the 27 studies. Qi gong exhibited the most consistent evidence for a positive effect on multidimensional function, with all 5 eligible trials demonstrating a significant improvement compared to control at the end of treatment. This is in line with a 2013 meta-analysis, which concluded that there was low-quality evidence supporting short-term improvements in multidimensional function for qi gong compared to usual care across 4 trials. Furthermore, all three studies included in the present review demonstrated that tai chi led to a significant improvement in multidimensional function compared to the control groups. This finding aligns with a recent meta-analysis that
identified a significant difference in multidimensional function between tai chi and control groups. On the contrary, the present review revealed mixed evidence for biofeedback, with fewer than half of the studies (1 out of 3) observing a significant improvement at the end of treatment. This observation aligns with a previous meta-analysis.

**Patient global impression of change**

PGIC was the least commonly reported outcome, addressed in only 4 out of 27 studies. Among these, only one trial on MBSR demonstrated a significant improvement compared to controls at the end of the intervention. Similarly, a systematic review and meta-analysis including 22 RCTs on movement and body awareness therapies for FM identified only one trial that assessed PGIC. This scarcity of data on PGIC underscores the need for more comprehensive assessments to understand the broader impact of mind-body therapies from the patient's perspective.

**Anxiety & depression**

Anxiety and depression were documented in fewer than half of the eligible studies, with 10 out of 27 studies reporting anxiety and 12 out of 27 studies reporting depression. Tai chi demonstrated the most evidence for a positive effect on anxiety and depression, with all 3 studies demonstrating a significant improvement post-treatment. This aligns with a prior systematic review and meta-analysis which demonstrated beneficial effects on anxiety and depression across various populations. Other mind-body therapies, including guided imagery, qi gong, and biofeedback, showed promise in improving anxiety and depressive symptoms in FM, the lack of studies reporting on these outcomes necessitates caution in drawing definitive conclusions. The two studies on yoga showed no significant changes to anxiety or depression at the end of treatment. However, a recent meta-analysis on yoga for people with rheumatic diseases observed...
a large effect of yoga on depressive symptoms and a moderate effect on anxiety compared with control groups. Further research is needed to explore mind-body therapies and their effect on mental health outcomes in FM due to the limited number of conducted studies and methodological issues in the existing research.

Safety assessments and reporting

Limited trials addressed the safety of mind-body therapies by monitoring the frequency and types of AEs throughout the treatment period. Only 10 out of 27 trials reported that they recorded AEs during the intervention, with three reporting that at least one AE occurred among the participants. This aligns with findings from other studies emphasizing the underrepresentation of AEs associated with mind-body therapies in the literature. For example, a meta-analysis highlighted that over two-thirds of trials on yoga did not assess its safety profile. Some notable AEs that have been reported include psychotic symptoms and an increased susceptibility to false memories associated with mindfulness as well as musculoskeletal injuries linked to yoga. Increased efforts in this domain would enable healthcare providers and users to make more informed decisions about the use of mind-body therapies. Such efforts would foster standardization within the field of CAIM and facilitate more accurate comparisons of the safety of different mind-body therapies.

Long term effects of mind-body therapies

A few trials (4 out of the 7 trials that performed follow-up assessments) reported that the improvements in outcomes were sustained after the completion of the intervention. Limited evidence was available to determine the long-term impact of mind-body interventions for adults with FM. Similarly, a systematic review by Theadom et al revealed that only 3 trials comparing mindfulness meditation therapies with usual care obtained follow-up data ranging between 1 to 3
months post-intervention. This limits crucial insights about the sustainability of mind-body therapies. A potential explanation is the lack of feasibility to perform consistent mind-body therapy practice at home. Future research may benefit from modifying mind-body interventions to promote adherence through simplified protocols and additional guided assistance.

Limitations of this review

Our systematic review has some limitations. First, we included only research articles published in English; however, some studies that involve tai chi, qi gong, or yoga interventions may have been published in Chinese or Korean journals. Thus, based on our eligibility criteria, this review may not encompass numerous reports of tai chi, qi gong, and yoga published in non-English journals or in journals not included in the five databases we searched. Second, the review does not include grey literature or unpublished findings. Third, we used several keywords and terms to search for specific mind-body therapies; however, we could not incorporate terms for every individual mind-body therapy used in the treatment or management of FM. Fourth, the small number of studies involving some types of mind-body therapy (e.g., autogenic training, MAT, PMR, yoga) reduces the robustness of our findings. Fifth, the movement therapies (e.g., qi gong, tai chi, yoga) included in this review share the common feature of combining physical body movement with a meditative mental state. These practices focus on prescribed, regimented body movements coupled with the goal of achieving a calm, mindful state, often supported by breathing exercises. However, some promising movement modalities, such as karate, tae kwon do, kung fu, and judo, were excluded due to insufficient literature meeting our criteria. Given the similarities between these martial arts and included practices like qi gong and tai chi, this exclusion may introduce bias. Future research should explore these modalities using rigorous methodologies to better understand their potential benefits for pain relief. Lastly, due to the
heterogeneity of the interventions and varying assessment scales used to measure our outcomes, meta-analyses were not conducted. As the body of evidence increases for specific mind-body therapies for people with FM, future reviews should consider performing meta-analyses for the therapeutic effectiveness and safety of specific types of mind-body therapy for FM.

Limitations of included studies

First, there were limited trials reporting on the safety of mind-body interventions, potentially impacting our understanding of the safety and feasibility of these interventions in clinical practice. Future trials should consistently report on the safety of the interventions to enhance the interpretation of results and ensure the safety of participants. Second, the evidence for outcomes in this review was limited by the methodological quality of the trials, with 9 RCTs and 5 quasi-experimental trials identified as high quality. Since robust RCTs are essential for providing reliable recommendations, future trials should focus on accurately reporting randomization procedures and allocation concealment processes, which generally scored lower in our JBI methodological quality assessment. Third, few trials reported whether improvements in outcomes were sustained post-intervention, limiting our understanding of the longer-term impact of mind-body interventions for adults with FM. Future trials should investigate the sustainability of benefits over long periods and explore the lasting effects once participants conclude their participation in mind-body therapy. Fourth, the heterogeneity in study designs and outcomes emphasizes the necessity for further well-designed, controlled trials to establish more conclusive evidence and guide clinical recommendations. A wide range of outcomes and measures were reported between trials, making it difficult to pool results and compare studies. Future trials should consider following the OMERACT initiative for standardization, incorporating a core set
of outcome measures to enhance consistency across clinical trials in FM. Lastly, there was a lack of trials that investigated the dose-response relationship of mind-body therapies.

**Conclusions**

This systematic review provided a comprehensive overview and appraisal of the existing literature on efficacy and safety of using mind-body therapies for FM. Our findings demonstrate that some mind-body therapies may be effective at improving pain, multidimensional function, fatigue, and sleep disturbance among adults with FM, however, the quality of the evidence is low. Traditional movement practices including qi gong and tai chi showed the most consistent evidence for improvements in these outcomes at the end of treatment, followed by guided imagery. In contrast, the efficacy of mindfulness, biofeedback, yoga, and autogenic training remains uncertain due to either low-quality evidence or a lack of recent trials investigating these therapies. The findings of our review can inform researchers, patients, and healthcare providers on the current evidence on specific Mind-body therapies for FM, and which patient-important outcomes demonstrate the most consistent improvement across trials. Future research should investigate the safety, long-term effects, and dose-response relationship of mind-body therapies while adhering to a standardized set of patient-important outcomes.

**Abbreviations**

AAPT: ACTTION-American Pain Society Pain Taxonomy

ACR: American College of Rheumatology

AE: Adverse events

BFI: Brief Fatigue Inventory

BPI: Brief Pain Inventory
CAIM: Complementary, Alternative, and Integrative Medicine

CBT: cognitive-behavioral therapy

CSF: Cerebrospinal fluid

EMG: Electromyogram

FACIT-F: Functional Assessment of Chronic Illness-Fatigue

FIQ: Fibromyalgia Impact Questionnaire

FIQR: Fibromyalgia Impact Questionnaire Revised

FM: Fibromyalgia

FSI: Fatigue Symptom Inventory

GHQ-28: General Health Questionnaire

GRADE: Grading of Recommendations Assessment, Development and Evaluation for assessing certainty (or quality)

HADS: Hospital Anxiety and Depression Scale

HRQoL: Health-related quality of life

JBI: Joanna Briggs Institute

MAF: Multidimensional Assessment of Fatigue

MAT: Meditation awareness training

MBSR: Mindfulness-based stress reduction

MFI-20: Multidimensional Fatigue Inventory

MPQ-LF: McGill Pain Questionnaire Long Form

NCCAM: National Center for Complementary and Alternative Medicine

OMERACT: Outcome Measures in Rheumatology Clinical Trials

PGIC: Patient global impression of change

PICOS: Population, Intervention, Comparator, Outcome, Study design
PMR: Progressive muscle relaxation

PRISMA: Preferred Reporting Items for Systematic reviews and Meta-Analyses

PROMIS: Patient-Reported Outcomes Measurement Information System

PSQI: Pittsburgh Sleep Quality Index

RCT: Randomized controlled trial

SF-36: 36-Item Short-Form Health Survey

S-FIQ: Spanish Fibromyalgia Impact Questionnaire

SG-MBI: Second-generation mindfulness-based intervention

SMPQ: Short-Form McGill Pain Questionnaire

SMR: Sensorimotor rhythm

SSQ: Stanford Sleep Questionnaire

STAI: State-Trait Anxiety Inventory

VAS: Visual Analog Scale

Acknowledgments

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Figures

Figure 1. PRISMA flow diagram. AMED = Allied and Complementary Medicine; APA = American Psychological Association; CINAHL = Cumulative Index to Nursing and Allied Health Literature.
Figure 1. PRISMA flow diagram. AMED = Allied and Complementary Medicine; APA = American Psychological Association; CINAHL = Cumulative Index to Nursing and Allied Health Literature.
<table>
<thead>
<tr>
<th>Author and year</th>
<th>Title</th>
<th>Study design</th>
<th>Country of participant population</th>
<th>Ethnicity of participant population</th>
<th>Where FM patients were recruited from</th>
<th>Sample size</th>
<th>Mean age (standard deviation)</th>
<th>Proportion female (%)</th>
<th>Definition of FM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alba 2022-62; Terrasa 2020-67</td>
<td>EEG-heart rate connectivity changes after sensorimotor rhythm neurofeedback training: Ancillary study.</td>
<td>Parallel RCT</td>
<td>Spain</td>
<td>Spanish</td>
<td>Primary care</td>
<td>n = 17</td>
<td>54.94 (10.11)</td>
<td>100</td>
<td>No definition provided</td>
</tr>
<tr>
<td>Andres-Rodriguez 2019-43</td>
<td>Immune-inflammatory pathways and clinical changes in fibromyalgia patients treated with Mindfulness-Based Stress Reduction (MBSR): A randomized, controlled clinical trial</td>
<td>Parallel RCT</td>
<td>Spain</td>
<td>Spanish</td>
<td>In-patient hospital database</td>
<td>n = 70</td>
<td>53.30 (8.06)</td>
<td>100</td>
<td>FM is a disabling syndrome characterized by chronic widespread musculoskeletal pain, increased pain sensitivity including allodynia and hyperalgesia with tenderness to touch but no known structural pathology in muscles, ligaments, or joints.</td>
</tr>
<tr>
<td>Barbosa-Torres 2021-44</td>
<td>Clinical findings in smr neurofeedback protocol training in women with fibromyalgia syndrome</td>
<td>Quasi-experimental with no control</td>
<td>Spain</td>
<td>Spanish</td>
<td>Primary care</td>
<td>n = 37</td>
<td>54.92 (7.89)</td>
<td>100</td>
<td>FM is a condition generally associated with multiple symptoms, such as sleep deprivation, tiredness, chronic fatigue and cognitive impairment. Its predominant characteristic is non-articular, widespread, chronic muscular-skeletal pain in specific areas all over the body. The psychological factors</td>
</tr>
</tbody>
</table>
most frequently found in FM patients are intense negative emotions (anxiety, depression), a maladaptive coping style, an unadjusted attention pattern and an excessive worry response.

FM is a chronic pain syndrome with a high burden for the individual person and for society. FM is characterized by chronic widespread pain, sleep disturbances, and additional symptoms such as fatigue and depression. Some patients report a decline in memory, cognitive function, and mental alertness. Activities of daily living, working ability, and quality of life are considerably limited.

According to the American College of Rheumatology guidelines, a patient satisfies diagnostic criteria for FM if they report widespread pain and high symptom
Severity that have persisted for at least three months with no alternate explanation. Fatigue is one of the most prevalent symptoms reported by women with FM, and may have the greatest impact of any symptom experienced.

<table>
<thead>
<tr>
<th>Grossman 2017 &amp; Schmidt 2011</th>
<th>Mindfulness-Based Intervention Does Not Influence Cardiac Autonomic Control or the Pattern of Physical Activity in Fibromyalgia during Daily Life</th>
<th>Parallel RCT</th>
<th>Germany</th>
<th>White; Other</th>
<th>Primary care, in-patient hospital database, news media, patient self-help groups</th>
<th>n = 168</th>
<th>54.00 (8.55)</th>
<th>100</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jones 2012</td>
<td>A randomized controlled trial of 8-form Tai chi improves symptoms and functional mobility in fibromyalgia patients.</td>
<td>Parallel RCT</td>
<td>United States</td>
<td>White; Other</td>
<td>Primary care, news media, FM support group, and Oregon Pain Society</td>
<td>n = 101</td>
<td>54.00 (NR)</td>
<td>92.82</td>
</tr>
<tr>
<td>Kaplun 2021</td>
<td>Effects of Brief Guided Imagery on Female Patients Diagnosed with Fibromyalgia: An</td>
<td>Parallel RCT</td>
<td>Israel</td>
<td>Israeli; Russian; European/African</td>
<td>Primary care</td>
<td>n = 37</td>
<td>58.70 (8.80)</td>
<td>100</td>
</tr>
</tbody>
</table>

FM is a clinical functional disorder with major symptoms of chronic widespread pain, fatigue, stiffness and sleep disturbance. FM is a common, multisymptomatic chronic pain illness with significant functional mobility limitations. People with FM suffer from widespread musculoskeletal pain, fatigue, stiffness, disturbed sleep, and declining physical function. FM is a syndrome characterized by chronic pain and moderate or severe fatigue accompanied by a lack of energy and exhaustion.
<table>
<thead>
<tr>
<th>Study</th>
<th>Design</th>
<th>Country</th>
<th>Control Group</th>
<th>Control Group Description</th>
<th>n Value</th>
<th>Mean (SD)</th>
<th>Effect Size</th>
<th>Study Findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lazaridou 2019&lt;sup&gt;51&lt;/sup&gt;</td>
<td>Exploratory Controlled Trial.</td>
<td>Quasi-experimental with no control</td>
<td>United States</td>
<td>Caucasian; African American</td>
<td>Primary care and news media</td>
<td>n = 46</td>
<td>48.50 (13.90)</td>
<td>100</td>
</tr>
<tr>
<td>Liu 2012&lt;sup&gt;52&lt;/sup&gt;</td>
<td>Quasi-experimental with no control</td>
<td>United States</td>
<td>American</td>
<td>Primary care and FM support group</td>
<td>n = 14</td>
<td>56.65 (NR)</td>
<td>100</td>
<td>FM is a disabling disorder featuring widespread chronic pain and other often debilitating symptoms including fatigue, sleep difficulties, and depressed mood that contribute to a high level of functional disability.</td>
</tr>
<tr>
<td>Lynch 2012&lt;sup&gt;53&lt;/sup&gt;; Sawynok 2014&lt;sup&gt;64&lt;/sup&gt;</td>
<td>Parallel RCT</td>
<td>Canada</td>
<td>Canadian</td>
<td>Primary care and FM support group</td>
<td>Lynch 2012: News media</td>
<td>n = 100</td>
<td>Lynch 2012: 52.00 (8.75)</td>
<td>Lynch 2012: 96.00</td>
</tr>
<tr>
<td>Maddali-Bongi 2016&lt;sup&gt;54&lt;/sup&gt;</td>
<td>Parallel RCT</td>
<td>Italy</td>
<td>Italian</td>
<td>NR</td>
<td>n = 44</td>
<td>52.24 (12.19)</td>
<td>NR</td>
<td>FM syndrome is a rheumatic disease, characterized by chronic widespread pain for more than 3 months and other...</td>
</tr>
<tr>
<td>Study</td>
<td>Title</td>
<td>Intervention</td>
<td>Country</td>
<td>Language</td>
<td>Setting</td>
<td>Sample Size</td>
<td>Mean Age (SD)</td>
<td>Effect Size</td>
</tr>
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<tr>
<td>Medina 2022&lt;sup&gt;55&lt;/sup&gt;</td>
<td>Differential Brain Perfusion Changes Following Two Mind-Body Interventions for Fibromyalgia Patients: an Arterial Spin Labelling fMRI Study.</td>
<td>Parallel RCT</td>
<td>Spain</td>
<td>Spanish</td>
<td>In-patient hospital database</td>
<td>n = 90</td>
<td>52.61 (8.36)</td>
<td>100</td>
</tr>
<tr>
<td>Menzies 2014&lt;sup&gt;56&lt;/sup&gt;</td>
<td>Effects of guided imagery on biobehavioral factors in women with fibromyalgia.</td>
<td>Parallel RCT</td>
<td>United States</td>
<td>Hispanic/Latino; Other</td>
<td>News media</td>
<td>n = 72</td>
<td>46.90 (12.80)</td>
<td>100</td>
</tr>
<tr>
<td>Onieva-Zafra 2015&lt;sup&gt;57&lt;/sup&gt;, 2019&lt;sup&gt;58&lt;/sup&gt;</td>
<td>Parallel RCT</td>
<td>Spain</td>
<td>Spanish</td>
<td>Various FM associations</td>
<td>n = 60</td>
<td>52.47 (6.17)</td>
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<tr>
<td>Effectiveness of guided imagery relaxation on levels of pain and depression in patients diagnosed with fibromyalgia.</td>
<td></td>
<td></td>
<td></td>
<td>Onieva-Zafra 2015: 3.60</td>
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</tbody>
</table>

Onieva-Zafra 2015: FM is a chronic disease that affects the life of the patient on all levels (social, personal, and professional), and thus, an interdisciplinary approach to its treatment is required.

Onieva-Zafra 2019: FM is a frequently diagnosed pain disorder primarily affecting women. It has a high comorbidity often accompanied by symptoms such as morning stiffness, fatigue, anxiety, depression, insomnia, and reduced cognitive performance.
<table>
<thead>
<tr>
<th>Study</th>
<th>Design</th>
<th>Country</th>
<th>Language</th>
<th>Arm</th>
<th>Setting</th>
<th>Sample Size</th>
<th>Mean Pain Score</th>
<th>Mean Health Score</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Perez-Aranda 2019&lt;sup&gt;59&lt;/sup&gt;</td>
<td>Parallel RCT</td>
<td>Spain</td>
<td>Spanish</td>
<td>Primary care</td>
<td>n = 225</td>
<td>53.27 (7.93)</td>
<td>98.22</td>
<td>FM is mainly characterized by chronic widespread pain, fatigue, stiffness, sleep problems, perceived cognitive dysfunction, and distress.</td>
<td></td>
</tr>
<tr>
<td>Rodriguez-Mansilla 2021&lt;sup&gt;60&lt;/sup&gt;</td>
<td>Parallel RCT</td>
<td>Spain</td>
<td>Spanish</td>
<td>Various FM associations</td>
<td>n = 141</td>
<td>52.24 (6.19)</td>
<td>100</td>
<td>FM is diffuse and widespread pain in combination with the presence of multiple tender points. In addition to pain, these patients have sensory symptoms, such as paraesthesia, motor symptoms, such as muscle stiffness, contractures and tremors, and vegetative symptoms, such as tingling sensations.</td>
<td></td>
</tr>
<tr>
<td>Romero-Zurita 2012&lt;sup&gt;61&lt;/sup&gt;</td>
<td>Quasi-experimental with no control</td>
<td>Spain</td>
<td>Spanish</td>
<td>Various local FM associations</td>
<td>n = 32</td>
<td>51.35 (6.75)</td>
<td>100</td>
<td>FM is a chronic diffuse pain condition that probably results from abnormal central pain processing. The symptoms most frequently are chronic pain, characterized by generalized pain, stiffness, fatigue, disturbed sleep, psychological distress,</td>
<td></td>
</tr>
</tbody>
</table>

FM = Fibromyalgia; RCT = Randomized Controlled Trial.
<table>
<thead>
<tr>
<th>Study (Year)</th>
<th>Intervention Description</th>
<th>Study Design</th>
<th>Country</th>
<th>Population Details</th>
<th>Sample Size</th>
<th>Primary Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sarmento 2020&lt;sup&gt;62&lt;/sup&gt;</td>
<td>The therapeutic efficacy of Qigong exercise on the main symptoms of fibromyalgia: A pilot randomized clinical trial.</td>
<td>Parallel RCT</td>
<td>United States</td>
<td>American primary care, and emergency or urgent care hospital database</td>
<td>n = 28</td>
<td>49.40 (13.19)</td>
</tr>
<tr>
<td>Sawynok 2013&lt;sup&gt;63&lt;/sup&gt;</td>
<td>Extension trial of qigong for fibromyalgia: a quantitative and qualitative study.</td>
<td>Quasi-experimental with no control</td>
<td>Canada</td>
<td>Canadian previous participants invited to participate in the extension trial</td>
<td>n = 20</td>
<td>53.00 (9.30)</td>
</tr>
<tr>
<td>Segura-Jimenez 2014&lt;sup&gt;65&lt;/sup&gt;</td>
<td>Effectiveness of Tai-Chi for decreasing acute pain in fibromyalgia patients</td>
<td>Quasi-experimental with no control</td>
<td>Spain</td>
<td>Spanish various FM associations</td>
<td>n = 43</td>
<td>51.70 (6.40)</td>
</tr>
<tr>
<td>Van-Gordon 2017&lt;sup&gt;68&lt;/sup&gt;</td>
<td>Meditation awareness training for the treatment of fibromyalgia syndrome: A randomized controlled trial.</td>
<td>Parallel RCT</td>
<td>England</td>
<td>British; White (Non-British); Asian; Black (Caribbean); various FM associations/support groups</td>
<td>n = 148</td>
<td>46.90 (9.43)</td>
</tr>
<tr>
<td>Study</td>
<td>Intervention</td>
<td>Country</td>
<td>Language</td>
<td>Recruitment Method</td>
<td>Sample Size</td>
<td>Mean Pain Score (SD)</td>
</tr>
<tr>
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<tr>
<td>Verkaik 2014&lt;sup&gt;69&lt;/sup&gt;</td>
<td>Guided imagery in people with fibromyalgia: a randomized controlled trial of effects on pain, functional status and self-efficacy.</td>
<td>Netherlands</td>
<td>Dutch</td>
<td>News media and various FM associations</td>
<td>n = 65</td>
<td>47.50 (11.38)</td>
</tr>
<tr>
<td>Wong 2018&lt;sup&gt;70&lt;/sup&gt;</td>
<td>Effectiveness of Tai Chi on Cardiac Autonomic Function and Symptomatology in Women With Fibromyalgia: A Randomized Controlled Trial.</td>
<td>Korea</td>
<td>Korean</td>
<td>NR</td>
<td>n = 37</td>
<td>51.00 (1.97)</td>
</tr>
<tr>
<td>Wu 2021&lt;sup&gt;71&lt;/sup&gt;</td>
<td>Effects of Neurofeedback on Fibromyalgia: A Randomized Controlled Trial.</td>
<td>Taiwan</td>
<td>Taiwanese</td>
<td>Primary care</td>
<td>n = 80</td>
<td>47.00 (13.13)</td>
</tr>
</tbody>
</table>

FM is a complex rheumatic disorder that affects up to 5% of the general population worldwide. In addition to chronic widespread pain, patients often experience fatigue, disturbed sleep, stiffness, reduced functioning, and cognitive problems.

FM is an idiopathic disease affecting approximately 3% of the world population, primarily diagnosed in middle-aged women. Although FM is mainly characterized by chronic pain and fatigue, reduced muscular strength and flexibility are common symptoms associated with the presentation of the disorder.

FM is a condition characterized by widespread pain, memory problems, sleep disturbances, and cognitive impairment. FM frequently co-occurs with irritable bowel syndrome, fatigue, depression, anxiety disorders, and poor quality of life.
| Yoo 2022 | Effects of progressive muscle relaxation therapy with home exercise on pain, fatigue, and stress in subjects with fibromyalgia syndrome: A pilot randomized controlled trial. | Parallel RCT | Korea | Korean | NR | n = 37 | NR (Range: 20-65) (NR) | 89.19 | FM is a chronic widespread pain disorder of the musculoskeletal system and is accompanied by symptoms of fatigue, depression, sleep disorders, and physical and mental stress. |

Abbreviations: FM: Fibromyalgia; NR: Not Reported; RCT: Randomized Controlled Trial.
### Table 2: Quality assessment of the included RCTs

<table>
<thead>
<tr>
<th>Citation</th>
<th>Q1</th>
<th>Q2</th>
<th>Q3</th>
<th>Q4</th>
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<th>Q6</th>
<th>Q7</th>
<th>Q8</th>
<th>Q9</th>
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<th>Q11</th>
<th>Q12</th>
<th>Q13</th>
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<tbody>
<tr>
<td>Alba 202242</td>
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<td>Unclear</td>
<td>N</td>
<td>Y</td>
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<td></td>
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<td>Y</td>
<td>Y</td>
<td>Unclear</td>
<td>N</td>
<td>Y</td>
<td>6/13</td>
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<tr>
<td>Andres-Rodriguez 201945</td>
<td>Y</td>
<td>Unclear</td>
<td>Y</td>
<td>Y</td>
<td>N</td>
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</tbody>
</table>

Note: Y, yes; N, no; U, unclear; N.A., not applicable.

1. Was true randomization used for assignment of participants to treatment groups?
2. Was allocation to treatment groups concealed?
3. Were treatment groups similar at the baseline?
4. Were participants blind to treatment assignment?
5. Were those delivering the treatment blind to treatment assignment?
6. Were treatment groups treated identically other than the intervention of interest?
7. Were outcomes assessors blind to treatment assignment?
8. Were outcomes measured in the same way for treatment groups?
9. Were outcomes measured in a reliable way?
10. Was follow up complete and if not, were differences between groups in terms of their follow up adequately described and analyzed?
11. Were participants analyzed in the groups to which they were randomized?
12. Was appropriate statistical analysis used?
13. Was the trial design appropriate, and any deviations from the standard RCT design (individual randomization, parallel groups) accounted for in the conduct and analysis of the trial?
## Table 3: Quality assessment of the included quasi-experimental studies

<table>
<thead>
<tr>
<th>Citation</th>
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<th>Q4</th>
<th>Q5</th>
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<td>Romero-Zurita 2012</td>
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<td>Sawynok 2013</td>
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<td>N</td>
<td>7/9</td>
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</table>

Note  Y, yes; N, no; U, unclear; N.A.; not applicable

1. Is it clear in the study what is the ‘cause’ and what is the ‘effect’ (i.e. there is no confusion about which variable comes first)?
2. Were the participants included in any comparisons similar?
3. Were the participants included in any comparisons receiving similar treatment/care, other than the exposure or intervention of interest?
4. Was there a control group?
5. Were there multiple measurements of the outcome both pre and post the intervention/exposure?
6. Was follow up complete and if not, were differences between groups in terms of their follow up adequately described and analyzed?
7. Were the outcomes of participants included in any comparisons measured in the same way?
8. Were outcomes measured in a reliable way?
9. Was appropriate statistical analysis used?
Table 4 Outcomes and findings of eligible studies (only includes our 8 patient important outcomes)
<table>
<thead>
<tr>
<th>Author and year</th>
<th>Type of mind-body therapy</th>
<th>Intensity and frequency</th>
<th>Control</th>
<th>Patient-important outcomes</th>
<th>Relevant instruments</th>
<th>Duration and follow-up</th>
<th>Main findings (intervention vs. control arm)</th>
<th>Challenges encountered</th>
<th>Conclusion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alba 2022&lt;sup&gt;1&lt;/sup&gt;; Terra 2020&lt;sup&gt;2&lt;/sup&gt;</td>
<td>SMR NFB training 3 sessions per week. NFB tasks included moving a ball to a computerized target.</td>
<td>The attention control intervention was false feedback (sham).</td>
<td>Pain, fatigue, multidimensional function (FM impact), and anxiety</td>
<td>SF-36 Pain subscale (pain), WHYMPI (pain), MPQ (pain), PVAQ (pain), SF-36 Vitality subscale (fatigue), FIQ (multidimensional function), BDI (depression), PASS (anxiety), and STAI (anxiety)</td>
<td>2 weeks Measurements pre-test and post-test</td>
<td>Positive: Good-SMR responders had significantly higher scores than poor SMR responders on SF-36 (pain) (p &lt; 0.05) post-intervention. No follow-up assessments AEs not reported</td>
<td>Study Design: Small sample size Lack of control for quality of reinforcement during training potentially influenced SMR self-regulation Study Population: Potential bias in the results due to participants taking regular medication during NFB training</td>
<td>SMR NFB training showed significant improvements in FM function and symptoms including pain.</td>
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<tr>
<td>Andrés-Rodriguez 2019&lt;sup&gt;3&lt;/sup&gt;</td>
<td>Usual care + weekly MBSR instructor-led training sessions once a week for 2 hours. Participants were told to practice mindfulness for 45 minutes daily at home with guidance from</td>
<td>The usual care was pharmacological treatment and counseling on aerobic exercise.</td>
<td>Multidimensional impact (FM impact), depression, and anxiety</td>
<td>FIQR (multidimensional function), HADS-D (depression), and HADS-A (anxiety)</td>
<td>8 weeks Measurements pre-test, post-test, and follow-up 12 months</td>
<td>Positive: Significant improvement in FIQR (multidimensional function) (p = 0.005); HADS-D (depression) (p = 0.006) post-intervention; and insignificant changes in anxiety. Follow-up assessments not reported AEs not reported</td>
<td>Study Design: Small sample size Study could not completely control for patients taking antidepressants Potential immune regulatory effects due to ethical reasons</td>
<td>MBSR intervention significantly improved symptoms and clinical severity of FM.</td>
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<tr>
<td></td>
<td>Workbooks and audio CDs and participate in an intensive mindfulness meditation retreat for 6 hours.</td>
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<tr>
<td>Barboza-Torres</td>
<td>SMR NFB training sessions 3 times per week for 15 minutes each. Sessions involved completing puzzles with subsequent rewards that included puzzle pieces and auditory beeps with auditory and visual stimuli.</td>
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<tr>
<td>Biofeedback</td>
<td>A control group was not utilized. Pain intensity, multidimensional function (FM impact, general health), depression, and anxiety.</td>
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<td></td>
<td>VAS (pain intensity), FIQR and GHQ-28 (multidimensional function), GHQ-28 (depression and anxiety).</td>
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<td>7 weeks</td>
<td>Measurements pre-test and post-test. Positive: Significant improvement in VAS (pain intensity) (p &lt; 0.001) post-intervention; FIQR (multidimensional function) (p &lt; 0.001) post-intervention, GHQ-28 (overall general health) (p = 0.011) post-intervention; depression (p &lt; 0.001) post-intervention; and anxiety (p &lt; 0.001) post-intervention.</td>
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<td></td>
<td>No follow-up assessments. AEs not reported.</td>
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<tr>
<td>Study Design:</td>
<td>Small sample size. Condition A4 of the brain state (assessing cognitive effort) of SMR training required a lot of cognitive resources and limited task concentration and improvements.</td>
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<tr>
<td>SMR NFB intervention</td>
<td>Significantly improved impact of symptoms of FM.</td>
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| Baumueller       | EMG biofeedback | Usual care (not) | SF-36 Pain subscale (pain); SF-36 Vitality | 8 weeks Measurements | No significant improvement in pain, fatigue, patient-rated global, multidimensional |
|                  |                 |                  |                                             |                        | Study Design: Small sample size |
|                  |                 |                  |                                             |                        | No significant improvements observed among FM |
Carson 2012

| Yoga | Yoga of Awareness (YoA) | The wait-list | Pain, fatigue, patient- | FIQR Pain subscale (pain), FIQR Fatigue | 8 weeks | Insignificant changes observed in FIQR (pain) post- | Study Design: Small sample size | YoA intervention provides improvements |

- instructor-led sessions 3 times a week for 3 weeks, then 1 session per week for 5 weeks. Participants were told to apply 3 minutes of conscious strain on the trapezius muscles and relax for 10 minutes. They were also instructed to follow an exercise program about conscious muscle relaxation for 15 minutes daily at home and during stressful events.
- rated global, multidimensional function, and depression subscale (fatigue), PGIC (patient-rated global), FIQ and SF-36 (multidimensional function), and BDI (depression)
- function or depression post-intervention or at follow-up.
- AEs not reported
- Lack of patient blinding
- Lack of a sham control group due to recognition of sham treatment by patients
- Lack of verification for adherence to the home exercise program for muscle relaxation
- patients after EMG biofeedback intervention.
sessions once a week for 120 minutes. Sessions included gentle stretching for 40 minutes, meditation for 25 minutes, breathing technique for 10 minutes, presentations including yoga principles and optimal coping for 20 minutes, and group discussions for 25 minutes.

Participants were also told to practice certain yoga techniques for 20-40 minutes each day for 5-7 weeks following the intervention. A group underwent routine follow-up at baseline and the second assessment time point.

Lack of active control group to control for attention bias or placebo effect from intervention. Significant reliance on self-reported data and potential effects from therapist due to the singular intervention provider.

Potential selection bias due to previous interest in study. Majority of middle-class educated white individuals. Potential difference in self-reported data on symptom and function scales.

AEs not reported. Trending towards clinical significance in treating FM and various factors with potentially larger benefits following more practice sessions.

Study Population: majority middle-class educated white individuals. Potential selection bias due to previous interest in study. Significant reliance on self-reported data and potential effects from therapist due to the singular intervention provider.
Cash MBSR 2015
MBSR instructor-led sessions once a week for 2.5 hours. The instructor taught attention-focusing techniques such as body scanning, sitting meditation, and yoga positions for relaxation. Participants were told to practice 45 minutes per day for 6 days per week at home with assistance from workbook.

The waitlist group was presented with the MBSR program after the study ended.

Sitting and sleep disturbance

VAS (pain), FSI (fatigue), and SSQ (sleep disturbance)

8 weeks

Measurements: pre-test, post-test, and follow-up 2 months

Positive: Significant improvement in FSI (fatigue) (p = 0.002) post-intervention but did not persist at follow-up; and SSQ (sleep disturbance) (p = 0.038) at post-intervention and follow-up, however when excluding participants lost to follow-up, sleep improvements were no longer significant.

Insignificant improvements observed in VAS (pain) post-intervention or at follow-up

Greater improvements were correlated with greater at-home practice

AEs not reported

Study Design: High physical function scores limited detection of improvement from intervention

Symptom severity in patients limited generalizability to healthier patients

Study Population: Racially similar patients limited generalizability

Patient-reported mindfulness not measured due to previous lack of validated mindfulness measures

MBSR intervention significantly improved sleep disturbance.
| Grossman 2017 | MBSR | Standard MBSR sessions once a week for 2.5 hours. | Pain perception, multidimensional function (FM impact and HRQoL), sleep disturbance, depression, and anxiety | PPS (pain perception), FIQ and PLC (multidimensional function), PSQI (sleep disturbance), CES-D (depression), and STAI (anxiety) | 8 weeks | No significant improvements in primary outcome, HRQoL, at post-intervention or follow-up in comparison to wait-list procedure. However, the MBSR group displayed significant improvements in 6 of 8 secondary outcomes post-intervention and at follow-up, including FIQ (FM impact) (p = 0.021); CES-D (depression) (p = 0.012); STAI (anxiety) (p = 0.003); PSQI (sleep quality/disturbance) (p = 0.004); PSS (pain perception) (affective pain, p < 0.001); and GCQ (physical symptoms) (p < 0.001). The wait-list group exhibited improvement in 2 outcomes including affective pain perception (p = 0.026) and complaints (p = 0.025). |
| Jones 2012 | Tai chi | FM-modified 8-form Yang- | Pain, fatigue, multidimensional | FIQ and BPI (pain), FIQ Fatigue subscale (fatigue), FIQ | 12 weeks | Positive: Significant improvements in FIQ (pain) (p = 0.0000) post-intervention, BPI |

Study Design:

Grossman 2017: Some participants found study to be uncomfortable and refused to participate which potentially influenced results. Size of study limited monitoring to single day for each measuring date. Greater monitoring past daytime raises privacy issues. Lack of between-group comparison with control group for majority of outcomes. MBSR had significant within-group improvements in outcomes including pain, multidimensional function, depression, anxiety, sleep disturbance, and physical symptoms. Nevertheless, since enhancements were not assessed in comparison to the control group, it is not possible to assert that MBSR produced the anticipated effects and outperformed the wait-list procedure.

Tai chi 2012: Difficult to develop double-blind study due to lack of sham. 12-week 8-form tai chi significantly improved FM symptoms including pain.
<p>| Style tai chi sessions per week for 90 minutes. The sessions emphasized slow, gentle, controlled/rhythmic movements during exercise, self-massage, natural breathing, and relaxation. The postures were static and dynamic. The exercises consisted of warming up for 15 minutes, tai chi for 45 minutes, a break for 15 minutes, and a cool-down period for 15 minutes. | Consisted of 90-minute group sessions for 2 sessions/week focusing on FM facts (week 1), healthy eating (weeks 3-7) and psych education about FM (8-11). | Function, sleep disturbance, depression, and anxiety | Test (severity) (p = 0.0008) post-intervention, BPI (interference) (p = 0.0000) post-intervention; FIQ Fatigue subscale (fatigue) (p = 0.0001) post-intervention; FIQ total scores (multidimensional function) (p = 0.0002) post-intervention; FIQ Sleep subscale (sleep disturbance) (p = 0.0001) post-intervention, PSQI (sleep disturbance) (p = 0.0003) post-intervention; FIQ non-pain symptoms subscale (depression) (p = 0.0001) post-intervention and FIQ non-pain symptoms subscale (anxiety) (p = 0.0001) post-intervention. | No follow-up assessments | AEs measured but no events | Tai chi treatment | Pain, fatigue, multidimensional function, sleep, anxiety, and depression compared to education control with potential for long-term improvements. | Study population: Higher levels of education | Decreased ethnic diversity in comparison to previous studies | Lack of children and sufficient number of men to study gender differences | Lack of follow-up contrary to previous studies | Results demonstrate significance of tai chi as additional treatment to FM. |
| Kaplun 2021* | Guided imagery sessions once a week for 1 hour. Training comprised 6 techniques that emphasized breathing, reducing pain and suffering through the tree, olive oil, magnet, blue light, and the waterfall exercises. Duration per exercise was 1-2 minutes. The participants were told to perform 3 brief guided imagery exercises per day. | Pain, fatigue, and sleep disturbance | SF-36 Pain subscale (pain), BPI (average, mildest and overall pain), SF-36 Energy/fatigue subscale (fatigue), and BPI Sleep subscale (sleep disturbance) | 6 weeks | Positive: Significant improvement observed in SF-36 Pain subscale (pain) (p = 0.000) post-intervention, BPI (average pain) (p = 0.011) post-intervention, BPI (mildest pain) (p = 0.003) post-intervention, BPI (overall pain) (p = 0.003) post-intervention; and BPI Sleep subscale (sleep disturbance) (p = 0.025) post-intervention. Significant increases in all areas except relief due to medication, physical/social functioning and role limitation due to physical health. No follow-up assessments AEs not reported | Study Design: Small sample size leading to potential for self-selection bias. Only one therapist throughout experiment. Potential benefits from group therapy sessions/interactions instead of intervention. Lack of monitoring outcomes during intervention. Timing of study prevented some eligible individuals from partaking. Suggests the neurological processes during brain practice in brief guided imagery should be analyzed in future studies. |
| Lazaridou 2019† | Yoga instructor | There is no control | BPI (pain), daily diary (fatigue), FIQR | 6 weeks | Positive: Significant improvement in BPI (pain) (p = 0.041) post-intervention and BPI Sleep subscale (sleep disturbance) (p = 0.001) post-intervention. Potential benefits from group therapy sessions/interactions instead of intervention. Lack of monitoring outcomes during intervention. Timing of study prevented some eligible individuals from partaking. | Study Design: Small sample size. | Brief guided imagery significantly improved pain, fatigue, and sleep disturbance. Daily yoga-based exercise positively impacted pain. |</p>
<table>
<thead>
<tr>
<th>Study</th>
<th>Intervention Details</th>
<th>Measures</th>
<th>Pre-test and Post-test Changes</th>
<th>Limitations/Recommendations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Liu 2012</td>
<td>Qi gong sessions once a week for 45-60 minutes</td>
<td>Pain, fatigue, multidimensional function (FM impact), and sleep disturbance</td>
<td>6 weeks</td>
<td>Qi gong significantly improved pain, fatigue, and multidimensional function. This specific form of qi gong exercise was easy to learn and practice.</td>
</tr>
<tr>
<td>Qi gong</td>
<td>The &quot;six healing sound&quot; instructor-led qi gong sessions once a week for 1-1.5 hours, including meditation, asanas, and mindfulness-based practices</td>
<td>Pain, fatigue, multidimensional function (FM impact), and sleep disturbance</td>
<td>6 weeks</td>
<td>Qi gong significantly improved pain, fatigue, and multidimensional function. This specific form of qi gong exercise was easy to learn and practice.</td>
</tr>
</tbody>
</table>

Lack of control group limiting generalizability

Multiple steps of intervention limit clarity in which component was beneficial

Study Population: High variability between patients and symptoms

Voluntary participation potentially leading to selection bias

High initial drop-out rate suggests great difficulty of intervention

Fatigue, and sleep among individuals with FM with a greater effect seen among those who engaged in more at-home practice.
| Lych 2012\(^3\), Sawynok 2014\(^4\) | Qi gong | The Chaoyi Fanhuan qi gong sessions once a week for 60 minutes. The intervention consisted of seven movements that emphasized relaxation, softness, and downward releases. | Pain, multidimensional function (FM impact and quality of life), and sleep disturbance. | NRS-PI (pain), FIQ (multidimensional function), and PSQI (sleep disturbance). | 24 weeks | Positive: Significant improvement in pain at 8 weeks (p < 0.001), 16 weeks (p = 0.01) and 24 weeks (p = 0.02); FIQ (multidimensional function) at 8 weeks (p < 0.001), 16 weeks (p = 0.003), and 24 weeks (p = 0.007); and PSQI (sleep disturbance) at 8 weeks (p = 0.001), 16 weeks (p < 0.001), and 24 weeks (p = 0.003). Qualitative comments about improved outcomes among patients. Greater improvements linked to greater practice times. No post-intervention follow-up assessments. | Study Design: Lack of blinding. Control group did not receive same level of attention in comparison to intervention group. Variable adherence to qi gong practice potentially affected mean results. Specific form of qi gong implemented reducing generalizability. Difficult to determine dose-response relationship. Self-practice level 1 Chaoyi Fanhuan qi gong training provided significant long-term improvements in areas including pain, multidimensional function, and sleep disturbance. Greater improvements were associated with those that adhered and practiced as per the recommended protocol (≥ 5 hours/week) in comparison to minimal practice (≤ 3 hours/week). |
Participants were instructed to practice once a day for 45-60 minutes at home.

2 AEs were encountered

| Madd ali Bongi 20164 | Tai chi | Tai ji quan sessions twice a week for 60 minutes. It consisted of 15 minutes of breathing and posture correction, 15 minutes of low-impact movements, and 30 minutes of 14 modified tai ji quan movements which were performed slowly, controlled and in a relaxed manner. | Pain, fatigue, multidimensional function (FM impact, quality of life), sleep disturbance, depression, and anxiety. | SF-36 Pain subscale (pain), FACIT-F and SF-36 Vitality subscale (fatigue), FIQ (multidimensional function), PSQI and PSQI Sleep disturbance subscale (sleep disturbance), HADS-D (depression), and HADS-A (anxiety). | 16 weeks Measurements pre-test and post-test | Positive: Significant improvements in SF-36 Pain subscale (pain) (p < 0.001) post-intervention; FACIT-F (fatigue) (p < 0.01) post-intervention and SF-36 Vitality subscale (fatigue) (p < 0.01) post-intervention; FIQ (multidimensional function) (p < 0.05) post-intervention; PSQI (sleep disturbance) (p < 0.05) post-intervention and PSQI Sleep disturbance subscale (sleep disturbance) (p = 0.001) post-intervention; and HADS-A (anxiety) (p < 0.05) post-intervention. Insignificant changes in depression post-intervention.
No follow-up assessments
AEs measured but no events | Study Design: Small sample size
Lack of follow-up
Lack of individualized program specific to participants’ abilities | Tai ji quan therapy significantly improved pain, fatigue, multidimensional function, sleep disturbance, and anxiety.
Successfully accepted by FM patients, evident by high adherence to the intervention. |
<table>
<thead>
<tr>
<th>Medina et al. 2022</th>
<th>MBSR</th>
<th>8 weeks</th>
<th>Positive: No significant improvements in VAS (pain), FIQR (multidimensional function), HADS (depression), and HADS (anxiety). No follow-up assessments. AEs not reported.</th>
<th>Study Design: Small sample size Limited images of brain activity from regional cerebral blood flow maps focusing on specific areas prevented whole brain analyses of effects from interventions. Both nonpharmacological interventions demonstrated changes in connectivity between brain activity through regional cerebral blood flow and symptoms of FM such as pain catastrophizing.</th>
</tr>
</thead>
<tbody>
<tr>
<td>MBSR sessions once a week for 2 hours. Group and homework sessions consisted of MBSR practice (e.g., sitting meditation, body scan, and mindful movements). Participants were also encouraged to attend a silent MBSR retreat for half a day between weeks 6 and 7.</td>
<td>The usual care consisted of medications with aerobic exercise counselling, based on each patient’s physical capabilities.</td>
<td>Pain intensity, multidimensional function (FM impact), depression, and anxiety.</td>
<td>VAS (pain intensity), FIQR (multidimensional function), HADS (depression), and HADS (anxiety).</td>
<td>Pain intensity, multidimensional function (FM impact), depression, and anxiety.</td>
</tr>
<tr>
<td>Menzies 2014</td>
<td>Guided Imagery</td>
<td>10 weeks</td>
<td>Positive: Significant improvements in BPI (pain severity) at week 6 (p = 0.03) and week 10 (p &lt; 0.01); BFI (fatigue) p = 0.02 at week 6 and week 10 (p &lt; 0.01); CES-D (depression) at week 10 (p = 0.02); and marginal significance observed in BPI (pain interference) at weeks 6 and 10.</td>
<td>Study Design: Lack of active control group Inaccurate self-reported data of at-home GI exercises Lack of explanation for mechanisms underlying the Guided imagery helped to significantly improve pain intensity, fatigue, and depression. Provides evidence to implement guided imagery as treatment for managing negative FM symptoms.</td>
</tr>
<tr>
<td>Instructed to listen to 3 20-minute CD tracks at least once daily (Track 1-guided). The control group maintained their treatment as usual.</td>
<td>Pain severity, pain interference, fatigue, and depression.</td>
<td>BPI (pain severity and pain interference), BFI (fatigue), and CES-D (depression).</td>
<td>BPI (pain severity), BFI (fatigue), and CES-D (depression).</td>
<td>BPI (pain severity), BFI (fatigue), and CES-D (depression).</td>
</tr>
<tr>
<td>Oniev-Zafra 2015, 2019</td>
<td>Guided Imagery</td>
<td>Three 1.5-hour guided imagery group sessions and instructions on using 2 guided imagery CDs containing 15-minute recordings of relaxation and visualization techniques.</td>
<td>Attention control group intervention consisted of three 1.5-hour sessions involving group conversations and reporting of symptoms.</td>
<td>Pain, fatigue, multidimensional function, sleep disturbances, depression, and anxiety.</td>
</tr>
</tbody>
</table>

Relationships between the FM parameters | No follow-up assessments AE s not reported |
<table>
<thead>
<tr>
<th>Study</th>
<th>Intervention</th>
<th>Duration</th>
<th>Measurements</th>
<th>Positive Findings</th>
<th>Limitations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Perez-Aranda 2019</td>
<td>MBSR</td>
<td>2-hour weekly group sessions consisting of meditation exercises and audiotapes for home use.</td>
<td>Multidimensional function (FM impact), patient global impression of change, and depression</td>
<td>FIQR (multidimensional function), PGIC (patient global impression of change), HADS-T (depression and anxiety), HADS (depression)</td>
<td>No follow-up assessments AEs not reported</td>
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<tr>
<td></td>
<td></td>
<td>8 weeks</td>
<td>Measurements pre-test, post-test, and follow-up 48 weeks</td>
<td>Positive: A significant improvement in FIQR (multidimensional function) compared to TAU post-intervention (p &lt; 0.001) and at follow-up (p = 0.001); PGIC (patient global impression of change) post-intervention (p &lt; 0.001); and HADS (depression) post-intervention with mindfulness practice (p = 0.03), and marginal improvement at week 48 with mindfulness practice (p = 0.05).</td>
<td>Intervention efficacy: Lacking group MBSR efficacy potentially reduced adherence Lack of equal distribution led to fewer participants with major depression in MBSR Low follow-up rates</td>
</tr>
<tr>
<td>Rodriguez-Mansilla 2021</td>
<td>Qi gong</td>
<td>Qi gong sessions twice a week for 45 minutes. The qi gong exercises emphasized</td>
<td></td>
<td>VAS (pain) and S-FIQ (multidimensional function)</td>
<td>9 AEs were encountered</td>
</tr>
<tr>
<td></td>
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<td></td>
<td>Exercise for well-being (qi gong) and the active exercise program significantly improved pain, and quality of life among FM patients.</td>
</tr>
</tbody>
</table>

| Official Journal of the American Academy of Pain Medicine |
| Rome-| Tai  | Low intensity FM-modified 8-form Yang-style tai chi 3 sessions per week for 60 minutes. Sessions included warmups, breathing, stretching, mobility, tai chi, and relaxation techniques. | Pain, fatigue, multidimensional function (FM impact), depression, and anxiety | SF-36 Pain subscale (pain), VAS (pain), FIQ VAS Fatigue subscale and SF-36 Vitality subscale (fatigue), FIQ (multidimensional function), VAS and HADS (depression), and VAS and HADS (anxiety) | 28 weeks | Positive: A significant improvement in VAS (pain) post-intervention ($p < 0.001$), SF-36 Pain subscale (pain) post-intervention ($p = 0.003$) and after the 12-week detraining period ($p$-value not reported); FIQ VAS Fatigue subscale (fatigue) post-intervention ($p = 0.018$) and detraining ($p$-value not reported); FIQ (multidimensional function) post-intervention ($p < 0.001$); VAS (depression) post-intervention ($p < 0.001$), HADS (depression) post-intervention ($p < 0.001$); VAS (anxiety) post-intervention ($p < 0.001$), HADS (anxiety) post-intervention ($p = 0.009$); insignificant improvement observed after the 12-week detraining period in VAS (pain), VAS (depression), VAS (anxiety), HADS (depression) and HADS (anxiety). AEs measured but no events | Difficult to compare results with other studies as this is the first study to analyze long-term effects of tai chi among FM patients 
- No RCT with control group 
- Unable to keep FM pharmacological treatments consistent during intervention 
- Unable to control preexisting notions about tai chi | Modified 8-Form Yang Style tai chi resulted in significant improvements in symptomatology, quality of life, functional capacity, and psychological outcomes among FM patients.

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Rome-| concentration, abdominal breathing, balance, controlled movements, and flexibility. and treatment as usual was continued.
<table>
<thead>
<tr>
<th>Sarmiento 2020&lt;sup&gt;2&lt;/sup&gt;</th>
<th>Qi gong</th>
<th>Group qi gong sessions one time per week for 45 minutes. At home “Six healing sounds” qi gong sessions twice per day for 25 minutes. Qi gong exercises included deep breathing synchronized with mild body movements, meditation, and diaphragmatic breathing.</th>
<th>Pain, fatigue, multidimensional function (FM impact and quality of life), sleep disturbance, depression, and anxiety</th>
<th>VAS and SMPQ (pain), FIQR VAS Fatigue subscale (fatigue), FIQR and QOLS (multidimensional function), PSQI (sleep disturbance), HADS (depression), and HADS (anxiety)</th>
<th>10 weeks Measurements pre-test and post-test</th>
<th>Positive: A significant decrease in SMPQ (p &lt; 0.01) post-intervention, VAS (pain) (p &lt; 0.05) post-intervention; FIQR VAS Fatigue subscale post-intervention (p &lt; 0.05); FIQR (multidimensional function) post-intervention (p &lt; 0.01), QOLS (multidimensional function) (p &lt; 0.05); PSQI (sleep disturbance) post-intervention (p &lt; 0.01); HADS depression (p &lt; 0.05) post-intervention; and HADS anxiety (p &lt; 0.05) post-intervention.</th>
<th>Limitations: Small sample sizes</th>
<th>Qi gong significantly improved chronic fatigue, widespread pain, quality of sleep, FM intensity, anxiety and depression.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sawynok 2013&lt;sup&gt;3&lt;/sup&gt;</td>
<td>Qi gong</td>
<td>Weekly group qi gong sessions for 60 minutes and daily at home practice for 60 minutes. Qi gong</td>
<td>Pain, multidimensional function (FM impact), sleep disturbance, and patient-rated global</td>
<td>NRS-PI (pain), FIQ (multidimensional function), PSQI (sleep disturbance), and PGIC (patient-rated global)</td>
<td>24 weeks Measurements pre-test, week 8, week 16, post-test</td>
<td>Positive: Significant improvement in pain at week 8 (p = 0.010), week 16 (p = 0.028), and week 24 (p = 0.012); FIQ (multidimensional function) at week 8 (p = 0.040), week 16 (p = 0.019) and week 24 (p = 0.036); and PSQI (sleep disturbance) at week 8 (p = 0.045), week 16 (p = 0.002) and week 24 (p = 0.004).</td>
<td>Limitations: Unable to conduct blinding</td>
<td>Qi gong resulted in Significant improvements in pain, FM impact, sleep impairments, and function.</td>
</tr>
<tr>
<td>Segura-Jimenez 2014</td>
<td>Tai chi</td>
<td>Modified low-moderate intensity 8-Form, Yang Style group tai chi sessions three times per week for 60 minutes. The tai chi sessions included posture work, slow and steady movements</td>
<td>A control group was not utilized.</td>
<td>Pain VAS (pain)</td>
<td>24 weeks Measurements pre-session and post-session</td>
<td>Positive: A significant cumulative change in pain at the beginning of week 16 (p &lt; 0.001); and insignificant cumulative change in pain for the first 12 weeks.</td>
<td>Validation: Unable to compare results with studies due to methodological differences. Limitations: Small sample size of men compared to women</td>
<td>Tai chi significantly improved acute pain in both 12- and 24-week intervention periods and improved cumulative pain in the 24-week intervention.</td>
</tr>
</tbody>
</table>
Van Gordon 2017

Weekly group meditation awareness sessions for 120 minutes each.

Cognitive behavioural theory for groups. Weekly sessions consisted of a 45-minute teaching component, 30-minute group discussions, and 30-minute guided discovery educational exercises. Emphasis placed on education

Pain, multidimensional function (FM impact), and sleep disturbance

SFMPQ (pain), FIQR (multidimensional function), and PSQI (sleep disturbance)

8 weeks Measurements pre-test, post-test, and follow-up 24 weeks

Positive: A significant improvement in SFMPQ (pain) post-intervention (p < 0.001) and at week 24 (p < 0.001); FIQR (multidimensional function) post-intervention (p < 0.001) and follow-up (p < 0.001); and PSQI (sleep disturbance) post-intervention (p < 0.001) and follow-up (p < 0.001).

AEs not reported

Limitations: Utilized subjective self-reported measures

Assessments conducted only at 3 time points

Potential pre-existing ideas about mindfulness/meditation

MAT significantly improved FM symptoms and perceived pain through decreased self-attachment.
<table>
<thead>
<tr>
<th>Study</th>
<th>Type of Intervention</th>
<th>Details</th>
<th>Outcome Measures</th>
<th>Length of Follow-Up</th>
<th>Findings</th>
<th>Limitations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Verkaik 2014</td>
<td>Guided Imagery</td>
<td>Two 1.5-hour group guided imagery sessions followed by daily at home guided imagery practice sessions for approximately 20-30 minutes.</td>
<td>Pain intensity and multidimensional function (FM impact)</td>
<td>4 weeks</td>
<td>Insignificant changes in pain intensity post-intervention, and unspecified pain intensity results at the 6-week follow-up. Insignificant changes in FIQ (multidimensional function).</td>
<td>Intervention: Different guided imagery exercises produced varying outcomes. Limitations: Only measured general pain intensity at the end of the day and not during/after exercises Direct reference to pain and FM adversities with lesser focus on positive imagery Short intervention period Sole focus on pain and not symptoms of FM, opposing participant recommendations</td>
</tr>
<tr>
<td>Wong 2018</td>
<td>Tai Chi</td>
<td>Supervised tai chi sessions three times per week for 55 minutes at 40-50% of the patient's heart rate</td>
<td>Pain, fatigue, and sleep disturbance</td>
<td>12 weeks</td>
<td>Positive: A significant reduction in VAS (pain) (p = 0.006) post-intervention; VAS (fatigue) post-intervention (p = 0.001); and no significant changes were observed for sleep. No follow-up assessments AEs measured but no events</td>
<td>Limitations: Baroreflex sensitivity, blood pressure, and catecholamines not measured unlike previous studies Small sample size Limited generalizability due to specific age range Tai chi training over 12 weeks had significant improvements in pain and fatigue.</td>
</tr>
<tr>
<td>Wu et al. (2021)</td>
<td>Biofeedback</td>
<td>NFB training sessions 2-3 times per week for 30 minutes. SMR and alpha rhythm feedback through relaxing and focusing on a computer game.</td>
<td>Pain, multidimensional function, and sleep disturbance</td>
<td>BPI (pain), FIQR (multidimensional function), and PSQI (sleep disturbance)</td>
<td>8 weeks</td>
<td>Measurements pre-test and post-test</td>
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<tr>
<td>Yoo et al. (2022)</td>
<td>PMR</td>
<td>Group PMR sessions twice per week for 40 minutes. Participants were also instructed to perform exercises at home twice per day for 40 minutes.</td>
<td>Pain and fatigue</td>
<td>VAS (pain), and MAF (fatigue)</td>
<td>8 weeks</td>
<td>Measurements pre-test and post-test</td>
</tr>
<tr>
<td>AE: adverse event; BDI: Beck Depression Inventory; BFI: Brief Fatigue Inventory; BPI: Brief Pain Inventory; CES-D: Center for Epidemiological Studies-Depression scale; EEG: electroencephalogram; EMG: Electromyogram; FACIT-F: Functional Assessment of Chronic Illness Therapy-Fatigue Scale; FibroQoL: multicomponent intervention for Fibromyalgia; FIQ: Fibromyalgia Impact Questionnaire; FIQR: Fibromyalgia Impact Questionnaire Revised; FM: fibromyalgia; FSI: Fatigue Symptom Inventory; GCQ: Giessen Complaint Questionnaire; GHQ-28: General Health Questionnaire; HADS: Hospital Anxiety and Depression Scale (A-anxiety subscale; D-depression subscale); HRQoL: health-related quality of life; MAF: Multidimensional Assessment of Fatigue; MAT: Meditation Awareness Training; MBSR: Mindfulness-Based Stress Reduction; MFI-20: 20-item Multidimensional Fatigue Inventory; MPQ: McGill Pain Questionnaire; MPQ-LF: McGill Pain Questionnaire Long Form; NFB: Neurofeedback; NRS-PI: 11-point numerical rating scale for pain intensity; PASS: Pain Anxiety Symptoms Scale; PGIC: Patient Global Impression of Change; PLC: Quality of Life Profile for the Chronically Ill; PMR: Progressive Muscle Relaxation; PPS: Pain Perception Scale; PROMIS: Patient-Reported Outcomes Measurement Information System; PSQI: Pittsburgh Sleep Quality Index; PVAQ: Pain Vigilance and Awareness Questionnaire; QOLS: Quality of Life Scale; SF-36: 36-item Short-Form Health Survey; S-FIQ: Spanish Fibromyalgia Impact Questionnaire; SMPQ/SFMPQ: Short-Form McGill Pain Questionnaire; SMR: Sensorimotor Rhythm; SSQ: Stanford Sleep Questionnaire; STAI: State-Trait-Anxiety-Inventory; TAU: treatment-as-usual; VAS: visual analogue scale; WHYMPI: West Haven-Yale Multidimensional Pain Inventory; YoA: Yoga of Awareness.</td>
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</table>
**Table 5** Outcomes and findings of eligible studies (all other health-related outcomes)
<table>
<thead>
<tr>
<th>Author and year</th>
<th>Type of mind-body therapy</th>
<th>Other health-related outcomes</th>
<th>Relevant instruments</th>
<th>Related findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alba 2022&lt;sup&gt;12&lt;/sup&gt;; Terrasa 2020&lt;sup&gt;17&lt;/sup&gt;</td>
<td>Biofeedback</td>
<td><strong>QoL, kinesiophobia, coping strategies, social support, connectivity between central region &amp; cortical regions of brain, and between neural activity &amp; heart rate</strong></td>
<td>SF-36 (QoL), TSK (kinesiophobia), CSQ (coping strategies), MOS (social support), fMRI (connectivity between central region and cortical regions of brain), and EEG (connectivity between neural activity and heart rate)</td>
<td>Positive: Good SMR responders showed improvement in SF-36 general health perception (p &lt; 0.05), SF-36-change in health (p &lt; 0.01), and increased functional connectivity of motor and somatosensory areas (p &lt; 0.001) post-intervention.</td>
</tr>
<tr>
<td>Andres-Rodriguez 2019&lt;sup&gt;43&lt;/sup&gt;</td>
<td>MBSR</td>
<td><strong>Perceived stress, general distress, subjective cognitive function, pain catastrophizing, psychological inflexibility (avoidance and cognitive fusion related to pain), mindfulness (observing, describing, acting with awareness, non-judging of inner experience, non-reacting to inner experience), serum levels of immune biomarkers including cytokines and chemokines (pro-inflammatory Interleukin (IL)-6, CXCL8, and</strong></td>
<td>PSS (perceived stress), HADS (general distress), MISCI (subjective cognitive function), PCS (pain catastrophizing), PIPS (psychological inflexibility), FFMQ (mindfulness), blood extraction (immune biomarkers)</td>
<td>Positive: Significantly improved PSS (perceived stress) (p = 0.006); HADS (general distress) (p = 0.020); MISCI (cognitive impairment) (p = 0.012); PCS (pain catastrophizing) (p = 0.036); FFMQ (mindfulness) (p &lt; 0.001); and helped maintain beneficial anti-inflammatory cytokine levels of (IL)-10 (p = 0.034) post-intervention.</td>
</tr>
<tr>
<td>Study</td>
<td>Intervention</td>
<td>Outcome Measures</td>
<td>Results</td>
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<tr>
<td>Barbosa-Torres 2021**</td>
<td>Biofeedback</td>
<td>SMR NFB</td>
<td>EEG on the sensorimotor cortex on right side of the scalp (SMR feedback, theta waves)</td>
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<td>Positive: Significant increase in amplitude of SMR waves (p = 0.010), decrease in theta waves (p &lt; 0.001) and increase in ratio of SMR/theta waves (p &lt; 0.001).</td>
<td></td>
</tr>
<tr>
<td>Baumüller 2017**</td>
<td>Biofeedback</td>
<td>Psychological distress, QoL aspects, pain intensity at commonly painful tender points, and widespread pain and tenderness</td>
<td>SCL-90-R (psychological distress), SF-36 subscales (physical functioning, role-physical, general health, social functioning, role-emotional, mental health), TPS (pain intensity), TPC test and dolorimeter (widespread pain and tenderness)</td>
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<tr>
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<td></td>
<td></td>
<td>No significant improvements in health status.</td>
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<td></td>
<td>Positive: Significant improvement solely in pain-pressure threshold in the trapezius muscle post-intervention (p = 0.016).</td>
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<tr>
<td>Carson 2012**</td>
<td>Yoga</td>
<td>Pain in myalgic tender points, strength, balance, pain acceptance, pain catastrophizing, pain coping strategies, and daily variables</td>
<td>TMS (pain in myalgic tender points), Timed Chair Rise (strength), SCBT (balance), CPAQ (pain acceptance), CSQ (pain catastrophizing), VMPCI (pain coping), and daily diaries (daily variables including pain, fatigue, distress, vigor, relaxation, and acceptance)</td>
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<td>Positive: VMPCI Use of religion subscale post-intervention (p = 0.007); and daily diaries Daily acceptance subscale post-intervention (p = 0.006).</td>
<td></td>
</tr>
<tr>
<td>Cash 2015**</td>
<td>MBSR</td>
<td>Perceived stress, symptom severity, physical functioning, and neuroendocrine function</td>
<td>PSS (perceived stress), FIQ symptom severity (symptom severity), FIQ physical functioning (physical functioning), and salivary cortisol (neuroendocrine function)</td>
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<td>Positive: Significant improvement in PSS (perceived stress) (p = 0.000); and FIQ symptom severity (p = 0.012) at post-intervention and follow-up.</td>
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<td></td>
<td>No significant improvements were found in pain, physical functioning, or cortisol.</td>
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<tr>
<td>Grossman &amp; Schmidt 2011**</td>
<td>MBSR</td>
<td>Mindfulness, daily experiences, ambulatory accelerometer and cardiorespiratory function (respiratory sinus arrhythmia and ventilation)</td>
<td>FMI (mindfulness), daily diaries (daily experiences), accelerometer (ambulatory accelerometer and physical activity), and ECG &amp; inductance plethysmography bands (cardiorespiratory function and respiration)</td>
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<td></td>
<td>No significant effects from MBSR intervention were reported.</td>
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<tr>
<td>Year</td>
<td>Intervention</td>
<td>Outcome Measures</td>
<td>Positive Findings</td>
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<tr>
<td>2012</td>
<td>Tai chi</td>
<td>ASES, TUG test, Maximum reach test, SLS, and external/internal rotation of shoulders</td>
<td>Significant improvements at post-intervention in ASES (self-efficacy) (p = 0.0001); TUG (functional mobility) (p = 0.0001); SLS (static balance) (p = 0.0001); and Maximum reach test (dynamic balance) (p = 0.0001).</td>
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</tr>
<tr>
<td>2021</td>
<td>Guided Imagery</td>
<td>BPI, TUG test, SLS, and Maximum reach test</td>
<td>Regarding BPI, significant improvements in overall activity (p = 0.002), mood (p = 0.001), walking ability (p = 0.006), and enjoyment of life (p = 0.025) post-intervention. Regarding SF-36, significant improvements in physical functioning (p = 0.030), role limitation due to emotional health (p = 0.046), emotional wellbeing (p = 0.007), and overall health (p = 0.001) post-intervention.</td>
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<tr>
<td>2019</td>
<td>Yoga</td>
<td>PCS, wrist actigraph, and daily diaries</td>
<td>Significant improvement in PCS (pain catastrophizing) (p = 0.039) post-intervention. No significant improvements in sleep actigraphy.</td>
<td></td>
</tr>
<tr>
<td>2012</td>
<td>Qi gong</td>
<td>Not Available</td>
<td>Not Applicable</td>
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<tr>
<td>2012</td>
<td>Qi gong</td>
<td>SF-36 Physical and Mental (QoL)</td>
<td>Significant improvement in SF-36 Physical (physical function) at 8 weeks (p &lt; 0.001), 16 weeks (p = 0.001), and 24 weeks (p = 0.004); and SF-36 Mental (mental function) at 8 weeks (p = 0.002).</td>
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<tr>
<td>2016</td>
<td>Tai chi</td>
<td>SF-36 subscales, HAQ, PSQI subscales, WPI, and tender points</td>
<td>Significant improvements post-intervention SF-36 (QoL) Summary physical index subscale (p &lt; 0.05), Physical functioning, Role-physical subscale, and Role-emotional subscale (all p &lt; 0.01), General health subscale (p &lt; 0.001); PSQI (sleep quality) Sleep duration subscale (p = 0.01); HADS (general distress) (p &lt; 0.05); WPI (widespread pain) (p &lt; 0.01); and tender points (tenderness) (p &lt; 0.0001).</td>
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<tr>
<td>2022</td>
<td>MBSR</td>
<td>PCS and fMRI arterial spin labelling</td>
<td>At baseline, positive correlation between changes in regional cerebral blood flow in anterior insula and anterior cingulate cortex (ACC) with pain. Significant improvement in PCS total (pain catastrophizing) (p = 0.0001).</td>
<td></td>
</tr>
<tr>
<td>Study</td>
<td>Intervention</td>
<td>Measures</td>
<td>Positive Findings</td>
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<tr>
<td>Menzies 2014&lt;sup&gt;26&lt;/sup&gt;</td>
<td>Guided Imagery</td>
<td>Self-efficacy, perceived stress, and plasma levels of immune biomarkers (C-reactive protein [CRP] and cytokine levels)</td>
<td>ASES and OSE (self-efficacy), PSS (perceived stress), and blood plasma samples (immune biomarkers of CRP and cytokine levels)</td>
<td>Significant improvements in OSE (self-efficacy) (p = 0.02) at week 10 and significant improvement in PSS (stress) (p = 0.05) at week 10. No significant changes in pro-and anti-inflammatory cytokines or CRP after intervention.</td>
</tr>
</tbody>
</table>
| Onieva-Zafra 2015<sup>27</sup>, 2019<sup>28</sup> | Guided Imagery | Pain intensity, sleep quality, self-efficacy, and QoL                      | Pressure algometer (pain intensity), PSQI (sleep quality), CPSS (self-efficacy), and SF-36 (QoL)                                               | **Positive:**  
Pain intensity:  
Significant improvement in pressure algometry in lower cervical (left side) (p = 0.034), second left rib (p < 0.039), and left greater trochanter (p = 0.042), right gluteal muscle (p = 0.007), and left gluteal muscle (p = 0.010) at week 4. Significant improvement in pain observed for lower cervical (left side) (p = 0.017), right gluteal muscle (p = 0.039), and left gluteal muscle (p = 0.004) at week 8.  
Sleep quality:  
Significant differences between groups in PSQI for sleep latency at week 4 (p = 0.039), sleep duration at week 4 (p = 0.019) and week 8 (p = 0.038), and habitual sleep efficiency at week 4 (p = 0.045). The quality of sleep significantly improved relative to baseline (p < 0.042).  
Self-efficacy:  
Significant differences in CPSS were found between groups at week 4 (p < 0.0349) and week 8 (p < 0.001).  
**QoL:**  
Significant differences found in SF-36 for mental health at week 8 (p = 0.028), and between groups for role physical at week 4 (p < 0.001) and week 8 (p < 0.007), and physical function at week 4 (p < 0.005) and week 8 (p < 0.001). |
| Perez-Aranda 2019<sup>29</sup> | MBSR | FM symptom severity, pain catastrophizing, stress, cognitive impairment, mindfulness, compassion, psychological inflexibility, pain-specific impression of | FSDC (FM symptom severity), PCS (pain catastrophizing), PSS (stress), MISCI (cognitive impairment), FFMQ (mindfulness), SCS-12 (compassion), PIPS (psychological inflexibility), PSIC (pain-specific impression of change), and CEQ (treatment expectancy and credibility) | **Positive:**  
Symptom severity:  
Significant improvement in FSDC versus FibroQoL at follow-up (p = 0.001), and versus TAU at post-intervention (p < 0.001) and follow-up (p < 0.001).  
Pain catastrophizing:  
Significant improvement in PCS versus FibroQoL at post-intervention (p = 0.025) and follow-up (p = 0.015), and versus TAU at post-intervention (p < 0.001) and follow-up (p = 0.002).  
**Stress:**  
**No significant changes in pro-and anti-inflammatory cytokines or CRP after intervention.** |
change, and treatment expectancy and credibility

Significant improvement in stress in PSS versus FibroQoL at post-intervention ($p = 0.001$), and versus TAU at post-intervention ($p < 0.001$) and follow-up ($p = 0.022$).

Cognitive Impairment:
Significant improvement in MISCI versus FibroQoL at post-intervention ($p < 0.001$), and versus TAU at post-intervention ($p < 0.001$) and follow-up ($p < 0.001$).

Mindfulness:
Significant improvement in FFMQ observe versus FibroQoL at post-intervention ($p = 0.002$) and versus TAU at post-intervention and follow-up ($p < 0.001$); in describe versus FibroQoL at follow-up ($p = 0.029$) and versus TAU at follow-up ($p = 0.004$); in act with awareness versus TAU at post-intervention ($p = 0.002$) and follow-up ($p = 0.026$); in nonjudgement versus FibroQoL at post-intervention ($p = 0.009$) and versus TAU at post-intervention ($p < 0.001$) and follow-up ($p = 0.005$).

Compassion:
Significant improvement in SCS-12 versus FibroQoL at post-intervention ($p = 0.050$), and versus TAU at post-intervention ($p = 0.009$).

Psychological inflexibility:
Significant improvement in PIPS versus FibroQoL at post-intervention ($p = 0.013$) and follow-up ($p = 0.037$), and versus TAU at post-intervention ($p = 0.001$) and follow-up ($p < 0.001$).

Pain-specific impression of change:
Significant improvement in PSIC subscales post-intervention (ranging from $p = 0.009$ to 0.001).

Treatment expectancy and credibility:
Significant differences for CEQ subscales versus FibroQoL at post-intervention ($p < 0.05$).

Rodriguez-Mansilla 2021

Qi gong

Static balance, centre of gravity, flexibility, one-leg stance, and perceived effort made in an activity

Wii-Fit pressure platform SLS (static balance), Wii-Fit pressure platform (centre of gravity), SRT (flexibility), and RPE (perceived effort made in an activity)

No significant between-group improvements in comparison to control group.

Romero-Zurita

Tai chi

Pain/tender points

TPS (pain/tender points assessments), chair stand test (lower-body muscular strength), handgrip

Positive:

Pain/tender points assessment:
<p>| 201261 | assessment, lower-body muscular strength, upper-body muscular strength, lower-body flexibility, upper-body flexibility, static balance, motor agility/dynamic balance, aerobic endurance, symptomatology, QoL, coping, global self-esteem, and self-efficacy strength (upper-body muscular strength), CSR (lower-body flexibility), BS (upper-body flexibility), blind flamingo test (static balance), TUG test (motor agility/dynamic balance), 6-minute walk test (aerobic endurance), FIQ subscales (symptomatology), SF-36 subscales (QoL), VPMI (coping), RSES (global self-esteem), and GSES (self-efficacy) | Significant improvements in pain threshold of tender points, tender point count and algometer score post-intervention (all $p &lt; 0.001$), and detraining ($p$-value not reported). Lower-body muscular strength: Significant improvement in chair stand test post-intervention ($p &lt; 0.001$). Upper-body muscular strength: Significant improvement in handgrip strength post-intervention ($p = 0.006$). Lower-body flexibility: Significant improvement in CSR post-intervention ($p &lt; 0.001$). Upper-body flexibility: Significant improvement in BS post-intervention ($p = 0.002$). Static balance: Significant improvement in blind flamingo test post-intervention ($p &lt; 0.001$). Motor agility/dynamic balance: Significant improvement in TUG test post-intervention ($p &lt; 0.001$). Aerobic endurance: Significant improvement in 6-minute walk post-intervention ($p = 0.006$). Fibromyalgia impact/symptomatology: Significant improvement in FIQ subscales: stiffness ($p = 0.005$), pain, morning tiredness post-intervention (all $p &lt; 0.001$). QoL: Significant improvements in SF-36 subscales physical role, general health, physical function, social functioning, and mental health post-intervention ($p &lt; 0.001$), and at detraining (excluding physical role) ($p$-value not reported). Coping strategies: Significant improvement in VPMI active coping post-intervention and after detraining ($p$-value not reported) ($p = 0.019$). Self-esteem: Significant improvement in RSES post-intervention ($p = 0.005$). |</p>
<table>
<thead>
<tr>
<th>Study Year</th>
<th>Intervention</th>
<th>Outcome Measure</th>
<th>Change Description</th>
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</thead>
<tbody>
<tr>
<td>Sarmento 2020</td>
<td>Qi gong</td>
<td>Pressure pain threshold</td>
<td>Dolorimeter (pressure pain threshold)</td>
</tr>
<tr>
<td>Sawynok 2013</td>
<td>Qi gong</td>
<td>QoL (physical and mental function) and patient satisfaction</td>
<td>SF-36 Physical subscale (physical QoL), SF-36 Mental subscale (mental QoL), and Patient Satisfaction Scale (patient satisfaction)</td>
</tr>
<tr>
<td>Segura-Jimenez 2014</td>
<td>Tai chi</td>
<td>Tender points</td>
<td>Pressure algometer (tender points)</td>
</tr>
<tr>
<td>Van Gordon 2017</td>
<td>MAT</td>
<td>General distress, Attachment (to self, symptoms, and environment), and civic engagement</td>
<td>DASS (general distress), NAS (attachment), and record of work hours (civic engagement)</td>
</tr>
<tr>
<td>Verkaik 2014</td>
<td>Guided Imagery</td>
<td>Self-efficacy</td>
<td>CPSS (self-efficacy)</td>
</tr>
<tr>
<td>Wong 2018</td>
<td>Tai chi</td>
<td>Heart rate variability (HRV), flexibility, muscle strength, and body composition</td>
<td>Cardiac autonomic modulation (HRV), SRT (flexibility), and 1RM test on leg extension machine (muscle strength), and an eight-polar tactile electrode impedance meter (body composition)</td>
</tr>
<tr>
<td>Flexibility: Significant improvement in the SRS post-intervention (p = 0.001).</td>
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<tr>
<td>Muscle strength: Significant improvement in 1RM post-intervention (p = 0.001).</td>
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<tr>
<td>Wu 2021</td>
<td>Biofeedback</td>
<td>FM function, sleep latency, and cognitive function</td>
<td>FIQR function, overall FIQR and FIQR symptoms (FM function), sleep onset latency in minutes (sleep latency), and PVT and DSTs (cognitive function)</td>
</tr>
<tr>
<td>Yoo 2022</td>
<td>PMR</td>
<td>Perceived stress, systolic/diastolic blood pressure, heart rate, and serum cortisol levels</td>
<td>PSS (perceived stress), electronic sphygmomanometer (systolic/diastolic blood pressure and heart rate), and blood samples (serum cortisol levels)</td>
</tr>
</tbody>
</table>
1RM: one repetition maximum; ASES: Arthritis Self-Efficacy Scale; BPI: Brief Pain Inventory; BS: back scratch test; CEQ: Credibility/Expectancy Questionnaire; CPAQ: 20-item Chronic Pain Acceptance Questionnaire; CPSS: Chronic Pain Self-Efficacy Scale; CSQ: Coping Strategies Questionnaire; CSR: chair sit and reach test; DASS: Depression, Anxiety, and Stress Scale; DST: Digit Span Test; ECG: electrocardiogram; EEG: electroencephalogram; FFMQ: Five Facets of Mindfulness Questionnaire; FibroQoL: multicomponent intervention for Fibromyalgia; FIQ: Fibromyalgia Impact Questionnaire; FIOR: Fibromyalgia Impact Questionnaire Revised; FM: fibromyalgia; FMI: Freiburg Mindfulness Inventory; fMRI: functional magnetic resonance imaging; FSDC: Fibromyalgia Survey Diagnostic Criteria; GSES: General Self-Efficacy Scale; HADS: Hospital Anxiety and Depression Scale; HAQ: Health Assessment Questionnaire; MAT: Meditation Awareness Training; MBSR: Mindfulness-Based Stress Reduction; MISCI: Multidimensional Inventory of Subjective Cognitive Impairment; MOS: MOS Social Support Survey; NAS: Non-Attachment Scale; NFB: neurofeedback; OSE: self-efficacy for managing other symptoms; PCS: Pain Catastrophizing Scale; PIPS: Psychological Inflexibility in Pain Scale; PMR: Progressive Muscle Relaxation; PSIC: Pain-Specific Impression of Change; PSQI: Pittsburgh Sleep Quality Inventory/Pittsburgh Sleep Quality Index; PSS: Perceived Stress Scale; PVT: Psychomotor Vigilance Test; QoL: Quality of Life; RPE: Borg Scale of Perceived Exertion; RSES: Rosenberg Self-Esteem Scale; SCBT: Sensory Integration for Balance Test; SCL-90-R: Symptom Checklist 90 Revised; SCS-12: Self-Compassion Scale; SF-36: 36-item Short-form Health Survey; SLS: single leg stance test; SMR: Sensorimotor rhythm; SRS: Sit and Reach Score; SRT: Sit and Reach Test; TAU: treatment-as-usual; TMS: Total Myalgic Score; TPC test: Tender Point Count test; TPS: Tender Point Score; TSK: Tampa Scale for Kinesiophobia; TUG test: 8-Foot Timed Get Up and Go test; VMPCI: Vanderbilt Multidimensional Pain Coping Inventory; VPMI: Vanderbilt Pain Management Inventory; WPI: Widespread Pain Index.