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**ADMINISTRATIVE INFORMATION****Support** - No external funding received. This review is conducted as part of a doctoral dissertation at National Yang Ming Chiao Tung University.**Review Stage at time of this submission** - Completed but not published.**Conflicts of interest** - The authors declare no conflicts of interest. This review is conducted as part of a doctoral dissertation and received no funding from exercise equipment manufacturers, pharmaceutical companies, or any other commercial entities.**INPLASY registration number:** INPLASY202650067**Amendments** - This protocol was registered with the International Platform of Registered Systematic Review and Meta-Analysis Protocols (INPLASY) on 11 May 2026 and was last updated on 11 May 2026.**INTRODUCTION**

**Review question / Objective** This systematic review and network meta-analysis aims to compare the effectiveness of six therapeutic exercise modalities — aerobic exercise, aquatic exercise, resistance training, flexibility exercise, mind-body exercise, and mixed exercise — in reducing the overall impact of fibromyalgia in women, as measured by the Fibromyalgia Impact Questionnaire (FIQ/FIQR) at 12 weeks.

Using the PICOS framework:

- P: Adult women diagnosed with fibromyalgia according to ACR criteria (1990, 2010, or 2016)
- I: Any therapeutic exercise modality as the sole intervention
- C: Usual care, no intervention, placebo, or alternative exercise modality

- O: FIQ/FIQR total score at 12 weeks (primary); dropout rates at 12 weeks (secondary)
- S: Randomized controlled trials only.

**Rationale** Fibromyalgia is a prevalent chronic pain syndrome disproportionately affecting women, with a female-to-male ratio as high as 13.7:1. The condition imposes a substantial burden across physical, psychological, and social domains, resulting in significant impairment of health-related quality of life. Therapeutic exercise has demonstrated broad benefits for this population; however, existing systematic reviews and pairwise meta-analyses do not enable simultaneous comparison of all available exercise modalities, and the optimal exercise prescription for women with fibromyalgia remains unclear.

Network meta-analysis (NMA) enables the simultaneous comparison of multiple interventions

within a single analytical framework, thereby facilitating comprehensive treatment ranking. By applying NMA methodology and restricting included studies to a standardized 12-week intervention timeframe — the most frequently reported assessment period in the literature — this review aims to generate robust, evidence-based guidance on which exercise modality yields the greatest reduction in fibromyalgia impact as measured by the FIQ/FIQR. Such evidence may ultimately support clinicians and patients in making informed, individualized decisions regarding therapeutic exercise selection.

**Condition being studied** Fibromyalgia is a chronic, centrally mediated pain syndrome characterized by widespread musculoskeletal pain, persistent fatigue, sleep disturbances, cognitive impairment, and psychological distress. It predominantly affects women, with an estimated prevalence of 1.2% to 5.4% in the general population depending on the diagnostic criteria applied. The overall impact of fibromyalgia is assessed using the Fibromyalgia Impact Questionnaire (FIQ) or its revised version (FIQR), which captures disease burden across multiple domains including physical functioning, work ability, fatigue, sleep, pain, stiffness, anxiety, and depression. Despite its high prevalence, fibromyalgia remains frequently underdiagnosed and inadequately managed in clinical practice.

## METHODS

**Search strategy** Systematic electronic searches were conducted across five major databases: PubMed, Cochrane Library, Web of Science, MEDLINE, and CINAHL, from inception to April 20, 2026. No language restrictions were applied.

The search strategy combined controlled vocabulary (MeSH terms) and free-text keywords across three domains:

Population: "Fibromyalgia" OR "Fibrositis" OR "Fibromyalgia Syndrome"

Intervention: "Exercise Therapy" OR "Resistance Training" OR "Strength Training" OR "Aerobic Exercise" OR "Aquatic Exercise" OR "Water Exercise" OR "Hydrotherapy" OR "Mind-body Exercise" OR "Yoga" OR "Pilates" OR "Tai Chi" OR "Flexibility Exercise" OR "Stretching" OR "Mixed Exercise" OR "Combined Exercise" OR "Physical Activity"

Outcome: "Fibromyalgia Impact Questionnaire" OR "FIQ" OR "FIQR" OR "quality of life" OR "disease

impact" OR "disease severity" OR "health-related quality of life"

Reference lists of relevant systematic reviews and meta-analyses identified during the database search were manually screened to identify additional eligible studies not captured by the electronic search.

**Participant or population** Adult women (aged 18 years or older) diagnosed with fibromyalgia according to the American College of Rheumatology (ACR) classification criteria (1990, 2010, or 2016). Studies exclusively enrolling male participants or mixed-sex samples without providing sex-stratified outcomes for women were excluded. No restrictions were applied regarding age, ethnicity, disease duration, or country of origin.

**Intervention** Any form of therapeutic exercise as the sole intervention in at least one study arm, categorized into six modalities:

1. Aerobic exercise (e.g., walking, treadmill, cycling)
2. Aquatic exercise (e.g., water aerobics, aquatic biondance, swimming)
3. Resistance training (e.g., weight training, elastic band exercises, machine-based strength training)
4. Flexibility exercise (e.g., stretching programs targeting major muscle groups)
5. Mind-body exercise (e.g., yoga, Pilates, Tai Chi)
6. Mixed exercise (combination of two or more distinct modalities within a single intervention arm)

All interventions were delivered over a 12-week period. Exercise protocols involving non-exercise components (e.g., pharmacological treatment, cognitive behavioral therapy, acupuncture, or nutritional supplementation) were excluded from the network.

**Comparator** The following comparator conditions were eligible:

1. Usual care (standard medical management without structured exercise)
2. No intervention / waitlist control
3. Placebo condition
4. An alternative therapeutic exercise modality (for head-to-head comparisons between exercise types)

Comparisons involving non-exercise interventions such as pharmacological treatments, cognitive behavioral therapy, manual therapy, or

acupuncture were excluded to maintain network transitivity and analytical coherence.

**Study designs to be included** Randomized controlled trials (RCTs) only. Non-randomized designs including observational studies, quasi-experimental trials, and uncontrolled before-after studies were excluded.

**Eligibility criteria** Inclusion criteria:

1. Randomized controlled trials enrolling adult women diagnosed with fibromyalgia according to ACR criteria (1990, 2010, or 2016)
2. Studies investigating therapeutic exercise as the sole intervention in at least one arm
3. FIQ or FIQR total score reported as an outcome measure
4. Pre- and post-intervention FIQ/FIQR data available at 12 weeks or nearest assessment point

Exclusion criteria:

1. Non-randomized study designs
2. Both arms receiving the same exercise modality
3. No FIQ/FIQR outcome measure
4. FIQ/FIQR subscale scores only, without validated total score
5. Incomplete or unavailable outcome data not obtainable from authors
6. Overlapping participant samples with another included trial
7. Comparisons involving non-exercise interventions (pharmacological, CBT, acupuncture, manual therapy)
8. Studies including male participants without sex-stratified outcomes.

**Information sources** Electronic databases searched (inception to April 20, 2026):

1. PubMed
2. Cochrane Library
3. Web of Science
4. MEDLINE
5. CINAHL (Cumulative Index to Nursing and Allied Health Literature)

Additional sources:

- Manual screening of reference lists of relevant systematic reviews and meta-analyses
- Corresponding authors contacted via email when outcome data were incomplete or unavailable in published articles

No language restrictions were applied.

**Main outcome(s)** Primary outcome: Change in fibromyalgia impact as measured by the Fibromyalgia Impact Questionnaire (FIQ) or its

revised version (FIQR) total score at 12 weeks after intervention commencement.

Effect measure: Standardized mean difference (SMD) with 95% confidence intervals, calculated from pre- and post-intervention mean and standard deviation values. All FIQ/FIQR scores were standardized to a common 0–100 scale prior to data synthesis to ensure consistency across included studies.

Timing: 12 weeks (or nearest available assessment point where 12-week data were not explicitly reported).

**Additional outcome(s)** Secondary outcome: Risk difference (RD) of dropout rates at 12 weeks, calculated as the difference in dropout proportions between each therapeutic exercise intervention group and the control group. A risk difference whose 95% confidence interval overlaps zero indicates no statistically significant difference in dropout rates, suggesting comparable acceptability between groups.

Treatment ranking: Surface under the cumulative ranking curve (SUCRA) will be used to rank all exercise modalities according to their comparative effectiveness.

**Data management** Data extraction was performed independently by two reviewers using a standardized extraction form. Extracted data included: reference details, sample characteristics, diagnostic criteria, exercise intervention details (modality, frequency, intensity, duration per F.I.T.T. principles), follow-up timepoints, and FIQ/FIQR outcome data (pre- and post-intervention mean and SD) and dropout numbers per group.

For studies reporting outcomes as median and interquartile range, validated conversion methods were applied. Discrepancies between reviewers were resolved through discussion or consultation with a third reviewer. Corresponding authors were contacted when required data were unavailable in the published report.

**Quality assessment / Risk of bias analysis**

Methodological quality of all included randomized controlled trials was assessed using the Cochrane Risk of Bias tool version 2 (RoB 2), evaluating five domains:

1. Bias arising from the randomization process
2. Bias due to deviations from intended interventions
3. Bias due to missing outcome data

4. Bias in outcome measurement
5. Bias in selection of the reported result

Each domain was rated as low risk, some concerns, or high risk. An overall risk of bias judgment was assigned to each study. Assessment was performed independently by two reviewers, with disagreements resolved by discussion or third-reviewer consultation.

**Strategy of data synthesis** A frequentist network meta-analysis was performed using MetaInsight (version 4.0.2, NIHR Complex Reviews Support Unit, UK), leveraging the netmeta package in R. A random-effects model was adopted to account for anticipated clinical and methodological heterogeneity.

A network plot was generated to display the geometry of available evidence, with node size proportional to sample size and edge thickness reflecting the number of direct comparisons. Effect sizes were reported as SMD with 95% CI for the primary outcome and RD with 95% CI for the secondary outcome.

Treatment rankings were estimated using SUCRA. League tables presented both direct and indirect comparison estimates. Inconsistency tests were conducted to detect disparities between direct and indirect evidence. Statistical significance was defined as  $p < 0.05$  (two-tailed).

A pre-post correlation coefficient of 0.8 was applied as recommended by the Cochrane Handbook.

**Subgroup analysis** No formal subgroup analyses were pre-specified. Sensitivity analyses were conducted as follows:

1. One-study removal analysis: each study was sequentially removed to assess the influence of individual studies on overall results and treatment rankings.
2. Pre-post correlation coefficient sensitivity analysis: effect sizes were recalculated using a correlation coefficient of 0.5 to examine robustness of findings relative to the primary coefficient of 0.8.

**Sensitivity analysis** Two sensitivity analyses were conducted:

1. One-study removal analysis: Each included study was sequentially removed from the primary network meta-analysis to assess whether any single study exerted undue influence on the overall

effect estimates and treatment rankings. Consistency of direction, magnitude, statistical significance, and SUCRA rankings were evaluated across all iterations.

2. Pre-post correlation coefficient analysis: The primary analysis applied a correlation coefficient of 0.8 as recommended by the Cochrane Handbook. A sensitivity analysis was conducted using a coefficient of 0.5 to examine whether the assumed correlation value influenced the direction, magnitude, statistical significance, or ranking of results.

**Language restriction** No language restrictions were applied. Studies published in any language were eligible for inclusion.

**Country(ies) involved** Taiwan.

**Other relevant information** This systematic review and network meta-analysis was conducted as part of a doctoral dissertation at the School of Nursing, National Yang Ming Chiao Tung University, Taiwan. Data extraction and analysis were completed prior to protocol registration due to timeline constraints. This registration is submitted to ensure transparency of the review methodology. The review was conducted and reported in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses extension statement for network meta-analyses (PRISMA-NMA).

**Keywords** Fibromyalgia; women; therapeutic exercise; network meta-analysis; Fibromyalgia Impact Questionnaire; FIQ; FIQR; mind-body exercise; resistance training; aquatic exercise; randomized controlled trials.

**Dissemination plans** The results of this systematic review and network meta-analysis will be submitted for publication in an international peer-reviewed nursing or rehabilitation journal. The findings will also be presented as part of a doctoral dissertation at the College of Nursing, National Yang Ming Chiao Tung University, Taiwan, and may be presented at relevant academic conferences.

#### **Contributions of each author**

Author 1 - Shu-Hua Huang - conceived the study, designed the search strategy, conducted database searches, performed study selection, extracted data, conducted the network meta-analysis, and drafted the manuscript.

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