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Effects of Mind-body exercise intervention on anxiety among women: A meta-analysis

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ADMINISTRATIVE INFORMATION

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Conflicts of interest - None declared.

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Amendments - This protocol was registered with the International Platform of Registered Systematic Review and Meta-Analysis Protocols (INPLASY) on 10 June 2025 and was last updated on 10 June 2025.

INTRODUCTION

Review question / Objective Using a meta-analytic framework, this study investigates the effects of mind-body exercise (MBE) interventions on anxiety levels in women, with the explicit exclusion of pregnant individuals and cancer patients. The research aims to synthesize specific parameter data (e.g., duration, frequency, intensity) across diverse MBE modalities, including tai chi, yoga, and qigong. The following research hypotheses are proposed:
Hypothesis 1: Mind-body exercise have a significant effect on reducing anxiety in women.
Hypothesis 2: Of all forms of exercise, Pilates shows the most significant effect in reducing anxiety levels in women.
Hypothesis 3: The optimal frequency of intervention is three times per week
Hypothesis 4: The optimal duration of each intervention is 90 minutes.
Hypothesis 5: A duration of 8 - 12 weeks for the entire exercise intervention will produce the best results.
Hypothesis 6: Studies conducted outside the national context are likely to report larger effect sizes in reducing anxiety among female pa.

Condition being studied Anxiety disorders are a leading cause of psychological distress worldwide, with women facing a significantly higher burden than men due to biological, psychological, and sociocultural factors (McLean et al., 2011). Biologically, susceptibility is rooted in estrogen fluctuations and genetic polymorphisms (e.g., COMT, 5-HTTLPR), which modulate neural reactivity to stress and emotional regulation (Schweizer-Schubert et al., 2021).Psychologically, cognitive patterns such as rumination (persistent negative self-reflection) and perfectionism exacerbate emotional dysregulation, fostering chronic anxiety through self-critical attribution of stressors (Flett et al., 2016).The main causes of

female anxiety at the social level are the double burden of workplace difficulties caused by gender inequality and family work, as well as the industrialization of appearance anxiety and the intensified stereotypes of traditional gender roles(Powell, 2018).The issue of female anxiety has become increasingly prominent in today's soc.

METHODS

Search strategy Literature searches were conducted across major Chinese and English databases on May 10, 2025. The search encompassed the China National Knowledge Infrastructure (CNKI) for Chinse literature, and Web of Science, PubMed, Cochrane Library, Embase, and Scopus, for English publications. The search period covered all available literature from the inception of each database through May 10, 2025.
The search strategy employed two groups of keywords for both Chinese and English databases, combined using Boolean operators. For Chinese databases, the first keyword group included: “mind-body exercise,”“physical activity,” “movement,” “tai chi,” “yoga,” “qigong,” “pilates,” and “Baduanjin.” The second group comprised “anxiety” and “mental health.” For English databases, the first keyword group consisted of “exercises,” “physical exercise,” “physical activity,” “tai chi,” “yoga,” “qigong,” “pilates,” and “Baduanjin.”The second group included “anxiety,” “angst,” “nervousness,” “hypervigilance,” “social anxiety,” “anxiety s.

Participant or population Groups of women of all ages suffering from anxiety.

Intervention The interventions were restricted to mind–body exercises, such as Pilates, Tai Chi, yoga, or Baduanjin, with each session lasting a minimum of 30 minutes and being administered multiple times throughout the intervention period.

Comparator Control conditions were limited to non-exercise activities or maintaining routine lifestyles.

Study designs to be included Under Review Manager 5.3 and Stata17.0, subgroup analyses were conducted on data from 1044 subjects across 17 studies from Chinese and English literature. The analyses examined intervention measures, weekly frequency, duration of a single intervention, total intervention period, country of location and age of participants. A random effects model was employed to assess the overall effect size and heterogeneity.

Eligibility criteria Studies in the form of conference abstracts, case reports, or systematic reviews were excluded from the analysis. Additionally, studies involving participants with a history of regular physical exercise lasting more than three months, as well as those employing cognitive therapy as a control condition, were excluded based on the predefined criteria. Furthermore, studies with missing pre- or post-intervention data and those published in languages other than Chinese or English were also excluded from the present analysis.

Information sources Literature searches were conducted across major Chinese and English databases on May 10, 2025. The search encompassed the China National Knowledge Infrastructure (CNKI) for Chinse literature, and Web of Science, PubMed, Cochrane Library, Embase, and Scopus, for English publications. The search period covered all available literature from the inception of each database through May 10, 2025.Two researchers independently conducted data extraction in strict accordance with a pre-established standardized protocol. In cases where data were incomplete or unclear, the researchers made systematic efforts to contact the corresponding authors via email. If no response was received within two weeks, a follow-up email was sent. Studies with data that remained missing or ambiguous after these communication efforts were excluded from the final analysis to ensure data integrity and reliability.

Main outcome(s) Two researchers independently conducted data extraction in strict accordance with a pre-established standardized protocol. The extracted data included key elements such as the first author’s name, publication year, study location, sample characteristics (including sample size and participant age), and comprehensive details of the intervention protocol, including intervention content, total duration, weekly session frequency, and individual session length. Additionally, outcome assessment measures were systematically collected. This study incorporated a total of 17 studies conducted in China, the United States, Turkey, Iran, Spain, and Malaysia, with a combined sample size of 1,044 participants. The sample encompassed a wide range of female populations, including female college students, postpartum women, breast cancer survivors, menopausal women, elderly women, and patients with diabetes or knee osteoarthritis. Participant ages ranged from young female college students (mean age: 19.16 ± 1.05 to 22.85 ± 1.26 years) to postmenopausal women (mean age: 69.98 ± 7.83 years). Sample sizes varied from 16 pairs (Turkish

young women) to 55 pairs (Spanish postmenopausal women), with Chinese studies comprising the majority (12 out of 17 studies). All interventions were classified as mind-body exercises. In the experimental groups, the interventions included Pilates (4 studies), Yoga (7 studies), Qigong (4 studies), and Tai Chi (2 studies). Control groups generally adopted conditions such as “maintaining daily life” or “routine care.” Intervention durations varied widely, ranging from 4 weeks (e.g., a U.S. study on Yoga for female college students) to 24 weeks (e.g., traditional fitness Qigong for menopausal and elderly women in China). Individual session durations typically ranged from 30 to 90 minutes, conducted 2 to 3 times per week. Anxiety outcomes were assessed using a variety of standardized instruments, including the SCL-90, SAS, STAI, GAD-7, BAI, and HADS. Several studies employed composite scales such as the HADS to evaluate both anxiety and depressive symptoms concurrently.

Quality assessment / Risk of bias analysis The methodological quality of the selected studies was appraised by applying the Physiotherapy Evidence Database (PEDro) scale. This scale consists of 11 items, with the first item not factored into the scoring process. For the remaining 10 items, a binary scoring system was employed: studies that satisfied the predefined criteria were awarded 1 point, while those that did not were given 0 points. Studies achieving a score of 6 or above were deemed to be of high quality. Two researchers independently evaluated each included article according to these PEDro scale guidelines. In instances where scoring discrepancies occurred, the disagreements were resolved either by consulting a third researcher or through collaborative discussions among the research team.

The Begg’s publication bias test was conducted using the .meta bias, begg command in Stata, with the effect size labeled as “Hedges’s g.”The analysis was based on the variables _meta_es (effect size) and _meta_se (standard error). The test yielded a Kendall’s score of -40.00, with a standard error of 24.276, a corresponding standard normal z-value of -1.69, and a two-tailed p-value of 0.1082. Using the conventional significance level of 0.05, the p-value exceeds the threshold, and thus the null hypothesis cannot be rejected. This indicates that there is insufficient evidence to suggest the presence of publication bias in the current meta-analysis on the effects of mind-body exercise interventions on anxiety levels in women. In other words, no significant selective publication effects related to study outcomes were detected in the publication process of the included literature.

Strategy of data synthesis The analysis of anxiety scale outcomes across selected studies was conducted using the random model in Revman 5.3 software. As the outcome measures were continue variables using consistent units, the standardized mean difference (SMD) was selected as the effect size metric. Effect sizes were interpreted according to (Cohen et al., 1983) guideline: SMD <0.2 indicating negligible effect, $0.2 \leq SMD < 0.5$ representing small effect, $0.5 \leq SMD < 0.8$ denoting medium effect, and SMD ≥ 0.8 signifying large effect.

Study heterogeneity was evaluated using the I^2 statistic. An I^2 value of zero indicates homogeneity among studies, warranting the use of a fixed-effects model for effect size aggregation. Conversely, I^2 values ≥50% suggest substantial heterogeneity, necessitating the application of a random-effects model and subsequent subgroup analyses to explore potential sources of variation.

Subgroup analysis Given the substantial heterogeneity observed in the overall effect size analysis, subgroup analyses were conducted to investigate potential moderating variables. Six intervention parameters were examined as potential sources of heterogeneity: intervention measures, weekly frequency, duration of a single intervention, total intervention period, country and age of participants (Table 4). These analyses aimed to systematically evaluate how variations in exercise program characteristics might influence intervention effectiveness.

Sensitivity analysis Figure 3 presents the sensitivity analysis chart generated using Stata software, designed to assess the stability of the meta-analysis results concerning the effects of mind-body exercise interventions on anxiety levels in women. This analysis was performed by sequentially omitting each included study to examine its impact on the overall effect size. The horizontal axis displays the estimated range of the effect size along with its confidence interval, while the vertical axis lists the individual studies, including "Kang 2018" and "Zhang 2023." Each dot in the figure represents the recalculated effect size after removing the corresponding study, and the accompanying vertical line indicates the revised confidence interval, with its lower and upper limits marked accordingly.The central objective of this sensitivity analysis is to evaluate how strongly a single study influences the combined effect estimate. If the removal of any individual study results in only minor fluctuations in the effect size and its confi.

Country(ies) involved China.

Keywords mind-body exercise, anxiety, women, female, mental health, effect size.

Contributions of each author

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