IJMS
Vol 50, No 3, March 2025

Review Article

# Effectiveness of Acupuncture and Acupressure for Improving the Sleep Quality of Menopausal Women: A Meta-Analysis

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Received: 02 June 2024
Revised: 02 September 2024
Accepted: 28 September 2024

## Abstract

**Background:** Various pharmacological and non-pharmacological treatments are utilized to address sleep disorders. This meta-analysis aimed to evaluate the effects of acupuncture and acupressure on enhancing sleep quality in menopausal women.

**Methods:** A systematic search was conducted using multiple databases, including Scopus, MEDLINE/PubMed, Cochrane CENTRAL, ProQuest, Google Scholar, and Iranian databases (SID, Iranmedex, Magiran) with no date restrictions up to July 2024. Studies published in both Persian and English were included in this meta-analysis. The search utilized keywords such as acupuncture, acupressure, sleep quality, insomnia, menopause, and sleep disorders. A pairwise random-effects meta-analysis was performed to calculate the mean difference (MD) and 95% confidence intervals (95% CIs).

**Results:** The analyses indicated that both acupuncture and acupressure effectively improved sleep quality in menopausal women. Eight trials with 499 participants demonstrated that acupressure significantly enhanced sleep quality (MD=-2.33, 95% CI=-3.27 to -1.38; $I^2$=94%, P<0.001, n=8). Additionally, six trials with 344 participants showed that acupuncture enhanced sleep quality (MD=-3.47, 95% CI=-5.06 to -1.88; $I^2$=97%, P<0.001, n=6).

**Conclusion:** The findings revealed that acupressure and acupuncture might improve sleep quality in menopausal women. However, there was a high heterogeneity between studies, and further research is required to confirm the findings of the present study.

Please cite this article as: Eskandari L, Keramat A, Rohani-Rasaf M. Effectiveness of Acupuncture and Acupressure for Improving the Sleep Quality of Menopausal Women: A Meta-Analysis. Iran J Med Sci. 2025;50(3):132-145. doi: 10.30476/ijms.2024.102726.3586.

**Keywords** ● Acupressure ● Acupuncture ● Sleep quality ● Menopause ● Meta-analysis

## What's Known

- Studies suggested that acupuncture might be a safe and effective treatment for insomnia in postmenopausal women and could have long-lasting effects.
- Acupressure was shown to significantly improve sleep quality and its various dimensions. It is a cost-effective and easily implemented method that can be valuable in this area.

## What's New

- This study is the first to investigate the effects of acupuncture and acupressure on postmenopausal women.
- This analysis revealed that both acupuncture and acupressure significantly improved sleep quality.

## Introduction

Menopause is a natural physiological transition that marks a significant phase in a woman's life, accompanied by various challenges. It is associated with common symptoms, such as depression, mood swings, hot flashes, night sweats, insomnia, osteoporosis, and other physical and mental complications. Among all these symptoms, sleep disturbances are particularly prevalent in menopausal women, and the decline in sleep quality has the most negative impact on women's daily function and overall quality of life.[1-4]

Menopausal insomnia is characterized by difficulty falling asleep, maintaining sleep, and experiencing early morning awakenings. Approximately 59% of middle-aged American women reported experiencing insomnia symptoms at least a few nights weekly.[5] Sleep is an essential aspect of human life, contributing to overall comfort and well-being.[6]

Insomnia is defined as "a complaint of insufficient sleep or lack of relaxation of the body after a period of normal sleep". Enough sleep can play an important role in maintaining homeostasis between illness and health due to its effect on the central nervous and immune systems.[7, 8]

Research indicated that women require more sleep than men, and 8-56% experience sleep disturbances during menopause.[9]

Nowadays, several non-drug treatments are considered complementary and alternative medicine.[6, 9] Acupuncture and acupressure are well-established therapeutic methods in traditional Chinese medicine, with a long history of use. Both methods are employed to prevent nausea, vomiting, and postoperative pain, reduce reliance on painkillers, alleviate anxiety, manage hot flashes, and menopausal insomnia.[6, 10, 11]

Acupressure is also a non-invasive method based on the principles of acupuncture, in which massage or other skin stimulation methods are applied to the acupoints.[12-14]

Abedian and others and Ahmadinezhad and colleagues reported the effectiveness of acupressure in improving sleep quality in postmenopausal women.[6, 15] Zhao and others showed that acupuncture enhanced sleep quality in menopausal women.[16] However, a study by Huang and others found no significant difference compared to the placebo group.[17]

Women's life expectancy has significantly increased during the 20th century, due to modern technology, medical advances, and living standards. The average life expectancy of women in Iran is 76-77 years.[18, 19] After reaching middle age, women still have approximately a third of their lives left.[20]

In contrast to the increase in life expectancy during the 20th century, the average age of menopause has remained relatively unchanged since ancient times.[21] It is estimated that approximately 95% of women will reach this age and spend a significant portion of their lives in this phase.[22]

For women undergoing menopause, insomnia is a major issue, and taking medications often has adverse side effects. Since ancient times, acupressure and acupuncture have been used as complementary therapies for various ailments. Recent studies have shown promising results in addressing menopausal symptoms in women, including sleeplessness.[4, 6, 24, 25]

Despite their popularity, there is limited evidence regarding the effectiveness of acupuncture and acupressure across various demographics. This meta-analysis aimed to systematically assess the available literature to establish the efficacy of acupuncture and acupressure in enhancing sleep quality in menopausal women. The findings of this review will be valuable to physicians, healthcare providers, and future research in this field.

## Materials and Methods

This systematic review and meta-analysis was conducted in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines.[25] The study protocol was approved by the Ethicals Committee of Shahroud University of Medical Sciences (code: IR.SHMU.REC.1403.069).

### *Search Strategy and Study Selection*

A comprehensive search was conducted in PubMed Central, MEDLINE, Cochrane Library, Scopus, Springer Link, Google Scholar, and Persian databases, such as SID, Iranmedex, and Magiran. There were no date restrictions during the search. However, only articles published in English and Persian until July 2024 were included in the review.

Relevant English keywords and their Persian equivalents, including acupuncture, acupressure, auricular acupressure, auricular acupuncture, sleep quality, insomnia, and menopause, were employed to identify pertinent articles. Additionally, the reference lists of these articles were manually reviewed to ensure a comprehensive search and to identify further potential sources.

The search strategy is outlined in table 1, which includes four databases and search engines.

### *Inclusion and Exclusion Criteria*

The included articles were selected based on the PICOS criteria (participants, intervention, comparison, outcomes, and study design). Articles were deemed relevant if they met the following criteria:

1. Participants: Menopausal women aged 40-60 diagnosed with sleep disruption, excluding those with primary insomnia.
2. Interventions: Traditional acupuncture, electroacupuncture, auricular acupuncture, acupressure, or auricular acupressure.

**Table 1:** Search strategy in four databases

| Databases | Search strategy | Results |
|---|---|---|
| PubMed (PubMed Central/ MEDLINE) | #1 (menopause[Title/Abstract]) OR (Postmenopause[Title/Abstract])) OR (perimenopause[Title/ Abstract]) | 4509 |
| | #2 (acupuncture[Title/Abstract])) OR (electroacupuncture[Title/Abstract])) OR (Auricular Acupuncture [Title/Abstract])) OR (acupressure[Title/Abstract])) OR (Auricular Acupressure[Title/ Abstract])) OR (auriculotherapy[Title/Abstract]) | 2225 |
| | #3 (Sham treatment[Title/Abstract])) OR (placebo [Title/Abstract])) OR (Randomized Controlled Trial[Title/Abstract]) | 15559 |
| | #4 (sleep disorder[Title/Abstract])) OR (sleep quality[Title/Abstract])) OR (insomnia[Title/Abstract]) | 7481 |
| | #5 # 1 AND #2 AND #3 AND #4 | 2632 |
| Cochrane library | #1 “acupuncture” OR “electroacupuncture” OR “auricular acupuncture” OR “acupressure” OR “auricular acupressure” OR Auriculotherapy | 25395 |
| | #2 “ sleep disorder” OR “ sleep quality” OR insomnia | 31626 |
| | #3 Menopause OR postmenopause OR Perimenopause | 18515 |
| | #4 placebo OR Sham control group OR Randomized controlled trial (RCT) | 448078 |
| | #5 #1 AND #2 AND #3 AND #4 | 334 |
| Scopus | TITLE-ABS- KEY ((menopause * OR Postmenopause * OR Perimenopause * AND (“acupuncture *” OR “ electroacupuncture *” OR “ Auricular Acupuncture *” OR “ acupressure *” OR “ Auricular Acupressure *” OR “ auriculotherapy “ AND “ Sham treatment*” OR “ placebo *” OR Randomized Controlled Trial AND “ sleep disorder *” OR “sleep pattern*” OR “ sleep quality *” OR “insomnia *”)) | 935 |

3. Comparison group: placebo
4. Outcome measures: Quantitative variables such as the Pittsburgh Sleep Quality Index (PSQI), Insomnia Severity Index (ISI), and a sleep status questionnaire.
5. Study design: Randomized controlled trials.
6. Language: Studies published in either Persian or English.

Exclusion criteria included studies with insufficient information, inability to access full-text articles, studies conducted in different populations, single-group study designs, low-quality studies, and those using reflexology and foot massage methods. Additionally, other types of articles, such as reviews, letters, and case reports, were excluded from the analysis. This ensured that the present study focused solely on randomized controlled trials examining the effects of acupuncture and acupressure on insomnia in menopausal women.

*Data Extraction and Quality Assessment*

Two independent researchers (L.E. and M.R.) conducted a comprehensive evaluation of the titles, abstracts, and full-text reviews of the selected studies. Disagreements were resolved by consensus or consultation with a third researcher (A.K).

The quality of the included studies was rigorously assessed using the Cochrane Group’s Risk of Bias tool for randomized controlled trials (RoB 2.0). This assessment was conducted using the RevMan software, developed by the Cochrane Collaboration (Copenhagen, Denmark).[26]

*Statistical Analysis*

This meta-analysis was performed using Cochrane Collaboration Review Manager Software (RevMan, version 5.1, Cochrane Collaboration, London, England) and Stata Software (version 17.0., Stata Corp LLC., College Station, Texas, USA).

The results were reported as mean differences (MD) along with 95% confidence intervals (CIs). In accordance with the guidelines outlined in the Cochrane Handbook for Systematic Reviews of Interventions, MDs and their corresponding 95% CIs were calculated. Heterogeneity was assessed using the Cochrane Q statistic and quantified by the $I^2$ statistic ($I^2 \geq 50\%$ and $PQ < 0.01$).[27]

## Results

*Description of Studies*

A comprehensive database search yielded 6,003 eligible articles. After removing 4,742 duplicates, 1,261 articles remained. Following title and abstract screening, 1,083 studies were excluded due to irrelevance to the research question, leaving 178 articles for full-text review. After a thorough full-text review by the researchers, 164 articles were excluded for various reasons, including combination therapy (78 articles), lack of randomization (34 articles), non-English or non-Persian language (13 articles), different treatment for controls (31 articles), incomplete data reporting (8 articles). Consequently, 14 articles remained for meta-analysis (figure 1).

*Study Characteristics*

All clinical trials included in this meta-analysis of acupressure and acupuncture employed placebo-controlled designs. Key information

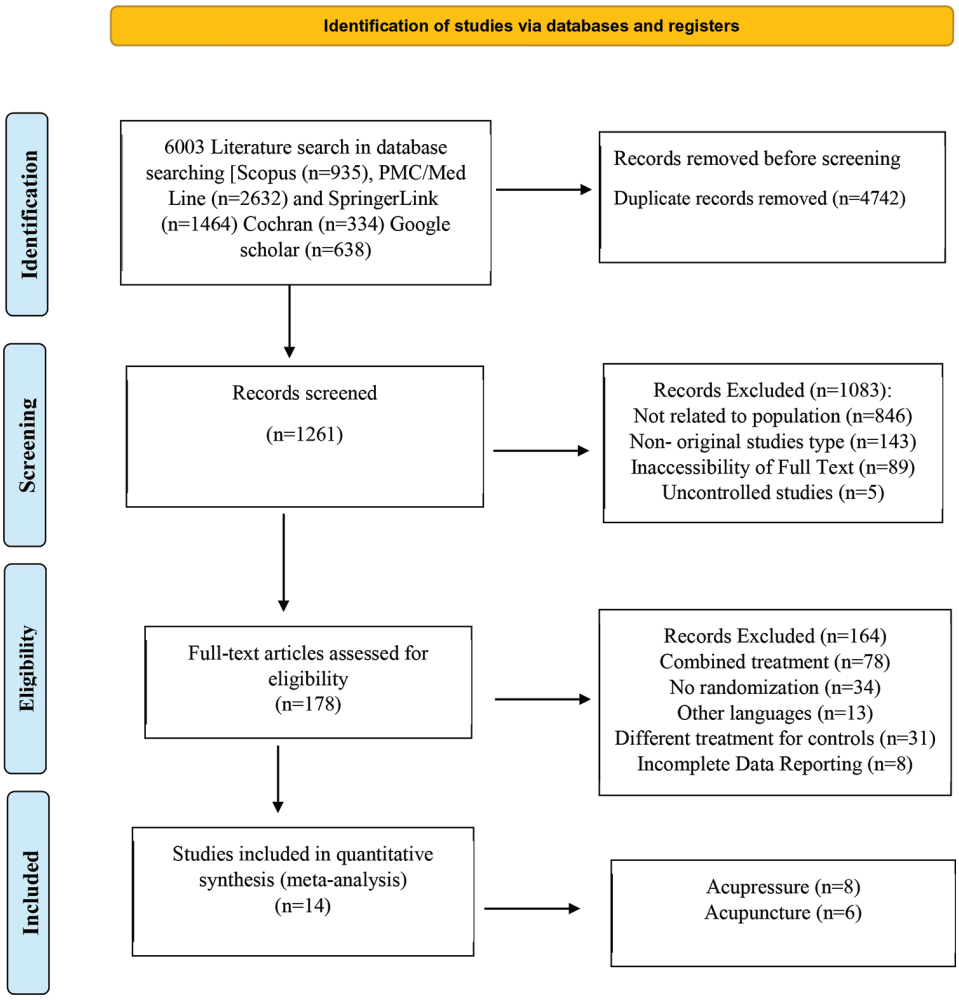


**Figure 1:** The flow diagram shows the study selection strategies according to the PRISMA guidelines.

was extracted from each study, which included the first author's name, country, publication year, detailed information about the intervention, duration of intervention, a summary of key findings (including any statistically significant results), study design, sample size, and other relevant information (table 2).

For studies in which the authors did not report their final results in the published article, the corresponding authors were contacted via email to request the missing data. Following that, one author provided the final data, and the study was subsequently included in the analysis.

As shown in table 2, half of the acupressure studies were conducted by Iranian researchers, while the other half were carried out by researchers from South Korea and Taiwan. Six studies focused on auricular acupressure, while two examined acupressure applied to other body regions. In contrast, acupuncture studies were predominantly conducted in China (five out of six), with one study conducted in the USA. Acupuncture was administered at various anatomical points across all studies.

*Analysis of Intervention*

Six trials involving 344 participants reported on the impact of acupuncture on sleep quality, revealing that acupuncture significantly improved sleep quality ([MD=-3.47, 95% CI=-5.06, -1.88]; $I^2$=97%, P>0.001; figure 2).[16, 17, 34, 36, 37]

Eight trials with 499 participants examined the effects of acupressure on sleep quality.[6, 7, 29-33, 38] The results indicated that acupressure was effective in improving sleep quality, ([MD=-2.33, 95% CI=-3.27, -1.38]; $I^2$=94%, P<0.001; figure 3).

Most studies utilized the PSQI to assess sleep quality, except for Cha and others, who employed the Sleep Status tool.[7]

*Risk of Bias*

In this meta-analysis, the risk of bias in the included studies was evaluated based on selection, performance, detection, attrition, and reporting bias, as well as sample size criteria. Overall, the risk of bias was deemed high for most studies, particularly in the domains of participant and personnel blinding and outcome assessment blinding.

Sensitivity analyses were conducted to assess the impact of excluding studies with a high risk of bias. The risk of bias in the studies on acupuncture is shown in figures 4a and b, and in the studies on acupressure in figures 5a and b.

High heterogeneity was observed among the studies of both acupuncture and acupressure. To identify potential sources of this heterogeneity, a leave-one-out sensitivity analysis was conducted. This method involves sequentially removing each study from the meta-analysis and recalculating the effect size and heterogeneity. Thereby, it was possible to assess the influence of individual studies on the overall results. The sensitivity analysis revealed that removing any single study did not significantly alter the overall heterogeneity in either the acupuncture or acupressure groups. Figures 6 and 7 graphically illustrate these findings.

**Table 2:** Summary of articles conducted to investigate the effect of acupressure and acupuncture on the sleep quality of menopausal women

| N | Authors, Year of publication | Country | Sample size Int/p | Study design | Duration of intervention | Findings | Type of intervention | Tool |
|---|---|---|---|---|---|---|---|---|
| 1 | Hadizadeh-Talasaz, 2023[28] | Iran | Intervention: 40 Placebo: 40 | A randomized, double-blind clinical trial | Pressure of ear seeds daily for 4 weeks in certain places of the ear | After the intervention, sleep quality significantly improved in the intervention group (P<0.001). | Auricular Acupressure | PSQI |
| 2 | Kim, 2024[29] | Korea | Intervention: 24 Placebo: 24 | A randomized single-blind, clinical trial | One session weekly for 8 consecutive weeks, and then an 8-week follow-up | The PSQI questionnaire showed significant differences over time in the intervention group (P<0.001). | Acupressure | PSQI |
| 3 | Eidani, 2022[30] | Iran | Intervention: 41 Placebo: 41 | A randomized, double-blind clinical trial | Pressure of Vaccaria seeds daily for 4 weeks in certain places of the ear | The mean scores of the total sleep quality score showed a significant difference (P<0.001) before and after the intervention in the intervention group. | Auricular Acupressure | PSQI |
| 4 | Ryu, 2020[31] | Korea | Intervention: 25 Placebo: 27 | A randomized, double-blind clinical trial | Pressure of Vaccaria seeds every night for 5 weeks in certain places of the ear | The study reported a significant difference between the intervention and control groups. | Acupressure | PSQI |
| 5 | Cha, 2017[7] | Korea | Intervention: 35 Placebo: 32 | A randomized, double-blind clinical trial | 2 times per week, for 2 weeks | A significant difference was observed between the intervention and placebo groups. | Auricular Acupressure | Sleep status |
| 6 | Abedian, 2015[6] | Iran | Intervention: 37 Placebo: 36 | A randomized, double-blind clinical trial | Three times a week for 4 weeks | A significant difference was observed between the intervention and placebo groups. | Acupressure | PSQI |
| 7 | Lo, 2013[32] | Taiwan | Intervention: 14 Placebo: 13 | A randomized, single-blind clinical trial | Both groups received magnetic press pellets for 3 weeks, but only the experimental group applied pressure three times daily. | A notable difference was observed between the intervention and placebo groups. | Auricular Acupressure | PSQI |
| 8 | Ozgoli, 2012[33] | Iran | Intervention: 35 Placebo: 35 | A randomized, single-blind clinical trial | Three times a week for 3 weeks | There was a significant difference between the intervention and placebo groups (P<0.001). | Acupressure | PSQI |

| N | Authors, Year of publication | Country | Sample size Int/p | Study design | Duration of intervention | Findings | Type of intervention | Tool |
|---|---|---|---|---|---|---|---|---|
| 9 | Zhao, 2023[16] | China | Intervention: 35 Placebo: 35 | A randomized, single-blind clinical trial | 17 sessions over 8 weeks and after16-week follow-up | The PSQI indicated significant differences over time in the intervention group (P<0.001); however, no significant differences were found between baseline and 16-week follow-up in both groups (P=0.08). | Acupuncture | PSQI |
| 10 | Li, 2020[34] | China | Intervention: 42 Placebo: 42 | A randomized, single-blind clinical trial | 18 times over 8 weeks and 20-week follow-up | The electroacupuncture intervention proved more effective than the placebo treatment in menopausal women with sleep disorders (P<0.001). | Acupuncture | PSQI |
| 11 | Zhao, 2019[35] | China | Intervention: 35 Placebo: 35 | A randomized, single-blind clinical trial | 17 sessions over 8 weeks | The PSQI questionnaire showed significant differences over time in the intervention group (P<0.001). | Acupuncture | PSQI |
| 12 | Fu, 2017[36] | China | Intervention: 38 Placebo: 38 | A randomized, single-blind clinical trial | Three times a week for 3 weeks and 10 times in total | After the intervention, according to the PSQI Index and PSG data, acupuncture significantly enhanced sleep efficiency and total sleep duration (P<0.001). | Acupuncture | PSQI |
| 13 | Hachul, 2012[37] | China | Intervention: 9 Placebo: 9 | A randomized, single-blind clinical trial | 10 times for 5 weeks | According to the Pittsburgh Sleep Quality Questionnaire, the acupuncture group showed significant improvement compared to the placebo group. | Acupuncture | PSQI |
| 14 | Huang, 2006[17] | America | Intervention: 12 Placebo: 17 | A randomized, double-blind clinical trial | 7 weeks, including 9 acupuncture sessions | The results after intervention were not significant in the two groups (P=0.17). | Acupuncture | PSQI |

ROB: Risk of bias; ISI: Insomnia severity index; PSQI: Pittsburgh Sleep Quality Index; Int: Intervention; P: Placebo; PSG: Polysomnography

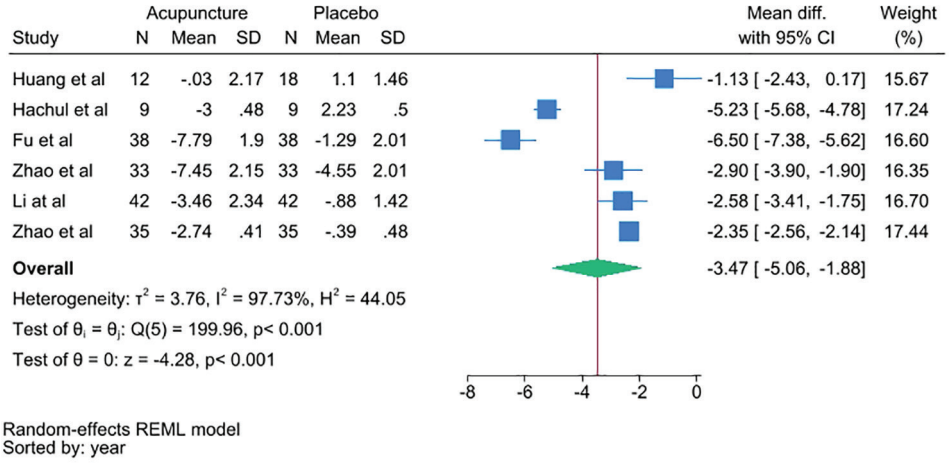


**Figure 2:** The forest plots display the comparison of acupuncture and placebo ([MD=-3.47, 95% CIs=-5.06 to -1.88]; $I^2$=97%, P<0.001).

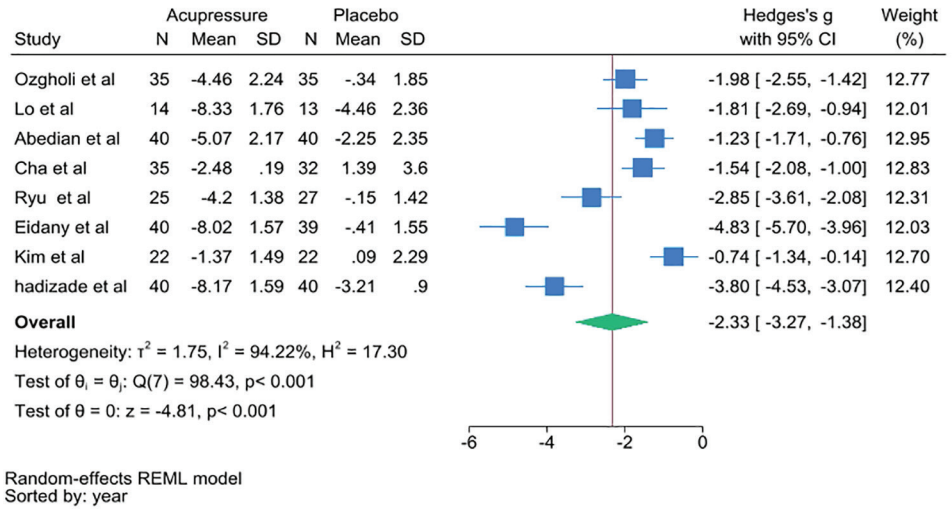


**Figure 3:** The forest plots show the comparison of acupressure versus placebo ([MD=-2.33, 95% CIs=-3.27 to -1.38]; $I^2$=94%, P<0.001).

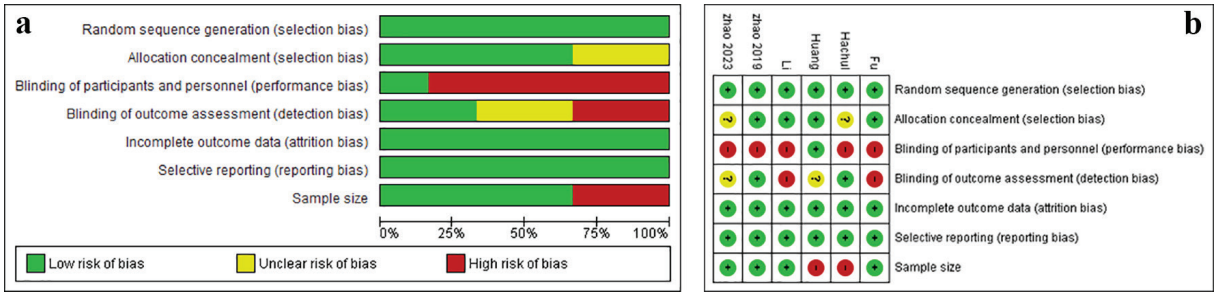


**Figure 4:** a) The risk of bias graph illustrates the comparison between acupuncture and placebo, and b) The summary of the risk of bias provides an overview of this comparison.

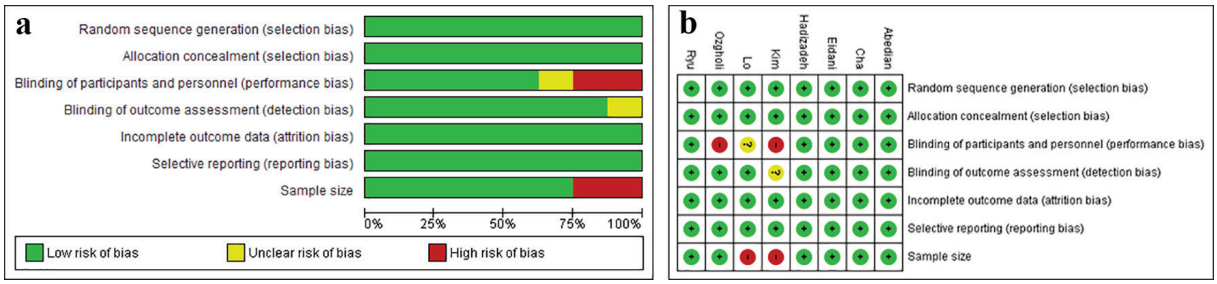


**Figure 5:** a) The risk of bias graph illustrates the comparison between acupressure and placebo, and b) The summary of the risk of bias provides an overview of the comparison between acupressure and placebo.

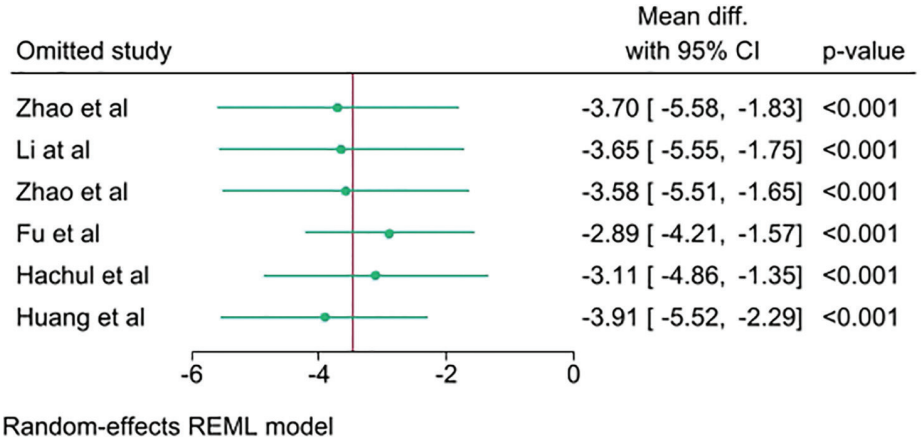


**Figure 6:** The Leave-one-out sensitivity analysis shows the impact of removing each study on the results for the acupuncture and placebo groups.

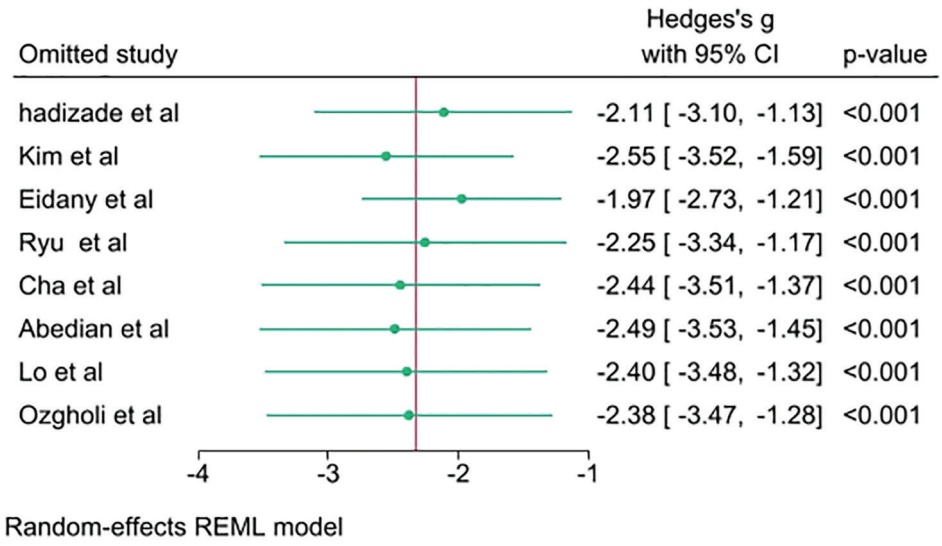


**Figure 7:** The Leave-one-out sensitivity analysis shows the impact of removing each study on the results for the acupressure and placebo groups.

Subgroup analysis is a common approach for exploring the sources of heterogeneity in meta-analyses.[39] While subgrouping was not feasible for the acupuncture studies, the acupressure studies were categorized into two subgroups; acupressure and auricular acupressure; based on the intervention methods employed.

Despite the efficacy of both techniques, no statistically significant difference was found between the effects of acupressure ([MD=-2.33, 95% CI=-3.27 to -1.38]; I²=94%, P<0.001) and auricular acupressure ([MD=-2.98, 95% CI=-4.53 to -1.43]; I²=94%, P<0.001; figures 8a and b). This suggested that both therapies had similar effects on sleep quality and might share common mechanisms of action.

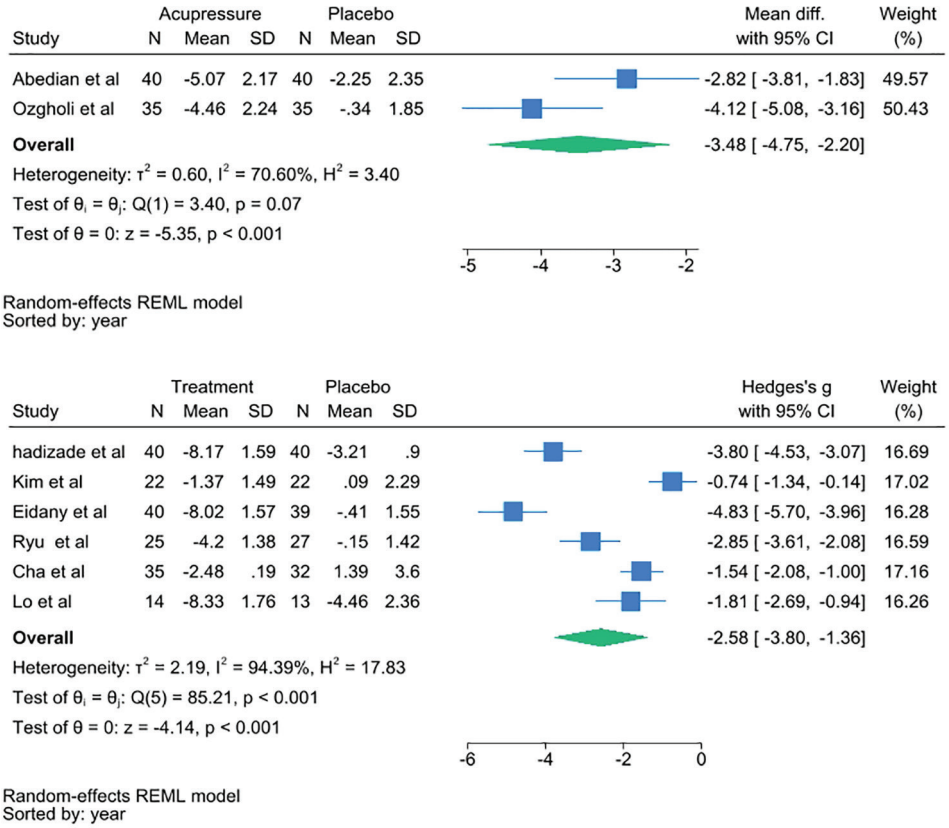


**Figure 8:** (a) Forest plots show subgroup analyses of acupressure versus placebo (MD=-3.48, 95% CI=-4.75 to -2.20; I²=70%, P<0.001). (b) Forest plots show subgroup analyses of auricular acupressure versus placebo (MD=-2.58, 95% CI=-3.80 to -1.36; I²=94%, P<0.001)

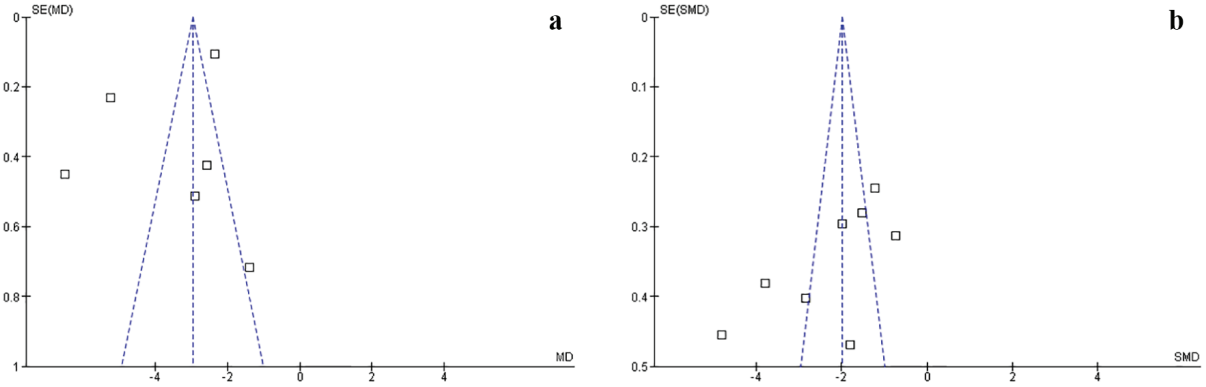


**Figure 9:** This figure displays funnel plots for the comparison of acupuncture versus placebo (panel a) and acupressure versus placebo (panel b). In panel (a), the analysis of acupuncture showed no significant publication bias, with Egger's test (P=0.619) and Begg's test (P>0.999), indicating no need for additional studies according to the trim-and-fill test. In panel (b), Egger's test for acupressure indicated significant publication bias (P=0.022), while Begg's test was not significant (P=0.173), and the trim-and-fill test did not add any studies, suggesting no publication bias.

A sensitivity analysis was conducted to identify potential sources of heterogeneity in the study findings. Additionally, a funnel plot was also generated to visually assess publication bias, and formal tests for publication bias, notably Begg's and Egger's tests, were conducted at an alpha level of 0.1.[40] The Egger's test found no evidence of small-study effects for acupuncture (β=2.42, P=0.6190) or acupressure (β=-11.83, P=0.0225). Similarly, Begg's test revealed no significant small-study effects for either intervention (acupuncture: P>0.999; acupressure: P=0.1735). The trim-and-fill analysis revealed no new studies, indicating the absence of publication bias. These findings suggested that the significant effects observed for both acupuncture ([MD=-3.473, 95% CI=-5.063, -1.882]) and acupressure (Hedges' g=-2.325, 95% CI=-3.273, -1.377) were robust and not significantly influenced by publication bias (figure 9).

## Discussion

This meta-analysis revealed that both acupuncture and acupressure were significantly more effective than a placebo in enhancing sleep quality among postmenopausal women. All studies examining acupressure reported significant improvements in sleep quality compared to control groups. However, the specific acupressure points and employed techniques varied across the studies. Notably, two studies focused on sleep-related body points,[6, 33] while six studies utilized auricular acupressure (auriculotherapy).[6, 7, 29-33, 38]

Abedian and colleagues trained participants to massage sleep-related acupressure points one hour prior to bedtime, observing significant improvements in sleep quality for both groups.[6] The placebo group exhibited a 17% enhancement in sleep quality, while the acupressure group demonstrated a 41% improvement, which was attributed to the psychological benefits associated with massaging acupressure points. Similarly, Ozgoli and others reported that using a specialized acupressure wristband for 15 min, three times a week, significantly improved sleep quality in postmenopausal women.[33]

Six studies investigated the effects of auriculotherapy on sleep quality, with the majority, except for Lo's study, employing comparable methodologies.[6, 7, 29-33, 38] These studies utilized stickers containing Vaccaria seeds on sleep-related ear points for the intervention group, while the placebo group received seedless stickers on non-effective points. In contrast, Lo and others used magnetic seeds in both groups, with the intervention group massaging the seeds at predetermined intervals throughout the day, while the control group left them undisturbed.[32] Following a three-week follow-up, the intervention group exhibited a significant improvement compared to the placebo group. Besides, they indicated significant improvements compared to the baseline. In traditional Chinese medicine, applying pressure to specific acupuncture points of the ear through various methods, including needles, electrical stimulation, seed stickers (magnetic or Vaccaria seeds), or manual pressure, can help regulate bodily functions and address numerous health issues. Auriculotherapy, as a subset of acupressure, offers a less invasive therapeutic option than acupuncture.[30]

Furthermore, Ahmadinezhad and colleagues, as well as Kung and others indicated significant enhancements in sleep quality following acupressure.[15, 24] However, these studies were not included in the meta-analysis due

to methodological variations. Ahmadinezhad and others compared acupressure with pilates exercises as non-pharmacological interventions for enhancing sleep quality in postmenopausal women, finding significant improvements in the acupressure group.[15] Similarly, Kung and colleagues conducted a single-group before-and-after study and reported that acupressure significantly increased both sleep duration and quality, while also reducing sleep onset latency.[24]

Waits and others conducted a meta-analysis and included 13 studies. The findings demonstrated that acupressure could reduce PSQI scores by 2.75 to 4.08 points, indicating substantial improvements in sleep quality among participants.[12]

It was hypothesized that both acupuncture and acupressure could improve sleep quality from both subjective and objective perspectives, potentially through the regulation of serotonin and melatonin levels.[13] In the case of acupressure, it was proposed that sustained pressure on acupoints for more than 1 min could stimulate the release of endorphins, neurotransmitters known for their pain-relieving and mood-enhancing properties. Additionally, it is believed that pressure applied to specific points might help balance the body's vital energy or Qi.[14] Acupuncture, recognized as a regulatory system, particularly of the central nervous system, can modulate the release of neurotransmitters such as serotonin, dopamine, norepinephrine, and beta-endorphins.[24] This mechanism has the potential to alleviate various neuropsychiatric symptoms, including mood disorders, cognitive issues, sleep disturbances, and difficulties in emotional regulation.[3] Consequently, numerous studies investigated the effects of acupuncture on sleep quality and menopause symptoms, generally yielding positive results.[41-43]

Numerous studies demonstrated that acupuncture could effectively improve sleep quality and alleviate menopausal symptoms. Chiu and others, in their review study, reported that acupuncture significantly increased serum estradiol levels while concurrently reducing follicle-stimulating hormone (FSH) and luteinizing hormone (LH) levels. Consequently, acupuncture should be integrated into a holistic approach to addressing sleep problems in postmenopausal women.[9] Moreover, Avis and Borud highlighted that acupuncture could alleviate hot flashes in this population.[44, 45]

Studies conducted by Hachul and others[37] Fu and colleagues[36] Li and others[34] Zhao and others[35] and Zhao and colleagues[16] further supported the beneficial effects of acupuncture on sleep quality in postmenopausal women. However, Huang and others did not find significant improvements in sleep quality following acupuncture in their study.[17] Hachul and others conducted 10 treatment sessions over 5 weeks targeting sleep disturbances in postmenopausal women. Assessments included polysomnography (PSG) and the PSQI, both revealed significant improvements in PSQI scores. Additionally, objective assessments using PSG demonstrated a higher percentage of N3 and N4 sleep stages in the acupuncture group than in the placebo group.[37]

Zhao and others investigated the effects of acupuncture on mood and sleep in postmenopausal women across 17 sessions over 8 weeks. At the 8-week mark, the results showed that the intervention group had significantly better sleep and lower anxiety levels than the placebo group. However, this difference was not significant at the 16-week follow-up.[16] In the study by Fu and others, 10 acupuncture sessions were conducted over 3 weeks. Assessment measures included the PSQI and ISI scores, along with PSG. After treatment, the acupuncture group showed a decrease of 8.03 points in the PSQI scores, compared to 1.29 points in the placebo group, and a change of 11.35 in the ISI scores, compared to 2.87 in the placebo group. Objective assessments from PSG revealed significant improvements in sleep efficiency, total sleep time, reduced night-time awakenings, and a lower percentage of stage 1 sleep in the acupuncture group. No significant changes were observed in the placebo group from baseline to post-treatment.[36]

Li and others also conducted a study comparing acupuncture with a placebo, involving 18 sessions over 8 weeks. The results showed significant improvements in total sleep time, sleep efficiency, and reductions in nightly awakenings in the acupuncture group compared to the placebo group ($P=0.007$, $P=0.023$, and $P=0.011$, respectively).[34]

In these studies, thin needles were inserted 10-30 mm into specific acupuncture points in the true acupuncture group to balance the body's yin and yang energy. In contrast, the placebo group received Streitberger needles, which were designed to simulate real acupuncture needles but retract into their sheaths upon skin contact, preventing deep penetration. This method enhanced the study's validity by differentiating between the actual therapeutic effects and the psychological expectancy associated with the treatment.[34, 36]

In a similar study by Huang and colleagues, nine acupuncture sessions were conducted over 7 weeks. Assessment measures included the

frequency and severity of night sweats and the PSQI. The findings showed a 47% reduction in night sweat frequency in the acupuncture group, which represented a significant difference compared to the placebo group (P<0.001). However, no significant differences in PSQI scores were identified between the intervention and placebo groups (P=0.026). Huang and others suggested the need for further research, given the strong correlation between improved sleep quality and reduced incidence of night sweats.[17]

The findings of the present review study suggested that both acupressure and acupuncture could effectively improve sleep quality in postmenopausal women. Despite these promising results, several limitations might influence the validity of the findings. A major limitation was the high heterogeneity among studies, resulting from differences in study design, methodology, intervention duration, sleep patterns across different populations, and follow-up periods. This heterogeneity was evident in both acupressure and acupuncture studies.

The frequency and duration of treatment sessions in the studies included in this meta-analysis varied significantly. The number of sessions ranged from 4-18 sessions and conducted over 2-8 weeks. Follow-up periods also differed, extending from 8 to 20 weeks post-intervention. The interventions included teaching self-care acupressure techniques for home use or the distribution of acupressure bands for specific times of the day. These factors contributed to the overall heterogeneity of the studies.

Another limitation was the small sample sizes in many of the studies. Approximately, 50% had a limited number of participants. Furthermore, the researchers' poor skills in languages other than English and Persian caused the exclusion of papers published in other languages. Several studies were also excluded from this meta-analysis due to the absence of final questionnaire scores, which reduced the number of studies included in the final analysis and increased the risk of bias, potentially undermining the validity of the results. To improve the robustness of future systematic reviews and reduce the risk of bias, researchers should strive to report comprehensive and relevant data.

Despite these limitations and the heterogeneity among studies, this research provided valuable insights into the effectiveness of acupuncture for improving sleep quality in postmenopausal women. It also underscored the importance of considering study characteristics, such as methodology, intervention duration, and follow-up periods, in meta-analyses of complementary and alternative medicine interventions.

## Conclusion

Acupuncture and acupressure appeared to be safe and efficient interventions for enhancing sleep quality in postmenopausal women. However, caution is warranted when interpreting these promising results due to concerns regarding the methodologies, evidence, and quality of reporting in the primary studies. Future research should prioritize adherence to rigorous reporting standards to enhance the reliability and validity of the findings.

## Acknowledgment

We would like to express our sincere gratitude to the Research Deputy of Shahroud University of Medical Sciences for providing the research grant (code: 14030030), which made this study possible. The AI was utilized to help with language translation, grammar, and spelling corrections. However, all scientific content and conclusions were developed by the authors themselves, without AI assistance.

## Authors' Contribution

L.E: Conceived the study design and methodology, conducted the literature search, and performed the data extraction and statistical analysis. Drafted the initial manuscript and revised it critically for important intellectual content; A.K: Supervised the overall project, coordinated the contributions of all authors, and ensured adherence to ethical standards. Reviewed and edited the manuscript for clarity, coherence, and completeness; M.R.R: Assisted in the development of the study protocol, contributed to the interpretation of the results, and provided feedback on the manuscript. Conducted additional analyses and ensured the accuracy of the data. All authors have reviewed, read, and approved the final manuscript and agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

**Conflict of Interest:** None declared.

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