

Title: Acupressure, Reflexology, and Auricular Acupressure for Insomnia: A Systematic Review of Randomized Controlled Trials

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Abstract

Previous randomized controlled trials (RCTs) have shown that acupuncture may be efficacious for insomnia. Instead of needling, acupressure, reflexology, and auricular acupressure are procedures involving physical pressure on acupoints or reflex areas. These variants of acupuncture are gaining popularity, perhaps due to their non-invasive nature. A systematic review has therefore been conducted to examine their efficacy and safety for insomnia. Two independent researchers searched 5 English and 10 Chinese databases from inception to May 2010. Forty RCTs were identified for analysis. Only 10 studies used sham controls, 4 used double-blind design, 9 studies scored 3 or more by the Jadad scale, and all had at least 1 domain with high risk of bias. Meta-analyses of the moderate-quality RCTs found that acupressure as monotherapy fared marginally better than sham control. Studies that compared auricular acupressure and sham control showed equivocal results. It was also found that acupressure, reflexology, or auricular acupressure as monotherapy or combined with routine care was significantly more efficacious than routine care or no treatment. Owing to the methodological limitations of the studies and equivocal results, the current evidence does not allow a clear conclusion on the benefits of acupressure, reflexology, and auricular acupressure for insomnia.

Keywords: Acupressure; Reflexology; Auricular acupressure; Acupuncture; Systematic review;

Meta-analysis.

Introduction

Insomnia is the most common sleep complaint, with approximately 9–15% of the general population worldwide suffering from insomnia symptoms accompanied by daytime consequences [1]. Insomnia may lead to fatigue, irritability, and impaired daytime functioning, and is associated with major depression, anxiety disorders, and substance abuse [2]. Despite the continuous progress in pharmacological and psychological treatments of insomnia, the use of complementary and alternative therapies as sole treatment or in association with conventional medicine is common. A national survey in the United States showed that 4.5% of noninstitutionalized adults reported using some form of complementary and alternative medicine to treat insomnia or trouble sleeping in the past year [3].

Among the complementary treatment modalities, acupuncture is one of the most popular procedures. The acupuncturists insert fine needles at specific points in the body, called acupoints, based on traditional Chinese medicine (TCM) meridian theory, followed by manual or electrical stimulation. Previous randomized controlled trials (RCTs) have shown that needle acupuncture is efficacious for the treatment of primary insomnia and residual insomnia associated with major

depressive disorder [4,5]. Applying safety precautions in acupuncture treatment, side effects such as minor bleeding and hematoma are uncommon, while complications including pneumothorax, other organ or tissue injuries, and infections are rare. Acupressure is a non-invasive variant of acupuncture in which the practitioners use the fingers, hands, elbow, or various devices to stimulate the acupoints based on TCM meridian theory. Similar to acupressure, reflexology involves the application of pressure to the feet, hands, or ears, but it is practiced based on reflexology charts with specific areas on the feet, hands, and ears corresponding to glands, organs, and body parts. Auricular acupressure may be considered as a form of reflexology in which seeds or pearls are adhered on the outer ears to stimulate specific areas based on reflexology charts.

Acupressure, reflexology, and auricular acupressure are gaining popularity, perhaps due to their non-invasive nature; for reflexology and auricular acupressure, they have the additional advantage of not having to totally disrobe. While previous systematic reviews of acupuncture for insomnia have included studies on acupressure, reflexology, and auricular acupressure [6-11], none of the reviews have separately analyzed the non-invasive form of acupuncture therapy and most of the reviews only covered English language literature. Given that such information is

important for research and clinical practice, we have conducted a systematic review of the English and Chinese language literature on RCTs of acupressure, reflexology, and auricular acupressure for the treatment of insomnia.

Method

Our systematic review set out to examine all TCM treatment modalities for insomnia, including Chinese herbal medicine, acupuncture, and variants of acupuncture. Due to the different theories, mechanisms of action, and techniques behind these TCM treatments, only the result on acupressure, reflexology, and auricular acupressure was reported in this paper. We searched the MEDLINE, EMBASE, Cochrane Central Register of Controlled Trials, Cumulative Index to Nursing and Allied Health Literature, and Allied and Complementary Medicine from inception to May 2010 using the grouped terms (insomnia* OR wakefull* OR sleepless* OR sleep*) AND ((acupuncture* OR acupoints* OR acupress* OR meridian* OR transcutaneous electrical nerve stimulation OR TENS OR moxibustion OR tuina) OR (herb* OR herbal medicine* OR traditional Chinese medicine* OR TCM)). The search also included China Journals Full-text Database, China Proceedings of Conference Full-text Database, Chinese Biomedical Literature Database, China Doctor Dissertations Full-text Database, China Master Theses Full-text Database, Chinese Science and Technology Documents Database, Chinese Dissertation Document Bibliography Database, Chinese Academic Papers Conference Database, Digital Periodical, and Taiwan Electronic Periodical Services. The reference lists of the retrieved papers

were further searched for relevant articles. Studies included in this review were randomized or quasi-randomized clinical trials that examined participants with a chief complaint of insomnia who used acupressure, reflexology or auricular acupressure as an intervention or as a co-intervention with Western medication or psychotherapy, in comparison with controls using placebo, Western medication, psychotherapy or no treatment. To ensure that all relevant articles were included, we did not set any specification for outcome measure, treatment duration, or study quality.

The authors (WFY and MKP) searched the databases and selected the relevant publications independently. Any disagreement about the eligibility of a study was resolved by systematic and thorough discussion. One author (MKP) extracted the data and the other (WFY) checked the extracted data. For each study, the following variables were extracted: study design, patients' characteristics including age, gender, and duration of insomnia, acupressure treatment protocol, control intervention, and outcome parameters. We assessed the study quality by a modified Jadad scale [12-13]. Points were awarded if: study was described as randomized (1 point); appropriate randomization method (1 point); subject blinded to intervention (1 point); evaluator blinded to therapy (1 point); and description of withdrawals and dropouts (1 point). The modified Jadad

scale score ranges from 1 to 5, with higher scores indicate better quality of the RCT. In addition, we analyzed the studies using the Cochrane's risks of bias assessment. The risks of bias assessment appraises a study in 6 domains: adequate sequence generation; allocation concealment; blinding of participants, personnel, and outcome assessors; incomplete outcome data; selective outcome reporting; and other sources of bias. Each domain was rated as 'yes' (low risk of bias), 'no' (high risk of bias), or 'unclear' (uncertain risk) [14]. Given the impossibility of blinding acupuncture practitioners, we only assessed the blinding of participants and outcome assessors.

We used the Cochrane Collaboration Review Manager software (RevMan 5.0) for statistical analysis. Data were summarized using risk ratio (RR) with 95% confidence intervals (CI) for binary outcome. Mean difference or standardized mean difference, effect size in standard deviation (SD), and their 95% CI were presented for continuous outcome. We included only RCTs with Jadad score ≥ 3 in efficacy analysis; while for safety analysis, all RCTs that had reported adverse events regardless of methodological quality were included. A meta-analysis for efficacy would be performed if studies were similar in clinical characteristics and had moderate methodological quality (Jadad score ≥ 3) [15]. We used fixed effects model when statistical

heterogeneity was absent (heterogeneity test, $p \geq 0.10$) and random effects model when

heterogeneity was present (heterogeneity test, $p < 0.10$).

Results

The search yielded 14045 potential titles for review, of which 4924 were duplicate records and 6249 were excluded for reasons of irrelevance. The full text of 2872 articles were retrieved for detailed assessment, of which 2413 were excluded for various reasons (Fig. 1). Of the remaining 459 studies, 40 examined the efficacy of acupressure, reflexology or auricular acupressure and were included in this review. Full details of the excluded studies are available from the authors upon request.

Table 1 summarizes the study design of all 40 included studies. Sample size of the studies ranged from 13 to 785, with a total of 4115 subjects. The studies were carried out in China, Hong Kong, Taiwan, Italy, Iran, or United States. Thirty of the 40 studies were published in Chinese and 10 were in English. Nineteen studies examined body acupressure based on TCM meridian theory (Studies 1-19) [16-34]; 12 of which were on acupressure monotherapy. Five studies (Studies 20-24) [35-39] examined foot reflexology, including 4 as monotherapy. Auricular acupressure was examined as monotherapy in all 16 studies (Studies 25-40) [40-55]. Thirty-one (77.5%) of the 40 reviewed studies were 2-arm; while 9 were 3-arm studies. Over half of the studies (52.5%) used Western medications as comparator, only 10 (25.0%) used sham

control, which included physical pressure on non-acupoints (Studies 1, 9, 10, and 14), light touch on acupoints (Studies 5, 12, and 13), and stainless steel press pellets (Study 26), *Junci medulla* (Study 34), or adhesive tape alone (Study 31) on auricular points. Other therapies used for comparison included routine care (n = 7), sleep hygiene (n = 2), needle acupuncture (n = 1), transcutaneous electrical acupoint stimulation (n = 1), music therapy (n = 1), and no treatment (n = 2). Different forms of auricular acupressure were compared with sham control or no treatment, including Study 34 using magnetic pearls or *Semen vaccariae* and Study 40 using 2 seeds or 1 seed of *Semen vaccariae*.

The duration of insomnia in the recruited subjects ranged from 3 days to 35 years. The criteria used for diagnosis of insomnia varied among studies. The most frequently used diagnostic criteria was the Chinese Classification of Mental Disorder (Chinese Psychiatric Association, 2001) [56], which was used in 9 studies. The International Classification of Diseases, 10th Revision or the International Classification of Sleep Disorder was used in 3 studies. Seven studies based solely on questionnaire score, 1 study used actigraph-derived sleep efficiency of less than 85% for diagnosis of insomnia, 1 study used the diagnostic criteria of a TCM textbook; and the other 19 studies did not specify the diagnostic system used.

Quality assessment

Assessment by the Jadad scale

Nine (22.5%) of the 40 reviewed studies had a Jadad score ≥ 3 (Table 2), including 4 studies on acupressure, 2 on reflexology, and 3 on auricular acupressure. Four studies (Studies 9, 10, 14, and 34) fulfilled the criteria of a double-blind study design and they also provided an appropriate description of the double-blind method; 6 (Studies 1, 13, 22, 24, 26, and 31) were single-blind study, and the remaining 30 were open-label studies. All 40 studies were reported as randomized trials, but only 8 had described the method of adequate randomization (Studies 8, 13, 19, 22, 26, 30, 37, and 38). Eight studies had described the dropouts (Studies 5, 10, 12, 13, 15, 24, 26, and 37).

Assessment by the Cochrane risks of bias

Table 3 summarizes the risks of bias according to the Cochrane criteria. All studies had at least 1

domain rated as high risk of bias. Adequate sequence generation was described in only 9 studies (Studies 5, 8, 13, 19, 22, 26, 30, 37, and 38). Adequate allocation concealment was described in 3 studies (Studies 9, 22, and 26). Incomplete outcome data were not adequately addressed in 7 studies (Studies 1, 9, 10, 14, 18, 22, and 34). Studies 22 and 35 did not report all outcome measures, suggestive of selective outcome reporting. Nine studies (Studies 9, 11, 20, 22, 25, 29, 32, 36, and 38) had not examined between-group imbalance at baseline. Only 4 studies (Studies 10, 12, 15, and 37) had performed power analysis.

Description of acupressure, reflexology, and auricular acupressure treatment

Standardized treatment was used in 16 acupressure studies (Studies 1-5, 7-10, 12-15, and 17-19), 2 reflexology studies (Studies 23 and 24), and 7 auricular acupressure studies (Studies 26, 29, 33-35, 37, and 40), while the rest adopted individualized approaches. The commonly used acupoints in acupressure were Baihui (GV20), Shenmen (HT7), Taiyang (EX-HN5), Fengchi (GB20), Yintang (EX1), and Sanyinjiao (SP6) (Table 4); while the commonly used reflex areas in foot reflexology were Cerebellum and Small Intestine (Table 5). The commonly used auricular reflex areas were Shenmen, Heart, Occipital, Subcortex, Endocrine, Liver, and Kidney

(Table 6). The acupressure and reflexology treatment in 21 of the 24 reviewed studies was performed by therapists using bare hands. A wrist acupressure device positioned on Shenmen (HT7) was used in Study 9. Blunt wooden needle was used in a reflexology study (Study 21). In Study 6, acupressure was performed by patients or their family members. *Semen vaccariae* seeds or pellets were used in 13 of the 16 auricular acupressure studies with the exception of Studies 26, 34, and 36, which used magnetic pellets.

The number of main acupoints used in the acupressure studies varied from 1 to 23, with an average of 8.1 acupoints (SD = 7.3). Acupressure was mostly given once per day, and the treatment ranged from 15 to 40 days, with an average of 26 days (SD = 7.0). In reflexology studies, the number of main reflex areas used varied from 3 to 19 (average = 8.4; SD = 6.6). The frequency of reflexology treatment was mostly once per day, and the duration of treatment ranged from 1 to 30 days (average = 20.6; SD = 10.6). In auricular acupressure studies, the number of main reflex areas varied from 3 to 8 per session, with an average of 5.2 areas (SD = 1.7). The ear acupoints were pressed in average 2.9 times per day, and the pellets were changed in average 3.1 times per week. The course of auricular acupressure ranged from 10 to 56 days, with an average of 26.5 days (SD = 12.6).

Efficacy assessment

All 40 reviewed studies assessed only the short term effect of acupressure, reflexology and auricular acupressure. Fourteen studies (Studies 3, 4, 6, 7, 11, 17, 20, 23, 25, 27, 29, 32, 36, and 38) had not used standardized outcome measures and only reported effective rate. The definition of effective rate was not standardized, but it was most often defined as the proportion of subjects who had at least some improvement of sleep or 30% reduction in the severity of insomnia by rating scales. Self-reported questionnaires were used in 24 studies (Studies 1, 2, 5, 8-10, 12-16, 18, 19, 21, 22, 24, 26, 30, 31, 33, 34, 37, 39, and 40). Four studies (Studies 10, 14, 22, and 26) used sleep diary, but in Study 22, the results were not reported due to missing data. Actigraphy was used in 1 study (Study 34) and polysomnography in 1 study (Study 31). Thirty-two (80.0%) of the 40 studies showed that acupressure, reflexology, or auricular acupressure was more effective than comparators in main outcome measures, including 15 (71.4%) of the 21 studies using Western medications as a comparator.

Monotherapy versus sham control

Acupressure

Acupressure was reported to be significantly more effective than sham acupressure in all 6 studies that compared acupressure with sham acupressure (Studies 1, 5, 9, 10, 12, and 13), and pooled analysis of 3 moderate-quality studies (Studies 9, 10, and 13) detected a significant improvement in subjective sleep questionnaire score, namely PSQI and AIS (standardized mean difference: -1.5, 95% CI: -2.8 to -0.1, $p = 0.03$, $I^2 = 91.0\%$) (Fig. 2).

Auricular acupressure

Based on the 3 sham-controlled studies, the evidence for auricular acupressure for the treatment of insomnia was equivocal. Study 26, a moderate-quality study with a small sample size of 22, showed that there was no significant difference between auricular acupressure and sham auricular acupressure in all outcome measures. Another moderate-quality study (Study 34) found that auricular acupressure using magnetic pearls resulted in longer total sleep time and higher sleep efficiency as measured by actigraphy compared to sham auricular acupressure (total sleep

time, mean difference: 52.7 min, 95% CI: 16.9 to 88.5, effect size: 0.69, 95% CI: 0.3 to 1.1, $p = 0.004$; sleep efficiency, mean difference: 11.6%, 95% CI: 5.5 to 17.6, effect size: 0.94, 95% CI: 0.5 to 1.4, $p < 0.001$), but there were no significant difference between auricular acupressure using *Semen vaccariae* and sham auricular acupressure. Study 31, a study with Jadad score of 2, found that auricular acupressure was more effective than sham auricular acupressure for the treatment of insomnia by self-report and polysomnography. Pooled analysis of the 2 moderate-quality studies (Studies 26 and 34) was not possible due to incompatible outcome measure.

Monotherapy versus Western medication

Acupressure

All 4 studies that compared acupressure against Western medication had low methodological quality (Jadad score < 3). Study 7 showed that acupressure resulted in a significantly higher effective rate for insomnia than estazolam, a benzodiazepine; for the other 3 studies (Studies 4, 8, and 11), there was no significant difference between acupressure and estazolam. Due to the low

methodological quality of the studies, meta-analysis was not performed.

Reflexology

Study 23, a study with Jadad score of 1, showed that reflexology was more effective in treating insomnia than hypnotics of unspecified nature and dosage, while another low quality study (Study 21) could not detect any significant between-group differences.

Auricular acupressure

All 10 studies (Studies 25, 27, 29, 30, 32, 33, 35, 36, 38, and 39) that compared auricular acupressure with Western medication were of low methodological quality. Seven of the 10 studies (Studies 25, 27, 29, 32, 36, 38, and 39) reported auricular acupressure was better than Western medication.

Monotherapy versus routine care or no treatment

Acupressure

Acupressure was reported to be significantly more effective than routine care in elderly residents of an assisted living facility (Study 1) and patients with end-stage renal failure receiving hemodialysis (Study 15). The only study with Jadad score ≥ 3 (Study 10) found that there was a significantly greater reduction in PSQI score in the acupressure group than in the routine care group among elderly nursing home residents (mean difference: -4.9, 95% CI: -6.4 to -3.3, effect size: -1.72, 95% CI: -2.4 to -1.1, $p < 0.001$).

Reflexology

Reflexology was reported to have a higher effective rate for insomnia than a combination of psychological care, including counseling, relaxation training, and education on sleep hygiene, lifestyle modification, and hypnotics use (Study 20); however, the study was of low methodological quality.

Auricular acupressure

A study with Jadad score of 3 (Study 37) found that auricular acupressure was more effective than no treatment in term of PSQI score reduction (mean difference: -2.5, 95% CI: -4.2 to -0.8, effect size: -0.82, 95% CI: -1.4 to -0.3, $p = 0.003$). Another study with low methodological quality (Study 28) showed that auricular acupressure resulted in longer total sleep time than routine care. A study with Jadad score of 1 (Study 40) reported that auricular acupressure using 2 seeds was more effective for insomnia than auricular acupressure using 1 seed or no treatment.

Monotherapy versus other therapies

Acupressure

A study with Jadad score of 1 (Study 17) showed that acupressure had a higher effective rate for insomnia than treatment using benzodiazepines and neck traction.

Reflexology

Study 22 with a Jadad score of 3 compared reflexology, needle acupuncture, and music therapy.

Based on the data presented in the paper, there was no significant difference in posttreatment PSQI score between reflexology and music therapy (mean difference: -2.0, 95% CI: -9.3 to 5.3, effect size: -0.44, 95% CI: -2.1 to 1.2, $p = 0.59$) and between reflexology and needle acupuncture (mean difference: 1.3, 95% CI: -6.3 to 8.9, effect size: 0.27, 95% CI: -1.2 to 1.8, $p = 0.74$).

Combination therapy versus routine care

Acupressure

A study with Jadad score of 3 (Study 14) showed that acupressure plus routine care resulted in lower PSQI scores in end-stage renal failure patients when compared with routine care (mean difference: -2.3, 95% CI: -4.3 to -0.3, effect size: -0.54, 95% CI: -1.0 to -0.05, $p = 0.03$); however, there was no significant difference between acupressure plus routine care and sham acupressure plus routine care, nor between sham acupressure plus routine care and routine care. Another study with low methodological quality (Study 18) found that acupressure plus routine care achieved higher effective rate for insomnia and produced greater reduction in PSQI score

than routine care.

Reflexology

A moderate-quality study (Study 24) found that reflexology plus routine care resulted in higher effective rate and shorter sleep onset latency and higher sleep efficiency by PSQI when compared with routine care (mean difference, sleep onset latency: -27.5 min, 95% CI: -36.6 to -18.5, effect size: -1.20, 95% CI: -1.6 to -0.8, $p < 0.001$; total sleep time: 93.6 min, 95% CI: 66.6 to 120.6, effect size: 1.36, 95% CI: 0.9 to 1.8, $p < 0.001$; sleep efficiency: 10.7%, 95% CI: 8.3 to 13.0, effect size: 1.79, 95% CI: 1.3 to 2.3, $p < 0.001$).

Combination therapy versus Western medication

Acupressure

Acupressure in combination with antidepressants (Study 16) or benzodiazepines (Study 19) resulted in significantly lower PSQI score when compared with antidepressants or

benzodiazepines alone. However, both studies were of low methodological quality; hence meta-analysis was not performed.

Combination therapy versus sleep hygiene

Acupressure

A low methodological quality study (Study 6) found that acupressure co-administered with sleep hygiene was more effective than sleep hygiene alone for the treatment of insomnia.

Adverse event reporting

Acupressure

Only 2 (10.5%) of the 19 acupressure studies (Studies 9 and 13) had monitored adverse events, and both reported that no adverse event was observed during acupressure.

Reflexology

Adverse events were reported in 2 of the 5 reflexology studies. In Study 21, 9 (15.0%) of the 60 participants receiving reflexology complained of pain at stimulation points that resolved within 1 hour, while 32 (53.3%) of the 60 subjects given benzodiazepines reported adverse events. None of the participants in both groups withdrew from the study due to adverse events. In another study (Study 24), no adverse event was reported in the reflexology group.

Auricular acupressure

Adverse events were reported in 3 (18.8%) of the 16 auricular acupressure studies. In Study 32, adverse events were detected only in the benzodiazepine group but not in the auricular acupressure group. Subjects receiving auricular acupressure in Studies 35 and 38 complained of pain at the stimulation points on the ears, but the severity and frequency were not reported.

Discussion

To the best of our knowledge, this is the first systematic review on the use of non-invasive form of acupuncture therapy, including acupressure, reflexology, and auricular acupressure in treating insomnia. Of the 40 RCTs that were reviewed, only 10 studies employed sham controls, 4 used a double-blind design, and 9 studies scored 3 or more by the Jadad scale. Meta-analyses of the moderate-quality RCTs found that acupressure as monotherapy fared marginally better than sham control. Studies that compared auricular acupressure and sham control obtained equivocal results. When compared with routine care or no treatment, monotherapy using acupressure or auricular acupressure and acupressure or reflexology plus routine care were significantly more efficacious for insomnia. We found that all included studies had at least 1 domain with high risk of bias and the sham control design might have limitations. Hence, despite the apparent positive findings reported, it would be premature to conclude that acupressure, reflexology, and auricular acupressure are indeed an effective strategy in treating insomnia.

This review found that methodological quality of the included RCTs was generally poor. Limitations included imprecise enrollment criteria, unclear randomization and allocation concealment methods, and lack of standardized diagnostic procedure and adverse event

monitoring. Incomplete outcome data reporting and biases related to blinding of participants and outcome assessment were common flaws. The control treatments reported were also problematic. Light touch at acupoints and adhesive tape alone on auricular points employed as sham controls in these study were probably invalid placebos because they could be easily identified by patients as inactive treatments. The use of *Junci medulla* as sham control in auricular acupressure might have a similar limitation if patients were aware that the pellets should be metallic. None of the reviewed RCTs have assessed the success of blinding in the participants. The application of physical force at non-acupoints is not an inert placebo, and may be efficacious for insomnia, as previous studies have shown that superficial needling at non-acupoints possesses therapeutic effect [57].

The reviewed studies varied greatly in the selection of acupoints, reflex areas and auricular points. Stimulation method, treatment duration, and frequency of treatment were also different across studies. Baihui (GV20), Taiyang (EX-HN5), Fengchi (GB20) and Yintang (EX1), Shenmen (HT7) and Sanyinjiao (SP6) were the commonly used acupoints in acupressure treatment for insomnia. These acupoints were also frequently used in needle acupuncture for insomnia [58]. Although both acupressure and needle acupuncture are practiced based on TCM

meridian theory, recent studies showed that they elicited different cortical and subcortical activities [59,60]. When applied at the same acupoints, needle acupuncture caused greater neuronal activation than acupressure did at the limbic system, such as the parahippocampal gyrus and anterior cingulate cortex [59,60]. These brain structures are important for the regulation of memory, emotion, and autonomic function and play a major role in causing insomnia. It is possible that needle acupuncture may have better efficacy than acupressure in the treatment of insomnia. Further studies are warranted to compare needle acupuncture and acupressure for treating insomnia. Cerebellum and Small Intestine were the most commonly used reflex areas in the foot reflexology studies. A functional magnetic resonance imaging study showed that stimulation of the foot reflex area Small Intestine activated not only the somatosensory area of the foot, but also the somatosensory areas corresponding to the small intestine and neighboring body parts [61]. Future neuroimaging studies should examine the effects of foot stimulation in subcortical and other cortical areas. Shenmen, Heart, Occipital, Subcortex, Endocrine, Liver, and Kidney were found to be the most commonly used auricular points. Basic and clinical studies of auricular acupressure suggested that stimulation of the auricular point Heart evoked sympatho-inhibitory responses [62,63], which could partly explain the therapeutic effects of auricular acupressure for insomnia. Nevertheless, the physiological

basis of these physical treatments for insomnia is still poorly understood, and further studies are necessary for a better understanding of their physiological effects.

The acupressure and reflexology treatment was performed by therapists using bare hands in the majority of the reviewed studies, with only a few studies using acupressure device or blunt wooden instrument for stimulation. For auricular acupressure, both *Semen vaccariae* and magnetic pellets had been used for stimulation. A three-arm parallel study reported that auricular acupressure using *Semen vaccariae* failed to show an improvement compared with treatment using *Junci medulla*, while magnetic pellet auricular acupressure showed favorable effects compared with both *Semen vaccariae* and *Junci medulla* groups [49]. The finding may indicate that the effects of auricular acupressure are related not to physical stimulation of points, but to magnetic fields. Further studies are needed to replicate the importance of magnetic pellet in auricular acupressure.

In view of the current findings, the following recommendations are made to improve the validity of study design for future trials. In order to achieve successful blinding of participants and minimize any physiological effects, we recommend a physical force of 2 to 3 kg at

non-acupoints or non-reflexology areas as sham control, as it has been reported that the minimal force required in acupressure and reflexology was 3 to 5 kg [20,27]. For auricular acupressure, the use of stainless steel pellets on non-auricular points and avoidance of external pressure may improve subject blinding. Moreover, assessments of credibility of treatments and success of blinding should be carried out when possible. Validated scales and quantitative sleep variables instead of effective rate should be used as outcome measures.

Our review found that acupressure, reflexology, and auricular acupressure are relatively safe with pain at the pressure points as the only reported adverse event. However, adverse effects such as skin irritation and infection might have been present, but un-reported [64], because *Semen vaccariae*, small metal balls, and magnetic pellets are secured at the auricular points by adhesive tape for extended period. In future studies, a systematic collection of adverse events in acupressure, reflexology, and auricular acupressure trials is necessary.

It is worthwhile to point out that our review had not included alternative and complementary therapies with treatment modalities other than physical pressure to acupoints. Cupping, transcutaneous electrical nerve stimulation, and external application of herbal medicine to

acupoints as therapies for insomnia may deserve a separate review. The major limitation of our study is that studies published in the native language of Japan and Korea where acupuncture was commonly practiced were not included. Moreover, selective publishing and reporting can be other major causes of bias.

In summary, although acupressure, reflexology, auricular acupressure had been reported to be more effective than sham control, routine care, no treatment, and benzodiazepines in the acute treatment of insomnia, we found that the reviewed studies were generally of low methodological quality and had limitations in sham control design. Hence, the seemingly promising results should be interpreted with caution. Further studies with improved methodological design, such as using better-designed sham control, double-blind design, validated subjective scales, and objective measures are most warranted to accurately determine the efficacy and safety of these modalities for insomnia.

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Table 1 Randomized controlled trials of acupressure, reflexology, and auricular acupressure for insomnia

No.	1 st Author (Year)	Country/ type of case	Mean age, y (range)/ % female	Duration of insomnia	Diagnostic system	Design	Follow-up	Sample size (Acup/ Control)	Control Intervention(s)	Outcome measure	Results reported
Acupressure											
1	Chen (1999)	Taiwan/ elderly residents in an assisted living facility	79.0 (61-98)/ 27.6%	NR	NR	3-parallel arms (Acup; Sham acup; routine care)	1 wk	102 (34/34/34)	Sham acup; routine care	PSQI	Acup significantly > routine care and Sham acup
2	Dai (2007)	China/ inpatients with end-stage renal disease	54.2 (20-84)/ 52.4%	NR	SRSS > 23	2-parallel arms (Acup + TCM, western medicine and routine care; Benzo + TCM, western medicine and routine care)	Nil	82 (42/40)	Estazolam 1mg/day	SRSS	Acup + TCM, western medicine & routine care significantly > Benzo + TCM, western medicine & routine care
3	Feng (2007)	China/ patients with hyperthyroidism	40 (24-56)/ 65%	NR	NR	2-parallel arms (Acup + routine care; Benzo + routine care)	Nil	80 (53/27)	Estazolam 2mg/day	Effective rate	Acup + routine care significantly > Benzo + routine care
4	He (2009)	China/ inpatients and outpatients of a acupressure clinic	NR(18-80)/ 58.2%	2 m - 20 y	NR	2-parallel arms (Acup; Benzo)	Nil	98 (49/49)	Estazolam 2mg/day	Effective rate	No significant difference between Acup and Benzo
5	Hsu (2006)	China/ residents in a long-term care institution	72.2(NR)/ 36%	NR	NR	2-parallel arms (Acup; Sham acup)	Nil	50 (25/25)	Sham acup	PSQI	Acup significantly > Sham acup
6	Lan (2009)	China/ inpatients, specialty NR	NR(31-72)/ 38%	4 m - 3 y	CCMD-3	2-parallel arms (Acup by self + sleep hygiene; sleep hygiene)	Nil	100 (50/50)	Sleep hygiene	Effective rate	Acup by self + sleep hygiene significantly > sleep hygiene
7	Li (2007)	China/ type of case NR	NR (17-75)/ 53.4%	14 d - 21y	CCMD	2-parallel arms (Acup; Benzo)	Nil	148 (74/74)	Estazolam 2mg/day	Effective rate	Acup significantly > Benzo

Table 1 Randomized controlled trials of acupressure, reflexology, and auricular acupressure for insomnia (Continued)

No.	1 st Author (Year)	Country/ type of case	Mean age, y (range)/ % female	Duration of insomnia	Diagnostic system	Design	Follow-up	Sample size (Acup/ Control)	Control Intervention	Outcome measure	Results reported
8	Li (2009)	China/ outpatients of <i>Tuina</i> clinic	36.7 (NR)/ 56.7%	average 12.4 m	CCMD-3	2-parallel arms (Acup; Benzo)	Nil	60 (30/30)	Estazolam 2 mg/day	PSQI, Effective rate	No significant differences between Acup and Benzo
9	Nordio (2008)	Italy/ type of case NR	64.1 (49-77)/ 33.3%	NR	NR	2-parallel arms (Acup device; Sham acup device)	Nil	40 (20/20)	Sham acup device	GHQ-28, STAI, PSQI	Acup device significantly > Sham acup device
10	Reza (2010)	Iran/ nursing home residents	75.2 (NR)/ 46.8%	NR	NR	3-parallel arms (Acup; Sham acup; routine care)	Nil	90 (30/30/30)	Sham acup; routine care	PSQI, sleep diary	Acup significantly > Sham acup and routine care
11	Song (2007)	China/ inpatients and outpatients, specialty NR	NR (NR)/ NR	NR	PSQI (cutoff score NR)	2-parallel arms (Acup; Benzo)	Nil	100 (50/50)	Estazolam dosage NR	Effective rate	No significant difference between Acup and Benzo
12	Sun (2005)	Taiwan/ nursing home residents	72.2 (NR)/ 46%	NR	AIS > 6 and PSQI > 6	2-parallel arms (Acup; Sham acup)	3 wks	50 (25/25)	Sham acup	AIS, PSQI	Acup significantly > Sham acup
13	Sun (2010)	Taiwan/ nursing home residents	70.5 (NR)/ 36%	NR	PSQI-T >5 and AIS >6	2-parallel arms (Acup; Sham acup)	2 wks	50 (25/25)	Sham acup	AIS	Acup significantly > Sham acup
14	Tsay (2003)	Taiwan/ patients on hemodialysis for end-stage renal failure	55.5 (NR)/ 54.8%	NR	NR	3-parallel arms (Acup + routine care; Sham acup + routine care; routine care)	1 wk	105 (35/35/35)	Sham acup; routine care	PSQI, sleep diary	Acup + routine care significantly > routine care; no differences between Acup + routine care and Sham acup + routine care; no difference between Sham acup + routine care and routine care
15	Tsay (2004)	Taiwan/ patients on hemodialysis for end-stage renal failure	58.2(NR)/ 66%	NR	PSQI \geq 5	3-parallel arms (Acup; TEAS; routine care)	Nil	108 (36/36/36)	TEAS; routine care	PFS, PSQI, BDI	Acup and TEAS significantly > routine care; no significant difference between Acup and TEAS

Table 1 Randomized controlled trials of acupressure, reflexology, and auricular acupressure for insomnia (Continued)

No.	1 st Author (Year)	Country/ type of case	Mean age, y (range)/ % female	Duration of insomnia	Diagnostic system	Design	Follow-up	Sample size (Acup/ Control)	Control Intervention	Outcome measure	Results reported
16	Wang (2007)	China/ outpatients with depression	49.2 (NR)/ 51.9%	NR	CCMD-3	2-parallel arms (Acup + antidepressants; antidepressants)	Nil	54 (27/27)	Sertraline 50-100mg / Venlafaxine 75-100mg/ Mirtazapine 15-45mg/day	PSQI, HAMD	Acup + antidepressants significantly > antidepressants
17	Yu (2007)	China/ inpatients and outpatients with cervical spondylosis	35 (17-73)/ 59.6%	7 d - 13 y	NR	2-parallel arms (Acup; Benzo + neck traction)	Nil	785 (436/349)	Diazepam 7.5mg/day	Effective rate	Acup significantly > Benzo + neck traction
18	Zhang (2007)	China/ ICU patients on ventilator	58.8 (25-76)/ 38.3%	NR	NR	2-parallel arms (Acup + routine care; routine care)	Nil	60 (30/30)	Routine care	PSQI, Effective rate	Acup + routine care significantly > routine care
19	Zhou (2007)	China/ outpatients, specialty NR	39.02 (NR)/ 66.7%	NR	ICD-10 and ICSD	2-parallel arms (Acup + Benzo; Benzo)	Nil	60 (30/30)	Alprazolam 0.4 mg/day	PSQI	Acup + Benzo significantly > Benzo
Reflexology											
20	Cao (2009)	China/ type of case NR	NR (15-81)/ 46.3%	NR	NR	2-parallel arms (Reflexology; routine care)	Nil	80 (40/40)	Routine care	Effective rate	Reflexology significantly > routine care
21	Gong (2009)	China/ inpatients and outpatients of acupressure clinic	51.5 (NR)/ 65%	average 17.0 m	CCMD-3-R	2-parallel arms (Reflexology; Benzo)	Nil	120 (60/60)	Alprazolam 0.4-0.8 mg/day	Effective rate, PSQI	No significant difference between Reflexology and Benzo
22	Hughes (2009)	UK/ university staff	47.2 (25-62)/ 60%	NR	PSQI > 5, BDI-II ≤ 13	3-parallel arms (Acupuncture; Reflexology; music therapy)	2 wks	13 (5/4/4)	Music therapy	PSQI, SF-36, sleep diary	No between-group comparisons were performed
23	Jiang (1999)	China/ outpatients, specialty NR	NR (25-72)/ 61.7%	6 m - 25 y	NR	2 arms cross-over (Reflexology; hypnotics)	Nil	128 (64/64)	Hypnotics type and dosage NR	Effective rate	Reflexology > hypnotics
24	Zhao (2006)	China/ geriatric inpatients	NR (60-90)/ 46.1%	NR	CCMD-3	2-parallel arms (Reflexology + routine care; routine care)	Nil	102 (52/50)	Routine care	Effective rate, PSQI	Reflexology + routine care significantly > routine care

Table 1 Randomized controlled trials of acupressure, reflexology, and auricular acupressure for insomnia (Continued)

No.	1 st Author (Year)	Country/ type of case	Mean age, y (range)/ % female	Duration of insomnia	Diagnostic system	Design	Follow-up	Sample size (Acup/ Control)	Control Intervention	Outcome measure	Results reported
<u>Auricular acupressure</u>											
25	Gao (1995)	China/ outpatients, specialty NR	NR (18-62)/ 29.5%	5 d - 21 y	NR	3-parallel arms (AA using <i>Semen vaccariae</i> ; Acup; Benzo)	Nil	258 (128/65/65)	Acup; Estazolam 2-4mg/d	Effective rate	AA significantly > Acup and Benzo
26	Hisghman (2006)	U.S./ outpatients, specialty NR	58.8(51-70) / 90.9%	NR	ICD-10	2-parallel arms (AA using magnetic pellets; Sham AA)	Nil	22 (11/11)	Sham AA	PSD, ISI, SF-12, TEQ	No significant difference between AA and Sham AA
27	Hu (2009)	China/ outpatients, specialty NR	NR (18-63)/ 61.7%	15 d - 16y	NR	2-parallel arms (AA using <i>Semen vaccariae</i> ; Benzo)	Nil	60 (30/30)	Estazolam 2mg/d	Effective rate	AA significantly > Benzo
28	Jin (2003)	China/ inpatients, medicine	42 (NR)/ 57.5%	NR	NR	2-parallel arms (AA using <i>Semen vaccariae</i> ; routine care)	Nil	120 (64/56)	Routine care	Total sleeping time	AA significantly > routine care
29	Lian (1990)	China/ type of case NR	NR (21->51)/ 57.5%	20 d - 7 y	NR	2-parallel arms (AA using <i>Semen vaccariae</i> ; Benzo)	Nil	160 (80/80)	Diazepam 10mg/d	Effective rate	AA significantly > Benzo
30	Liang (2008)	China/ patients of neurology and rehabilitation clinic	62.9 (NR)/ 51.6%	NR	NR	2-parallel arms (AA <i>Semen vaccariae</i> ; Benzo)	1 m	93 (47/46)	Estazolam 1mg/d	PSQI	No significant differences between AA and Benzo
31	Lin (2007)	Taiwan/ inpatients and outpatients, specialty NR	39.9 (18-58)/ 45%	NR	CCMD-3-R	2-parallel arms (AA using <i>Semen vaccariae</i> ; Sham AA)	Nil	60 (30/30)	Sham AA	Effective rate, PSG, PSQI	AA significantly > Sham AA

Table 1 Randomized controlled trials of acupressure, reflexology, and auricular acupressure for insomnia (Continued)

No.	1 st Author (Year)	Country/ type of case	Mean age, y (range)/ % female	Duration of insomnia	Diagnostic system	Design	Follow-up	Sample size (Acup/ Control)	Control Intervention	Outcome measure	Results reported
32	Luo (1999)	China/ outpatients, specialty NR	46.4 (18-73)/ 38.7%	3 d - 21 y	NR	2-parallel arms (AA with various stimulation according to severity; hypnotics)	Nil	120 (60/60)	Phenobarbital/ Methaqualone/ Xalogen	Effective rate	AA significantly > hypnotics
33	Luo (2010)	China/ outpatients of a university clinic	19.9 (NR)/ 52.4%	Average 18.6 m	CCMD-3	2-parallel arms (AA using <i>Semen vaccariae</i> ; Benzo)	Nil	42 (21/21)	Estazolam 1-2mg/d	Effective rate, PSQI	AA significantly > Benzo in PSQI; no significant difference between AA and Benzo in effective rate
34	Suen (2002)	China/ residents of elderly hostels	81.7 (NR)/ 92%	NR	Actigraph-derived sleep efficiency < 85%	3-parallel arms (AA using magnetic pearls; AA using <i>Semen vaccariae</i> ; Sham AA)	Nil	120 (60/30/30)	AA using using <i>Semen vaccariae</i> ; Sham AA	SQ, actigraph	AA using magnetic pellets significantly > AA using seeds and Sham AA in actigraph-derived nocturnal sleep time and sleep efficiency
35	Wang (1993)	China/ outpatients, specialty NR	32.5 (NR)/ 63.3%	Average 2.1 y	NR	2-parallel arms (AA using <i>Semen vaccariae</i> ; Benzo)	Nil	60 (30/30)	Diazepam 5mg/c	Effective rate, SCL-90	Both groups significantly improved after treatment; no between group comparison
36	Wang (2002)	China/ type of case NR	NR (21-73)/ 48.3%	NR	Criteria of diagnosis and therapeutic effect of Internal diseases in TCM	2-parallel arms (AA using magnetic pearls; Benzo)	Nil	60 (30/30)	Diazepam 5mg/d	Effective rate	AA significantly > Benzo
37	Wang (2008)	Taiwan/ nursing students from a university	31.3 (NR)/ NR	NR	PSQI \geq 5	2-parallel arms (AA using <i>Semen vaccariae</i> ; no treatment)	Nil	60 (30/30)	No treatment	PSQI	AA significantly > No treatment

Table 1 Randomized controlled trials of acupressure, reflexology, and auricular acupressure for insomnia (Continued)

No.	1 st Author (Year)	Country/ type of case	Mean age, y (range)/ % female	Duration of insomnia	Diagnostic system	Design	Follow-up	Sample size (Acup/ Control)	Control Intervention	Outcome measure	Results reported
38	Zhang (2000)	China/ type of case NR	NR (NR)/ 53.3%	1 m - 35 y	Textbook	2-parallel arms (AA using <i>Semen vaccariae</i> seeds; Benzo)	Nil	60 (30/30)	Diazepam 5mg/d	Effective rate	AA significantly > Benzo
39	Zhang (2008)	China/ patients on hemodialysis	51.6 (NR)/ 50%	Average 7.7 m	ICD-10, CCMD-3, PSQI > 7	3-parallel arms (AA using <i>Semen vaccariae</i> ; Benzo; sleep hygiene)	6m	60 (20/20/20)	Estazolam 1-3mg/d; sleep hygiene	PSQI, effective rate	AA significantly > Benzo and sleep hygiene in PSQI; AA and Benzo significantly > routine care in effective rate, but no difference between AA and Benzo
40	Zhang (2009)	China/ outpatients, specialty NR	NR (34-72)/ 84%	1-10 y	NR	3-parallel arms (Double-seed AA; Single-seed AA; no treatment)	Nil	94 (38/34/32)	Single-seed AA; no treatment	PSQI, effective rate	Double-seed AA significantly > Single-seed AA and no treatment

AA, auricular acupressure; Acup, acupressure; AIS, Athens Insomnia Scale; BDI, Beck Depression Inventory; Benzo, benzodiazepine; CCMD, Chinese Classification of Mental Disorder; DSM-4-TR, Diagnostic and Statistical Manual of Mental Disorders, fourth edition, text revision; GHQ-28, General Health Questionnaire, 28 items; HAMD, Hamilton Depression Rating Scale; ICD-10, International Classification of Diseases, 10th Revision; ICSD, International Classification of Sleep Disorder; ISI, Insomnia Severity Index; KSD, Karolinska Sleep Diary; NR, not reported; PFS, Piper Fatigue Scale; PSD, Pittsburgh Sleep Diary; PSG, polysomnography; PSQI, Pittsburgh Sleep Quality Index; SCL-90, Symptom Checklist-90; SF-12/SF-36, 12-item/36-item Short Form Health Survey; Sham acup, sham acupressure; SQ, Sleep Questionnaire; SRSS, Self-rating Scale on Sleep; STAI, State Trait Anxiety Inventory; TEAS, Transcutaneous Electrical Acupoint Stimulation; TEQ, Treatment Expectancy Questionnaire

Table 2 Modified Jadad score of the included acupressure, reflexology, and auricular acupressure trials

No.	1 st Author (Year)	Described as randomized	Appropriate randomization method described	Subject blinded to intervention	Evaluator blinded to intervention	Description of withdrawals and dropouts	Total
<u>Acupressure</u>							
1	Chen (1999)	1	0	1	0	0	2
2	Dai (2007)	1	0	0	0	0	1
3	Feng (2007)	1	0	0	0	0	1
4	He (2009)	1	0	0	0	0	1
5	Hsu (2006)	1	0	0	0	1	2
6	Lan (2009)	1	0	0	0	0	1
7	Li (2007)	1	0	0	0	0	1
8	Li (2009)	1	1	0	0	0	2
9	Nordio (2008)	1	0	1	1	0	3
10	Reza (2010)	1	0	1	1	1	4
11	Song (2007)	1	0	0	0	0	1
12	Sun (2005)	1	0	0	0	1	2
13	Sun (2010)	1	1	0	1	1	4
14	Tsay (2003)	1	0	1	1	0	3
15	Tsay (2004)	1	0	0	0	1	2
16	Wang (2007)	1	0	0	0	0	1
17	Yu (2007)	1	0	0	0	0	1
18	Zhang (2007)	1	0	0	0	0	1
19	Zhou (2007)	1	1	0	0	0	2
<u>Reflexology</u>							
20	Cao (2009)	1	0	0	0	0	1
21	Gong (2009)	1	0	0	0	0	1
22	Hughes. (2009)	1	1	0	1	0	3
23	Jiang (1999)	1	0	0	0	0	1
24	Zhao (2006)	1	0	0	1	1	3

Table 2 Modified Jadad score of the included acupressure, reflexology, and auricular acupressure trials (continued)

No.	1 st Author (Year)	Described as randomized	Appropriate randomization method described	Subject blinded to intervention	Evaluator blinded to intervention	Description of withdrawals and dropouts	Total
<u>Auricular acupressure</u>							
25	Gao (1995)	1	0	0	0	0	1
26	Hisghman (2006)	1	1	1	0	1	4
27	Hu (2009)	1	0	0	0	0	1
28	Jin (2003)	1	0	0	0	0	1
29	Lian (1990)	1	0	0	0	0	1
30	Liang (2008)	1	1	0	0	0	2
31	Lin (2007)	1	0	1	0	0	2
32	Luo (1999)	1	0	0	0	0	1
33	Luo (2010)	1	0	0	0	0	1
34	Suen (2002)	1	0	1	1	0	3
35	Wang (1993)	1	0	0	0	0	1
36	Wang (2002)	1	0	0	0	0	1
37	Wang (2008)	1	1	0	0	1	3
38	Zhang (2000)	1	1	0	0	0	2
39	Zhang (2008)	1	0	0	0	0	1
40	Zhang (2009)	1	0	0	0	0	1

Table 3 Assessment of risks of bias of the included acupressure, reflexology, and auricular acupressure trials

No.	1 st Author (Year)	Adequate sequence generation	Allocation concealment	Blinding	Incomplete outcome data addressed	Free of selective reporting	Free of other bias
<u>Acupressure</u>							
1	Chen (1999)	?	?	-	-	+	?
2	Dai (2007)	?	?	-	+	+	?
3	Feng (2007)	?	?	-	+	+	?
4	He (2009)	?	?	-	+	+	?
5	Hsu (2006)	+	?	-	+	+	?
6	Lan (2009)	?	?	-	+	+	?
7	Li (2007)	?	?	-	+	+	?
8	Li (2009)	+	?	-	+	+	?
9	Nordio (2008)	?	+	+	-	+	?
10	Reza (2010)	?	?	+	-	+	+
11	Song (2007)	?	?	-	+	+	?
12	Sun (2005)	?	?	-	+	+	?
13	Sun (2010)	+	?	-	+	+	+
14	Tsay (2003)	?	?	+	-	+	?
15	Tsay (2004)	?	?	-	+	+	+
16	Wang (2007)	-	-	-	+	+	?
17	Yu (2007)	?	?	-	+	+	?
18	Zhang (2007)	?	?	-	-	+	?
19	Zhou (2007)	+	?	-	+	+	?
<u>Reflexology</u>							
20	Cao (2009)	?	?	-	+	+	?
21	Gong (2009)	-	-	-	+	+	?
22	Hughes (2009)	+	+	-	-	-	?
23	Jiang (1999)	?	?	-	+	+	?
24	Zhao (2006)	?	?	-	+	+	?

Table 3 Assessment of risks of bias of the included acupressure, reflexology, and auricular acupressure trials (continued)

No.	1 st Author (Year)	Adequate sequence generation	Allocation concealment	Blinding	Incomplete outcome data addressed	Free of selective reporting	Free of other bias
<u>Auricular acupressure</u>							
25	Gao (1995)	?	?	-	+	+	?
26	Hisghman (2006)	+	+	-	+	+	?
27	Hu (2009)	?	?	-	+	+	?
28	Jin (2003)	?	?	-	+	+	?
29	Lian (1990)	?	?	-	+	+	?
30	Liang (2008)	+	?	-	+	+	?
31	Lin (2007)	?	?	-	+	+	?
32	Luo (1999)	?	?	-	+	+	?
33	Luo (2010)	?	?	-	+	+	?
34	Suen (2002)	?	?	+	-	+	?
35	Wang (1993)	?	?	-	+	-	?
36	Wang (2002)	?	?	-	+	+	?
37	Wang (2008)	+	?	-	+	+	+
38	Zhang (2000)	+	?	-	+	+	?
39	Zhang (2008)	?	?	-	+	+	?
40	Zhang (2009)	?	?	-	+	+	?
+ Yes (low risk of bias)		? Unclear (uncertain risk)		- No (high risk of bias)			

Table 4 Summary of acupressure treatment protocol

No.	1 st Author (year)	Stimulation mode/medium	Treatment regimen	Body parts	Acupressure technique	Main acupoints/ meridian
1	Chen (1999)	Standardized/ hands	5 times/wk for 3 wks; 15 min each session.	Body, ear	Mean finger pressure of left and right hands were 3.69 kg (SD = 0.14) and 3.98 kg (SD = 0.36), respectively.	Baihui (GV20), Fengchi (GB20), Anmian, Shenmen (HT7), Ear Shenmen.
2	Dai (2007)	Standardized/ hands	Once a day for 4 wks; 20-30 min each session.	Body	NR	Yungchuan (KI1), Taixi (KI3), Zusanli (ST36), Sanyinjiao (SP6).
3	Feng (2007)	Standardized/ hands	Once a day for 4 days; 10-15 min each session.	Body	NR	Shangxing (GV23), Touwei (ST8), Cuanzhu (BL2), Sizhukong (SJ23), Yintang (EX1), Baihui (GV20), Taiyang (EX-HN5), Fengchi (GB20), Jianjing (GB21), and Taiyang meridians
4	He (2009)	Standardized/ hands	Once a day, 10 days per course for 2 courses; 20 min each session.	Body	NR	Yintang (EX-HN3), Shenting (GV24), Cuanzhu (BL2), Jingming (BL1), Yuyao (EX-HN4), Taiyang (EX-HN5), Jiaosun (SJ20), Baihui (GV20), Zhongwan (CV12), Qihai (CV6), Guanyuan (CV4), Fengchi (GB20), Jianjing (GB21), Xinshu (BL15), Ganshu (BL18), Pishu (BL20), Weishu (BL21), Shenshu (BL23), Mingmen (GV4), Gall bladder Meridian
5	Hsu (2006)	Standardized/ hands	Once a day for 5 wks; 5 min each session.	Body	Finger pressure was between 3 and 5 kg.	Shenmen (HT7)
6	Lan (2009)	Individualized/ self-treatment by hands or assisted by family members	Once a day for 3 wks; duration of each session NR.	Body	NR	Sishencong (EX-HN1), Sanyinjiao (SP6), Shenmen (HT7).

Table 4 Summary of acupressure treatment protocol (Continued)

No.	1st Author (year)	Stimulation mode/ medium	Treatment regimen	Body parts	Acupressure technique	Main acupoints/ meridian
7	Li (2007)	Standardized/ hands	Once a day, 10 days per course for 2 courses; duration of each session NR.	Body	NR	Yintang (EX-HN3), Shenting (GV24), Cuanzhu (BL2), Jingming (BL1), Yuyao (EX-HN4), Taiyang (EX-HN5), Jiaosun (SJ20), Baihui (GV20), Zhongwan (CV12), Qihai (CV6), Guanyuan (CV4), Xinshu (BL15), Ganshu (BL18), Pishu (BL20), Weishu (BL21), Shenshu (BL23), Mingmen (GV4)
8	Li (2009)	Standardized/ hands	Once a day, 10 days per course for 3 courses; 30 min each session.	Body	NR	Baihui (GV20), Shenting (GV24), Yintang (EX-HN3), Dazhui (GV14), Guanyuan (CV4), Shenque (CV8), Jingming (BL1), Taiyang (EX-HN5), Fengchi (GB20), Xinshu (BL15), Jueyinshu (BL14), Shenshu (BL23)
9	Nordio (2008)	Standardized/ wrist acupressure device	Once a day, 20 days per course; patients wore the wrist acupressure device for whole night.	Body	NR	Shenmen (HT7)
10	Reza (2010)	Standardized/ hands	3 times per wk for 4 wks	Body	Finger pressure was between 3 and 4 kg. Mean finger pressure of left and right hands were 3.39 kg (SD = 0.23) and 3.21 kg (SD = 0.28), respectively.	Neiguan (PC6), Shenmen (HT7), Yungchuan (KI1), Sanyinjiao (SP6), Anmian
11	Song (2007)	Individualized/ hands	Once a day for 15 days; 15 min each session	Body	NR	Baihui (GV20), Touwei (ST8), Yintang (EX-HN3), Shenting (GV24), Shuaigbu (GB8), Sishencong (EX-HN1), Anmian, Jianjing (GB21), Shenmen (HT7), Zusanli (ST36), Jingming (BL1), Yuyao (EX-HN4), Sizhukong (SJ23), Taiyang (EX-HN5), Siba (ST2), Neiguan (PC6), Sanyinjiao (SP6), Xinshu (BL15), Ganshu (BL18), Pishu (BL20), Fengchi (GB20)
12	Sun (2005)	Standardized/ hands	Once a day for 3 wks; 5 min each session	Foot	Finger pressure was between 3 and 5 kg.	Yungchuan (KI1)

Table 4 Summary of acupressure treatment protocol (Continued)

No.	1 st Author (year)	Stimulation mode/ medium	Treatment regimen	Body parts	Acupressure technique	Main acupoints/ meridian
13	Sun (2010)	Standardized/ hands	Once a day for 5 wks; 5 min each session	Body	NR	Shenmen (HT7)
14	Tsay (2003)	Standardized/ hands	3 days per wk for 4 wks; 14 min each session	Body, ear	Mean finger pressure of left and right hands were 3.56 kg (SD = 0.15) and 3.88 kg (SD = 0.33), respectively.	Shenmen (HT7), Ear Shenmen, Yungchuan (KI1)
15	Tsay (2004)	Standardized/ hands	3 days per wk for 4 wks; 15 min each session	Body	Finger pressure was between 3 and 4 kg.	Yungchuan (KI1), Zusanli (ST36), Yanglingchuan (GB34), Sanyinjiao (SP6)
16	Wang (2007)	Individualized/ hands	No. of treatment and duration NR.	Body	NR	Geshu (BL17), Xinshu (BL15), Pishu (BL20), Weishu (BL21), Shenshu (BL23), Mingmen (GV4), Yaoyangguan (GV3), Panguangshu (BL28), Danzhong (CV17), Zhongwan (CV12), Tianshu (ST25), Qihai (CV6), Guanyuan (CV4), Zusanli (ST36), Sanyinjiao (SP6), Neiguan (PC6), Shenmen (HT7), Yintang (EX-HN3), Shangxing (GV23), Baihui (GV20), Taiyang (EX-HN5), Fengchi (GB20), Jianjing (GB21)
17	Yu (2007)	Standardized/ hands	6 times as a course for 1-6 courses, average 2.5 courses; 17-23 min each session.	Body	NR	Fengchi (GB20), Wangu (GB12), Tianzhu (BL10), Taiyang (EX-HN5), Yifeng (SJ17), Quepen (ST12)
18	Zhang (2007)	Standardized/ hands	Once a day, no. of sessions NR; 20 min each session	Body	NR	Shangxing (GV23), Touwei (ST8), Cuanzhu (BL2), Sizhukong (SJ23), Yintang (EX1), Baihui (GV20), Taiyang (EX-HN5), Fengchi (GB20), Jianjing (GB21), and Bladder meridian
19	Zhou (2007)	Standardized/ hands	One every other day; 10 treatments as a course for 2 courses; 35 min each session	Body	NR	Governor vessel, urinary bladder meridian, Baihui (GV20), Yintang (EX1), Taiyang (EX5), Jingming (BL1)

Table 5 Summary of reflexology treatment protocol

No.	1 st Author (year)	Stimulation mode/ medium	Treatment regimen	Body parts	Reflexology technique	Main acupoints/ meridian
20	Cao (2009)	Individualized/ hands	Once or twice a day; duration for each session NR	Foot	NR	Planter reflex area: Basic reflex area, Frontal sinus, Eye, Ear, Pituitary, Small intestine, Large intestine.
21	Gong (2009)	Individualized/ blunt wooden needle	Once a day for 30 days; 45-60 min each session.	Foot	NR	Planter Reflex area: Cerebellum, Thyroid gland, Cerebrum.
22	Hughes (2009)	Individualized/ hands	Twice per wk for 3 wks; 40 min each session	Foot	NR	Plantar reflex area: Central nervous system, Thyroid, Pineal and Pituitary glands
23	Jiang (1999)	Standardized/ hands	Once a day for 10 days; 30 min each session.	Foot	NR	Planter reflex area: Celiac plexus, Kidney, Ureter, Bladder, Insomnia, Head, Cerebellum, Heart, Small intestine, Frontal sinus
24	Zhao (2006)	Standardized/ hands	Once a day, 7 times as a course for 3 courses; 40 min each session	Foot	Finger pressure was described as mild to moderate and comfortable to patients.	Planter reflex area: Kidney, Adrenal gland, Celiac plexus, Ureter, Bladder, Urethra, Trigeminal nerve, Cerebellum, Cerebrum, Pituitary, Heart, Small intestine, Sex gland, Cervical vertebra, Eye, Stomach, Liver, Bone, Lymph node

Table 6 Summary of auricular acupressure treatment protocol

No.	1 st Author (year)	Stimulation mode/ medium	Treatment regimen	Acupressure technique	Main acupoints
25	Gao (1995)	Individualized/ <i>Semen vaccariae</i>	Press 2-3 times a day, change plaster every 1-2 days on alternate ears; 10 days as a course for 1-12 courses	NR	Shenmen, Heart, and Brain
26	Hisghman (2006)	Standardized/ magnetic pellets	Change plaster 2 times per wk on alternate ears; 2 weeks	NR	Shenmen, Heart, Kidney, Liver, Spleen, Occiput, and Subcortex
27	Hu (2009)	Individualized/ <i>Semen vaccariae</i>	Press 3-5 times a day, change plaster every 1-5 days on alternate ears; 10 days as a course for 2 courses, 3-day break between course	Seeds were pressed to produce mild pain sensation that was tolerable to patients.	Shenmen, Sympathetic, Subcortex, and Neurasthenia
28	Jin (2003)	Individualized/ <i>Semen vaccariae</i>	Press 2-3 times a day, change plaster every 3-5 days on alternate ears, 10 days as a course, 1-2-day break between course, no. of course NR	NR	Shenmen, Occiput, and Sympathetic
29	Lian (1990)	Standardized/ <i>Semen vaccariae</i>	Press once a day, change plaster 1-3 days; 30 days	NR	Shenmen, Heart, Liver, Endocrine, Subcortex, Sympathetic, and Cervical Vertebrae
30	Liang (2008)	Individualized/pellets	Change plaster once every 3-5 days on alternate ears; duration of treatment NR	NR	Shenmen, Endocrine, Sympathetic, Occiput, and Eye
31	Lin (2007)	Individualized/ <i>Semen vaccariae</i>	Press 5 times a day, change plaster once every 3 days on alternate ears; 15 days as a course for 3 courses, 3-day break between course	NR	Endocrine, Shenmen, and Heart
32	Luo (1999)	Individualized/ pellets for mild severity insomnia; press-tack needles or acupuncture needles for more severe patients.	Pellet: press 3-5 min for 3-5 times a day, change plaster every 1-2 days Press-tack needles: embedded for 2 days, press 3-5 times before sleep. Acupuncture needles: left for 30 min and manipulated every 10 min. All treatments lasted 10 days on alternate ears.	Seeds were pressed to produce mild hot and pain sensation that was tolerable to patients.	Heart, Shenmen, Brain, and Kidney
33	Luo (2010)	Standardized/ <i>Semen vaccariae</i>	Press once a day, change plaster once every 2 days on alternate ears; 30 days	Seeds were pressed to produce hot and pain sensation and mild redness that was tolerable to patients.	Shenmen, Endocrine, Heart, Liver, Spleen, and Kidney

Table 6 Summary of auricular acupressure treatment protocol (Continued)

No.	1 st Author (year)	Stimulation mode/ medium	Treatment regimen	Description on the pressing	Main acupoints
34	Suen (2002)	Standardized/ magnetic pellets	Change plaster once every 3 days on alternate ears; 3 wks	NR	Shenmen, Heart, Kidney, Liver, Spleen, Occiput, and Subcortex
35	Wang (1993)	Standardized/ pellets	Change plaster once every other day on both ears; 10 times	NR	Shenmen, Heart, Kidney, Yuanzhong, and Insomnia
36	Wang (2002)	Individualized/ magnetic pellets	Change plaster once every 3 days on alternate ears; 3-10 days	Seeds were pressed to produce numbness, sourness, distention, pain and hot sensation that was tolerable to patients.	Shenmen, Sympathetic, Endocrine, and Heart
37	Wang (2008)	Standardized/ <i>Semen vaccariae</i>	Press once every 3 days, change plaster once every 7 days on alternate ears; 4 times	NR	Shenmen, Heart, Sympathetic, and Occiput
38	Zhang (2000)	Individualized/ <i>Semen vaccariae</i>	Press 4-6 times a day, change plaster once every 5-6 days on alternate ears; 15 days	Seeds were pressed to produce mild redness, hot and pain sensation that was tolerable to patients.	Shenmen, Heart, Occiput, Forehead, Anterior Pituitary, and Sympathetic
39	Zhang (2008)	Individualized/ <i>Semen vaccariae</i>	Press 4-5 times a day, change plaster once every 3-5 days on alternate ears; 4 wks as a course for 2 courses	Seeds were pressed to produce numbness, sourness, distention, pain and hot sensation that was tolerable to patients.	Shenmen, Occiput, Neurasthenia Area, Neurasthenia Point, Sympathetic, Heart, and Deep Sleep Point
40	Zhang (2009)	Standardized/ <i>Semen vaccariae</i> (single-/double-seed)	Press once every 3 hrs, change plaster once every 3 days on alternate ears; 10 times	Seeds were pressed to produce numbness, sourness, distention, pain and hot sensation that was tolerable to patients.	Heart, Kidney, Shenmen, Sympathetic, Stomach, Gall, Liver, and Spleen

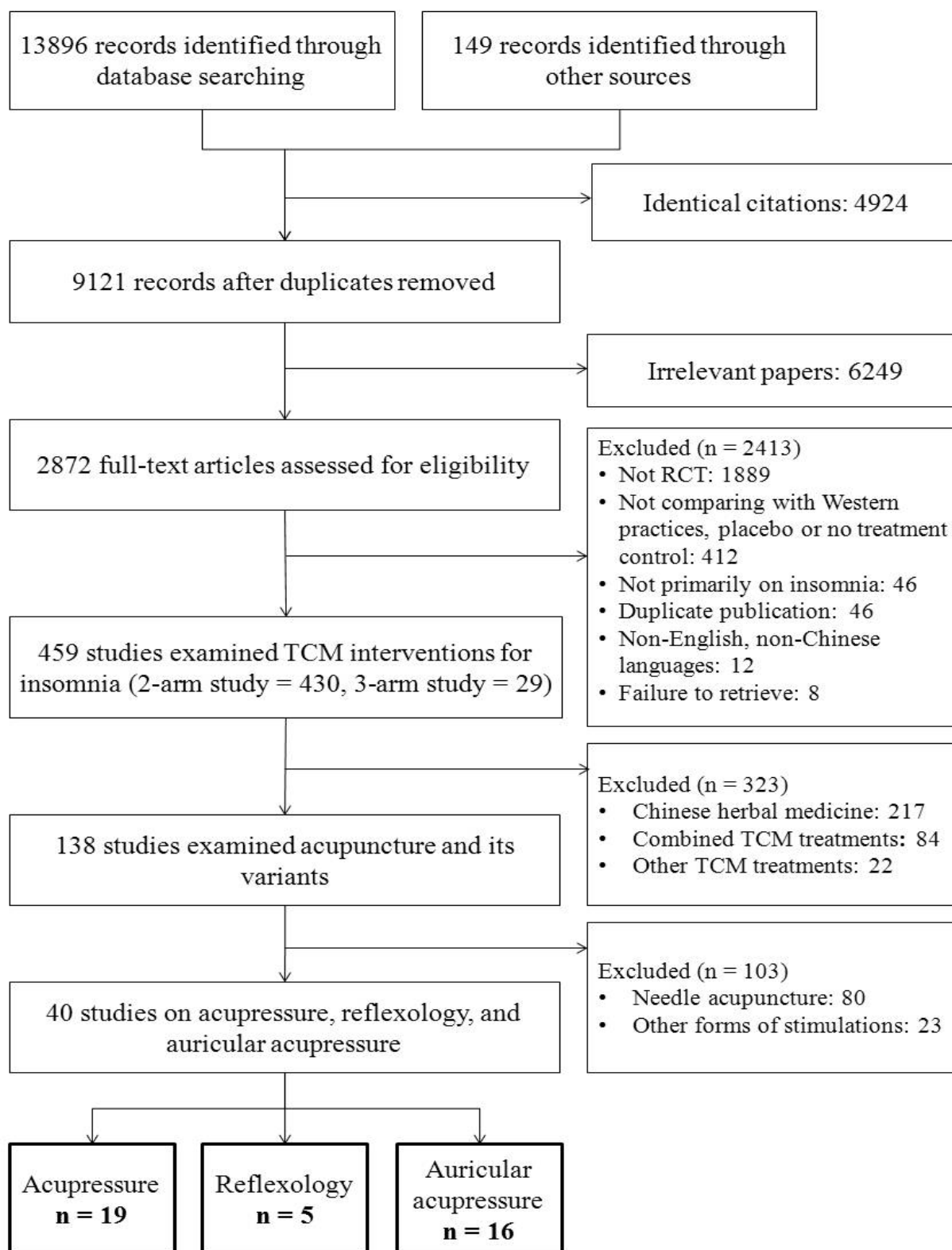
Fig. 1. Selection of trials for inclusion in the review

Fig. 2. Comparison of acupressure versus sham acupressure in posttreatment sleep questionnaire score