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Acupuncture for treatment of insomnia: An overview of systematic reviews

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ABSTRACT

Purpose: To evaluate the reliability of the methodological quality and outcome measures of systematic review (SR) /meta-analysis (MA) of acupuncture for insomnia.
Methods: We conducted a comprehensive literature search for SRs with MAs in seven international and Chinese databases. Two reviewers independently extracted data and assessed the methodological quality of the reviews according to the Assessing the Methodological Quality of Systematic Reviews 2 (AMSTAR-2), the Grading of Recommendations, Assessment, Development and Evaluation (GRADE) was used to rate the quality of evidence.
Results: Thirty-four reviews were included. The AMSTAR-2 score showed that most of the included studies were of low methodological quality and included only two high-quality literatures. The lowest score were the item 10 (all the studies didn't report on the sources of funding for the studies included in the review), item 7(32 studies didn't provide a list of excluded studies and justify the exclusions) and item 3 (27 studies didn't explain their selection of the study designs for inclusion in the review).
Conclusion: Most of the reviews included suggested that the acupuncture group was more effective than the control group in the treatment of insomnia, but the methodological quality of most of the studies and the quality of evidence were low.

1. Introduction

Insomnia is the most common sleep disorder in the clinic. In adults, the diagnostic criteria for insomnia are as high as 10%–15%, and it is a chronic disease.[1] Insomnia seriously damages the physical and mental health of patients, affects their quality of life, even induces traffic accidents and endangers personal and public safety. It is a serious burden to individuals and society. Proven approaches of treating insomnia include traditional Chinese medicine therapy, western medicine therapy and so on. The main drugs include estrazolam, alprazolam, diazepam, etc. Although pharmacological treatments are effective in the treatment of insomnia, their usage is limited due to concerns about abuse, addiction, dependence, inhibition of respiration and adverse reactions.[1,2] So, beyond the above strategies, people try to relieve insomnia by complementary or alternative treatments,[3] such as acupuncture is one of the most effective complementary treatments for treatment of insomnia.

Acupuncture is a Traditional Chinese Medicine (TCM) therapy that involves penetrating the skin with thin, solid, metallic needles that are operated by hand or electrical stimulation.[4] As a safe and effective natural therapy, acupuncture has been added to the latest *guidelines for the diagnosis and treatment of insomnia in China* formulated by the China Sleep Research Association.[5]

Some SRs/MAs about acupuncture for insomnia have been published, those studies had compared the efficacy of acupuncture treatment with drug therapy. However, the quality of them has not been evaluated, which is an essential step before treatment recommendations was presented and applied confidently.[6,7] The current overview intended to fill these gaps in the literature, investigate the general characteristics, evaluate the methodological quality and the reliability of the conclusions of the SR of acupuncture for insomnia through AMSTAR-2 statement and GRADE system in order to provide evidence reference for evidence-based decision-making.

2. Material and methods

The overview of systematic reviews was performed according to the

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Cochrane handbook (http://www.cochrane.org/resources/handbook), Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) statement as well as some high quality methodological articles.[8–10]

2.1. Literature search

A computer-based literature search of the PubMed, EMBASE, Web of science, Cochrane library, Chinese Biomedical Databases (CBM), VIP and China National Knowledge Infrastructure (CNKI) was conducted from inception until September 25, 2018, without restrictions of publication time and language. We searched the above databases using the following terminology: ("insomnia" OR "dyssomnias" OR "sleep disorders" OR "sleep initiation and maintenance disorders") combined with ("acupuncture" OR "acupuncture therapy" OR "electro-acupuncture" OR "acupuncture ear" OR "auricular needle" OR "auricular acupuncture" OR "abdominal acupuncture" OR "scalp acupuncture" OR "acupuncture points" OR "catgut implantation") combined with ("systematic" OR "review" OR "meta-analysis"). In addition, the selected references for all eligible studies were manually retrieved to ensure the comprehensiveness of the search. Search strategies in Pubmed were listed in Appendix A.

2.2. Inclusion criteria

The SRs/MAs of all clinical randomized controlled trials (RCTs) about acupuncture for insomnia were included. Subjects included should be diagnosed as insomnia according to the Classification and Diagnostic Criteria of Chinese Mental Disorders (CCMD) or other authoritative diagnostic criteria, no restrictions on gender, age, race, onset time and source of cases. Treatment group intervention measures: acupuncture therapy (such as acupuncture, electroacupuncture, auricular acupuncture, body acupuncture, etc.) or acupuncture combined with other therapies; Control group intervention: comfort therapy (placebo, pseudo-acupuncture or blank control), other therapies (Western medicine, traditional Chinese medicine or non-drug therapy, etc.).

2.3. Exclusion criteria

Literature on non-major intervention of acupuncture in the treatment group or literature on acupuncture as an intervention in the control group, retrospective study, repeated publication, comments, conference abstracts, and studies on which the data could not be extracted.

2.4. Literature screening and data extraction

The study selection and data extraction were performed by two researchers independently and then cross-checked. In the event of disagreement, the two sides discussed and decided.

All the retrieved articles were imported into the EndNote X7 software and the duplicate publications were excluded. Then the two authors sift the articles independently by reading the titles, abstracts and the full text of the articles according to the inclusion and exclusion criteria.

According to the characteristics of the selected documents, the basic characteristic tables of the standard documents are formulated, information on the last name of the first author, publication year, country, design, number of research cases, sample size, interventions, control measures, quality assessment methods and conclusions were extracted from each article that were included in the overview.

2.5. Quality assessment

The methodological quality of included SRs/MAs were appraised by the AMSTAR-2 tool, the original version of AMSTAR consists of 11 domains, and AMSTAR-2 retains the original version of 10 domains and modifies and extends them, the current AMSTAR-2 consists of 16 domains, and the evaluation option is reduced to three options, "Yes", "Partial Yes" and "No".[11,12]

The GRADE system was used to assess the quality of evidence associated with specific outcomes from five aspects: limitations, inconsistencies, indirectness, inaccuracy, and publication bias.[13,14]

The quality of included studies was evaluated by two authors independently according to the corresponding standards. Disagreements were resolved by consensus or discussions with the third author.

3. Results

3.1. Study identification

In total, 395 reviews were identified for screening. After de-duplication, 208 studies were retrieved from the database search and screened via title and abstract. Following title and abstract screening, 73 full-text review articles were selected for further evaluation. Examining these full-text articles resulted in the exclusion of 37 articles (Appendix B), 34 reviews met all inclusion criteria and are included in our overview of systematic reviews. The flow diagram depicting the selection process is provided for reference in Fig. 1.

3.2. Characteristics of included reviews

The characteristics of the included reviews are summarized in Table 1. All articles were published between 2005 and 2018, including 30 articles from China, 3 from South Korea and 1 from Australia. Twenty-three SRs/MAs (67.6%) were published in Chinese and the remaining eleven (32.4%) were published in English, and all SRs/Mas included only RCTs.

N = 17 used Cochrane criteria to evaluate the quality of literature.[15–31] N = 16 reviews used Jadad scale.[32–47] N = 1 used Agency for Healthcare Research and Quality (AHRQ).[48] N = 28 were published in journals.[15,17,19–26,29–39,42–48] N = 6 were master's degree papers in China.[16,18,27,28,40,41] The number of studies included in each SR/MA ranged from 6 to 57 and the total participants ranged from 435 to 4 140. The intervention measures were mostly acupuncture therapy (AT), auricular acupuncture (AA), body acupuncture (BA) or electro-acupuncture (EA) in the treatment group and drugs, sham AT, no treatment or placebo in the control group.

3.3. Effectiveness of acupuncture for insomnia

A total of twenty-eight MAs reported pooled results of AT versus conventional drug. The effect of acupuncture on insomnia is obvious, because all the summarized evidence favored the treatment group. Liu and Zhang has a relatively obvious results, there is no heterogeneity in either study. with pooled OR = 4.36, (95%CI = (2.16, 8.80), $P < 0.0001$, $I^2 = 0\%$, four RCTs), and RR = 4.09, (95%CI = (2.02, 8.28), $P < 0.01$, $I^2 = 0\%$, 4 RCTs).[24,27]

There were six pooled results on AT versus sham acupuncture. Results showed that the real acupuncture was more effective than sham acupuncture on improving sleep quality. The pooled results of Tang is OR = 2.99, (95%CI = (0.82, 10.93), P = 0.0002, $I^2 = 30\%$, 2 RCTs).[28]

There were two pooled results summarized from 12 RCTs comparing EA with conventional drug on the effectiveness on insomnia. Both showed higher overall efficacy in the EA group, with pooled OR = 3.48, (95%CI = (1.88, 6.44), $P < 0.0001$, $I^2 = 2\%$, 7 RCTs) and MD = -0.45, (95%CI = (-0.59, -0.31), $P < 0.00001$, $I^2 = 50\%$, 5 RCTs).[41,42]

Two reviews reported pooled results of AA versus conventional drug and both showed that the effectiveness of AA was better than that of the control interventions, with statistical significance, The results of Chen show that RR = 1.93, (95% CI = (1.40, 2.66), $p < 0.05$).[33,34]

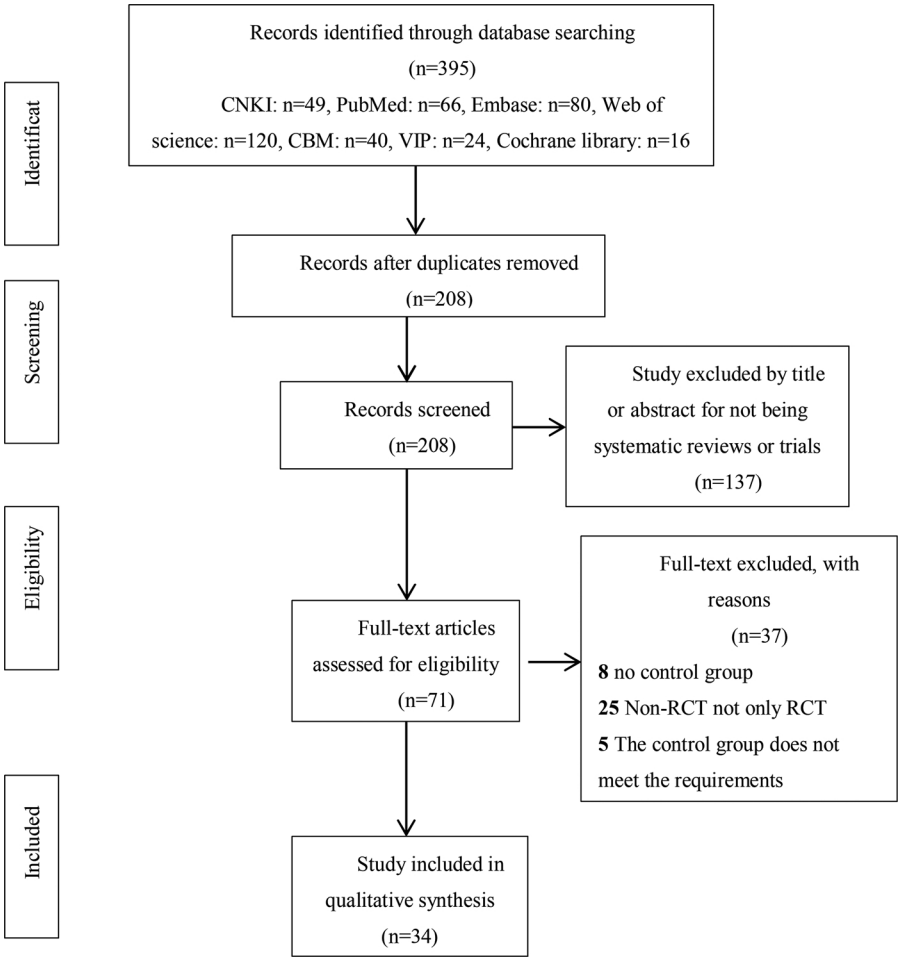

Fig. 1. Flow chart of the literature search and study selection process.

3.4. Quality of included reviews (AMSTAR-2)

The original AMSTAR were often judged the quality of the methodology by deriving an overall score of each item, AMSTAR-2 recommend that users adopt the rating process based on identification of critical domains, the critical domains of the AMSTAR-2 scale include items 2, 4, 7, 9, 11, 13, and 15.[11] Based on AMSTAR-2 classification, two reviews were high quality,[15,48] twenty-one reviews low quality,[16,18,20,21,23–26,28–31,35–37,39–41,43,44,46] and eleven critically low.[17,19,22,27,32–34,38,42,45,47]The AMSTAR-2 score is given in Table 2. AMSTAR-2 score showed that the key factors affecting the quality of the literature included item 3 (just 7 reviews explained their selection of the study designs for inclusion in the review[15,25,28,35,36,39,48]), item 7 (only 2 studies provided a list of excluded studies and justify the exclusions[15,48]) and item 10 (none of the studies reported on the sources of funding for the studies included in the review).

3.5. Quality of evidence in included reviews (GRADE)

The 34 SRs/MAs included 53 outcomes related to the effectiveness of acupuncture for insomnia, which were not included because of the descriptive analysis of individual outcome indicators. The results of GRADE evaluation showed that 28 outcomes were of low quality, 15 were very low quality and 10 were moderate (Table 3). All the outcomes were biased in randomness, allocation, concealment and blindness, and some outcomes have the problem of heterogeneity and the publication bias caused by the lack of inclusion of the study.

4. Discussion

The overview of SRs/MAs is a comprehensive research method for evaluating factors related to the treatment, etiology, diagnosis and prognosis of the same health problem.[14,36] the purpose of us was to provide a comprehensive overview of the evidence obtained from the SRs/MAs to determine the effectiveness of acupuncture in the treatment of insomnia.

This was the first overview that evaluated the SRs/MAs of acupuncture treatment of insomnia. Our overview included 34 SRs/MAs of acupuncture for insomnia, published in 2005–2018, including 6 in 2015, 7 in 2016, and 8 in 2017. Since 2015, a remarkable multitude of SRs/MAs of acupuncture for insomnia has emerged, and more researchers were beginning to notice the substitution of acupuncture. To minimize some adverse effects of traditional therapies and some people would rather use naturopathy instead.[49]

High quality SRs/MAs will be helpful to provide scientific evidence for clinicians, patients and other evidence users.[50–52] The evaluation results of AMSTAR-2 showed that there were 2 reviews were high quality, 21 reviews were low quality and 11 critically low. All of the included studies met items 1, 9, 11, 12 and 13, in other words, (1) All of the research questions and criteria were based on PICO; (2) Used a reasonable bias risk assessment method; (3) Used appropriate methods for statistical combination of results; (4) All of the included studies were RCTs with low bias risk; (5) Reasonable statistical methods were used for meta-analysis.

Two high quality reviews provided a list of excluded studies and justify the exclusions,[15,48] despite being methodologically sound, were

Table 1
Characteristics and categorization of the included reviews.

Author (Ref) year	Country	Study design n; participants n	Intervention	Controlled intervention	Quality assessment	Overall conclusion(quote)
LI ([30]) 2005	China	RCTs n = 6; n = 585.	AT	Drugs	Jadad scale	The effective rate of acupuncture group was better than that of western medicine group.
Chen ([31]) 2007	China	RCTs n = 6; n = 673.	AA	Drugs	Jadad scale	The recovery rate and improvement rate of AA group is better than that of western medicine group, and it is more effective to maintain sleep.
Lee ([32]) 2008	Korea	RCTs n = 10; n = 642.	AA	Placebo needle AA; No treatment	Jadad scale	AA has a positive effect on sleep efficiency compared with comfort injection, but in general, the effect of ear acupuncture on insomnia is limited.
Cao ([46]) 2009	China	RCTs n = 46; n = 3811.	BA; EA	Drugs	AHRQ	Acupuncture appears to be effective in treatment of insomnia.
Liu ([33]) 2009	China	RCTs&CCTs n = 10; n = 1387.	AT	Drugs	Jadad scale	The current clinical evidence has proved that acupuncture is effective in the treatment of insomnia.
Yeung ([34]) 2009	China	RCTs n = 20; n = 1299.	TNA	Drugs; Sham AT	Jadad score	TNA appeared to be more efficacious in improving sleep than sleep hygiene counseling and sham acupuncture.
Li ([35]) 2010	China	RCTs n = 21; n = 1705.	AT	Drugs	Jadad scale	Multiple acupuncture treatments are effective in the treatment of insomnia.
Du ([14]) 2011	China	RCTs n = 21; n = 1728.	AT	Drugs	Cochrane criteria	Acupuncture has advantages in improving sleep quality.
Cheuk ([13]) 2012	China	RCTs n = 33; n = 2293.	AT	Sham AT ; No treatment; Placebo; Drugs	Cochrane criteria	The current evidence is not sufficiently rigorousto support or refute acupuncture for treating insomnia.
Zhang ([15]) 2012	China	RCTs n = 11; n = 858.	AT	Drugs	Cochrane criteria	Compared with medicine, acupuncture therapy can effectively improve peri-menopausal sleep disorders.
Chen ([36]) 2015	China	RCTs n = 27; n = 2430.	AT	Drugs	Jadad score	Acupuncture and moxibustion treatment of insomnia is simple and easy, high safety, less side effects, more and more attention has been paid to it.
Fan ([16]) 2015	China	RCTs n = 16; n = 1424.	AT	Drugs	Cochrane criteria	Acupuncture and moxibustion may have some advantages over western medicine or traditional Chinese medicine in the treatment of peri-menstrual insomnia.
Liang ([38]) 2015	China	RCTs n = 20; n = 1547.	AT	Drugs	Jadad score	Treatment of Insomnia after apoplexy by Acupuncture is better than Western Medicine.
Gao ([37]) 2015	China	RCTs n = 10; n = 757.	AT; EA	Drugs	Jadad score	AT is effective for insomnia, and compare with drugs it has certain advantages.
Sun ([39]) 2015	China	RCTs n = 41; n = 2579.	EA	Drugs	Jadad score	Effect of EA on primary insomnia is better than that of medicine.
Wang ([17]) 2015	China	RCTs n = 6; n = 653.	AT	Drugs	Cochrane criteria	Acupuncture treatment of Insomnia due to Yin deficiency has more advantages than drugs.
Chiu ([18]) 2016	China	RCTs n = 31; n = 2433.	AT	Drugs; sham AT	Cochrane criteria	Acupuncture is associated with a significant reduction in sleep disturbances in women experiencing menopause- related sleep disturbances.
Lee ([19]) 2016	Korea	RCTs n = 13; n = 1051.	AA; AT; EA	Drugs	Cochrane criteria	Acupuncture could be effective for treating insomnia after stroke.
Shergis ([21]) 2016	Australia	RCTs n = 30; n = 2363.	AT; EA	Drugs; Placebo	Cochrane criteria	Acupuncture compared to sham/placebo and pharmacotherapy showed statistically significant results.
Li ([20]) 2016	China	RCTs n = 11; n = 1075.	AT	Drugs	Cochrane criteria	Acupuncture and moxibustion have certain advantages in treating senile insomnia.
Mao ([40]) 2016	China	RCTs n = 11; n = 1055.	AT	Drugs	Jadad score	Acupuncture and moxibustion is effective in treating insomnia, and the curative effect is higher than that in drug therapy.
Wei ([41]) 2016	China	RCTs n = 10; n = 487.	EA	Drugs	Jadad score	EA is an effective treatment for primary insomnia and can improve sleep quality.
Zhang ([22]) 2016	China	RCTs n = 8; n = 539.	AT	Drugs	Cochrane criteria	Acupuncture and moxibustion in the treatment of peri-menopausal sleep disorders is safe and effective.
Choi ([23]) 2017	Korea	RCTs n = 6; n = 475.	AT; EA	Drugs; sham AT	Cochrane criteria	There is a low level of evidence that acupuncture may be superior to sham acupuncture, drugs or hormones therapy.
Dong ([42]) 2017	China	RCTs n = 18; n = 1678.	AT; EA	Drugs; sham AT	Jadad score	Acupuncture could be an alternative therapy to medication for treating depression-related insomnia.
Huang ([24]) 2017	China	RCTs n = 57; n = 4140.	AT; EA	Drugs; sham AT	Cochrane criteria	Acupuncture and/or moxibustion may be effective for Primary insomnia although no significant difference in effectiveness rate and PSQI.
Liu ([25]) 2017	China	RCTs n = 15; n = 1002.	AT; EA	Drugs; sham AT	Cochrane criteria	Acupuncture or acupuncture combined with other therapies was better than only taking western medicine or only taking traditional Chinese medicine.
Liu ([43]) 2017	China	RCTs n = 14; n = 1102.	AT; EA	Drugs	Jadad score	AT is better than PI benzodiazepine, can significantly improve the overall efficacy .
Liu ([44]) 2017	China	RCTs n = 25; n = 2193.	AT	Drugs	Jadad score	…AT of insomnia is superior to drug therapy, indicating that AT of insomnia has a unique advantage of effective and safe…
Tang ([26]) 2017	China	RCTs n = 13; n = 1109.	AT	Drugs; sham AT	Cochrane criteria	…Acupuncture Qiao meridian is better than the sleep drugs in the improvement of the average sleep latency Length of time, rapid eye movement…
Yin ([27]) 2017	China	RCTs n = 10; n = 1006.	AT	Drugs	Cochrane criteria	Safety and effectiveness of acupuncture and moxibustion combined with traditional Chinese medicine in the treatment of insomnia.
Fu ([28]) 2018	China	RCTs n = 7; n = 435.	AT	Drugs	Cochrane criteria	The effect of acupuncture combined with auricular acupoint pressing in the treatment of insomnia patients with cerebral apoplexy was better than that of the control group with no adverse reaction.
Yang ([45]) 2018	China	RCTs n = 7; n = 539.	AT	Drugs	Jadad score	AT of senile insomnia is superior to non-AT.
Zhu ([29]) 2018	China	RCTs n = 19; n = 1410.	AT	Drugs	Cochrane criteria	Scalp acupuncture treatment of primary insomnia is superior to western medicine in effective rate.

AT: acupuncture therapy; AA: auricular acupuncture; BA: Body acupuncture; EA: Electroacupuncture; AHRQ: Agency for Healthcare Research and Quality; TNA: Traditional needle acupuncture.

Table 2
Critical appraisal of studies included, through using the AMSTAR tool.

Author(year)	AMSTAR																Overall quality
	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12	Q13	Q14	Q15	Q16	
LI (2005)	1	0.5	0	0.5	0	0	0	1	1	0	1	1	1	1	0	0	CL
Chen (2007)	1	1	0	0.5	1	1	0	1	1	0	1	1	1	0	0	0	CL
Lee (2008)	1	0.5	0	1	1	1	0	1	1	0	1	1	1	1	0	1	CL
Cao (2009)	1	1	1	0.5	1	1	1	1	1	0	1	1	1	1	1	1	H
Yeung (2009)	1	0.5	1	1	1	1	0	1	1	0	1	1	1	1	1	0	L
Liu (2009)	1	1	1	1	1	1	0	0.5	1	0	1	1	1	1	1	0	L
Li (2010)	1	1	0	1	1	1	0	0.5	1	0	1	1	1	1	1	0	L
Du (2011)	1	1	0	1	1	1	0	1	1	0	1	1	1	1	1	0	L
Cheuk (2012)	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	H
Zhang (2012)	1	1	0	1	1	1	0	1	1	0	1	1	1	1	0	0	CL
Chen (2015)	1	0.5	0	0	0	0	0	0	1	0	1	1	1	0	1	0	CL
Fan (2015)	1	1	0	0.5	1	1	0	1	1	0	1	1	1	1	1	1	L
Liang (2015)	1	1	0	0.5	0	0	0	0.5	1	0	1	1	1	1	1	1	L
Gao (2015)	1	1	1	1	0	0	0	1	1	0	1	1	1	1	1	0	L
Sun (2015)	1	1	0	0.5	0	1	0	0.5	1	0	1	1	1	1	1	1	L
Wang (2015)	1	1	0	1	1	1	0	1	1	0	1	1	1	1	0	0	CL
Chiu (2016)	1	1	0	1	1	1	0	0.5	1	0	1	1	1	0	1	0	L
Lee (2016)	1	1	0	0.5	1	1	0	1	1	0	1	1	1	1	1	1	L
Shergis (2016)	1	1	0	1	1	1	0	1	1	0	1	1	1	1	1	1	L
Li (2016)	1	1	0	0.5	1	1	0	1	1	0	1	1	1	0	0	0	CL
Mao (2016)	1	1	0	0.5	0	0	0	0.5	1	0	1	1	1	0	0	0	CL
Wei (2016)	1	1	0	1	0	0	0	1	1	0	1	1	1	1	1	0	L
Zhang (2016)	1	1	0	1	1	1	0	1	1	0	1	1	1	1	1	0	L
Choi (2017)	1	1	1	1	1	1	0	1	1	0	1	1	1	1	1	1	L
Dong (2017)	1	1	0	1	1	1	0	1	1	0	1	1	1	1	1	1	L
Huang (2017)	1	1	0	0.5	1	1	0	1	1	0	1	1	1	1	1	1	L
Liu (2017)	1	1	0	0.5	1	1	0	1	1	0	1	1	1	1	0	1	CL
Liu (2017)	1	0.5	0	0.5	1	1	0	1	1	0	1	1	1	1	0	0	CL
Liu (2017)	1	1	0	1	1	1	0	1	1	0	1	1	1	1	1	0	L
Tang (2017)	1	1	1	1	1	1	0	1	1	0	1	1	1	1	1	1	L
Yin (2017)	1	1	0	1	1	1	0	1	1	0	1	1	1	1	1	0	L
Fu (2018)	1	1	0	1	1	1	0	1	1	0	1	1	1	1	1	0	L
Yang (2018)	1	1	0	1	0	0	0	0.5	1	0	1	1	1	1	0	0	CL
Zhu (2018)	1	1	0	1	1	1	0	0.5	1	0	1	1	1	1	1	0	L
Number of 1(%)	34(100)	29(85.3)	7(20.6)	21(61.8)	26(76.5)	27(79.4)	2(0.59)	25(73.5)	34(100)	0(0)	34(100)	34(100)	34(100)	29(85.3)	24(70.6)	13(38.2)	

1: Yes; 0.5: partial Yes; 0: No; CL: Critically low; L: Low; H: High.
Q1: Did the research questions and inclusion criteria for the review include the components of PICO?
Q2: Did the report of the review contain an explicit statement that the review methods were established prior to the conduct of the review and did the report justify any significant deviations from the protocol?
Q3: Did the review authors explain their selection of the study designs for inclusion in the review?
Q4: Did the review authors use a comprehensive literature search strategy?
Q5: Did the review authors perform study selection in duplicate?
Q6: Did the review authors perform data extraction in duplicate?
Q7: Did the review authors provide a list of excluded studies and justify the exclusions?
Q8: Did the review authors describe the included studies in adequate detail?
Q9: Did the review authors use a satisfactory technique for assessing the risk of bias (RoB) in individual studies that were included in the review?
Q10: Did the review authors report on the sources of funding for the studies included in the review?
Q11: If meta-analysis was performed did the review authors use appropriate methods for statistical combination of results?
Q12: If meta-analysis was performed, did the review authors assess the potential impact of RoB in individual studies on the results of the meta-analysis or other evidence synthesis?
Q13: Did the review authors account for RoB in individual studies when interpreting/discussing the results of the review?
Q14: Did the review authors provide a satisfactory explanation for, and discussion of, any heterogeneity observed in the results of the review?
Q15: If they performed quantitative synthesis did the review authors carry out an adequate investigation of publication bias (small study bias) and discuss its likely impact on the results of the review?
Q16: Did the review authors report any potential sources of conflict of interest, including any funding they received for conducting the review?

Table 3
GRADE quality grading of 34 SRs/MAs of acupuncture for insomnia.

Author(year)	Outcomes (n)	Limitations	Inconsistency	Indirectness	Imprecision	Publication bias	Quality of evidence
LI (2005)	Effectiveness(6)	−1①	0	0	0	0	Moderate
Chen (2007)	Effectiveness(5)	−1①	−1②	0	0	0	Low
	Recovery(5)	−1①	−1②	0	0	0	Low
Lee (2008)	Effectiveness(2)	−1①	0	0	0	−1④	Low
Cao (2009)	Effectiveness(10)	−1①	0	0	0	−1④	Low
Yeung (2009)	Effectiveness(17)	−1①	0	0	0	−1④	Low
Liu (2009)	Effectiveness(10)	−1①	0	0	0	−1④	Low
Li (2010)	Effectiveness(3)	−1①	0	0	−1③	−1④	Very low
Du (2011)	Effectiveness(4)	−1①	0	0	0	0	Moderate
Cheuk (2012)	Effectiveness(2)	−1①	0	0	0	−1⑤	Low
Zhang (2012)	Effectiveness(11)	−1①	−1②	0	−1③	0	Very low
Chen (2015)	Effectiveness(27)	−1①	−1②	0	0	−1④	Very low
Fan (2015)	Effectiveness(14)	−1①	−1②	0	0	−1④	Very low
	PSQI score(6)	−1①	−1②	0	0	−1④	Very low
Liang (2015)	Effectiveness(12)	−1①	0	0	0	0	Moderate
Gao (2015)	Effectiveness(8)	−1①	0	0	0	−1④	Low
	PSQI score(7)	−1①	−1②	0	0	−1④	Very low
Sun (2015)	Effectiveness(7)	−1①	0	0	0	−1④	Low
Wang (2015)	Effectiveness(6)	−1①	0	0	−1③	−1⑤	Very low
	PSQI score(2)	−1①	0	0	−1③	−1⑤	Very low
Chiu (2016)	Effectiveness(27)	−1①	−1②	0	0	0	Low
Lee (2016)	Effectiveness(7)	−1①	−1②	0	0	0	Low
Shergis (2016)	PSQI score(23)	−1①	−1②	0	0	0	Low
Li (2016)	Effectiveness(9)	−1①	0	0	0	0	Low
	PSQI score(6)	−1①	−1②	0	0	0	Low
	Cure rate(7)	−1①	0	0	0	0	Low
	PSQI score after follow-up(2)	−1①	−1②	0	0	−1⑤	Very low
Mao (2016)	Effectiveness(8)	−1①	0	0	0	−1⑤	Low
Wei (2016)	PSQI score(5)	−1①	0	0	0	−1④	Low
Zhang (2016)	Effectiveness(4)	−1①	0	0	−1③	−1④	Very low
	PSQI score(2)	−1①	0	0	0	−1④	Low
Choi (2017)	Effectiveness(2)	−1①	−1②	0	0	−1⑤	Very low
	PSQI score(3)	−1①	0	0	0	−1⑤	Low
Dong (2017)	PSQI score(10)	−1①	−1②	0	0	−1④	Very low
Huang (2017)	Effectiveness(21)	−1①	0	0	0	0	Moderate
	PSQI score(12)	−1①	0	0	0	0	Moderate
Liu (2017)	Effectiveness(4)	−1①	0	0	0	−1⑤	Low
	PSQI score(2)	−1①	0	0	0	−1⑤	Low
Liu (2017)	Effectiveness(10)	−1①	0	0	0	0	Moderate
	PSQI score(4)	−1①	0	0	0	0	Moderate
Liu (2017)	Effectiveness(25)	−1①	0	0	0	0	Moderate
	PSQI score(13)	−1①	−1②	0	0	0	Low
Tang (2017)	Effectiveness(10)	−1①	0	0	0	0	Moderate
	PSQI score(4)	−1①	0	0	0	0	Moderate
	HAMD score(1)	−1①	0	0	0	−1④	Low
	Safety(2)	−1①	0	0	0	−1④	Low
Yin (2017)	Effectiveness(10)	−1①	0	0	0	−1④	Low
Fu (2018)	Effectiveness(7)	−1①	0	0	−1③	0	Low
	PSQI score(3)	−1①	0	0	0	−1⑤	Low
Yang (2018)	Effectiveness(4)	−1①	−1②	0	0	−1⑤	Very low
	PSQI score(5)	−1①	0	0	0	−1⑤	Low
Zhu (2018)	Effectiveness(12)	−1①	−1②	0	0	−1④	Very low
	PSQI score(7)	−1①	−1②	0	0	−1④	Very low

PSQI: Pittsburgh Sleep quality Index; HAMD: Hamilton Depression Rating Scale; ①: The design of the experiment with a large bias in random, distributive hiding or blind; ②: The confidence interval overlaps less, the heterogeneity test P is very small, and the I^2 is larger; ③: Confidence interval is not narrow enough; ④: Funnel graph asymmetry; ⑤: Fewer studies are included and there may be greater publication bias.

not without limitations. Cao et al. [48] was criticized for the search strategy was not comprehensive and there was no reported on the sources of funding for the studies included in the review, which will have an impact on the final result. Similarly, the main problem with Cheuk et al. [15] was that there was no reported on the sources of funding for the studies included in the review, which seriously affected the results of the quality evaluation and resulted in a lack of completeness in most other studies.

Of the 21 low quality studies and 11 critically low quality studies, none provided a list of excluded studies, and none of them reported on the sources of funding for the studies included in their reviews; 84.4% of them did not explain their selection of the study designs for inclusion in the review, which was not conducive to the rigor of the system review; 37.5% reviews did not use comprehensive strategy when searching,[18,21,22,26,27,32,33,38,40–42,45] which may cause bias to the results; 65.6% of them had not explained the financial support information involved in the article,[17,19,22,27,32–34,42,45,47] which will not only reduce the methodological quality of the article, but may also have an impact on the final result. To sum up, the methodological quality of SRs/MAs in this field still need to be improved. Researchers should pay attention to comply with the requirements of the relevant items of the AMSTAR-2 scale and strictly control the methodological quality of the articles.

The GRADE system was used to classify the evidence quality of the SRs/MAs. We found that the most of the evidence quality grades were low or very low, 10(18.9%) outcomes were of moderate quality. All of the outcome indicators were demoted because of the limitations caused by bias in random, distributive hiding or blind. Through further

analyzed, we found that the limitation in this respect was mainly due to the particularity of acupuncture therapy, which cannot be blind to patients.[14] 18(34%) outcomes downgraded due to greater heterogeneity and 6(11.3%) due to the confidence interval was not narrow enough, 32(60.4%) outcomes were determined to be likely to have publication bias due to funnel graph asymmetry and fewer studies are included. In terms of overall effective rate, all of the 7 moderate quality outcomes considered that the acupuncture group was superior to the control group in the treatment of insomnia.[16,26,28,32,40,45,46] 3 moderate quality outcomes are Pittsburgh Sleep quality Index scale (PSQI) and the results showed that the sleep quality of acupuncture group was better than that of control group.[26,28,45]

Our overview showed that acupuncture may be beneficial to insomnia patients. To our knowledge, this overview is more comprehensive and is integrated evaluation based on the SRs/MAs of acupuncture for treatment of insomnia, and the results will provide more comprehensive information for future studies. Based on the current evidence and the safety of acupuncture, there was a case for the use of acupuncture as an adjunctive therapy in insomnia, especially for patients who cannot stand traditional medication.[53]

A major limitation of our overview: evaluation of methodological quality and quality of evidence was a subjective process. Different researchers had their own independent judgment on each factor, so the results may vary. Although this study had been independently evaluated and checked by two researchers, it may still be different from other studies.

5. Conclusion

Although acupuncture is more effective than traditional medicine, sham acupuncture and sleep hygiene counseling used to treat insomnia, the results of this study show that the methodological quality of the included studies is generally low. Therefore, the interpretation of seemingly "promising" results should be very cautious. At present, the evidence level of SR/MA of methodology quality and outcome index of acupuncture for insomnia needs to be improved. Researchers should observe the relevant norms of AMSTAR-2 scale and GRADE scale when writing SR/MA and further improve the quality of research in the future.

Conflict of interest

The authors declare that they have no conflict of interests.

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Appendix A. Search strategies of PubMed database

Strategies
#1 Dyssomnias[Mesh]
#2 Insomnia[ti, ab] OR Dyssomnias[ti, ab] OR Sleep Disorders[ti, ab] OR Sleep Initiation and Maintenance Disorders[ti, ab]
#3 (#1 OR #2)
#4 Acupuncture[Mesh]
#5 Acupuncture[ti, ab] OR acupuncture therapy[ti, ab] OR electro-acupuncture[ti, ab] OR acupuncture ear[ti, ab] OR auricular needle[ti, ab] OR auricular acupuncture[ti, ab] OR abdominal acupuncture[ti, ab] OR scalp acupuncture[ti, ab] OR acupuncture points[ti, ab] OR catgut implantation[ti, ab]
#6 (#4 OR #5)
#7 meta-analysis[Mesh]
#8 Systematic[ti, ab] OR review[ti, ab] OR meta-analysis[ti, ab]
#9 (#7 AND #8)
#10 (#3 AND #6 AND #9)

Appendix B. Full text articles excluded with reasons

Full text articles excluded	Reasons
Ramprasad Kalavapalli et al.(2007)[1]	Not providing sufficient information
Mang et al.(2008)[2]	Non-systematic review
Sun et al.(2010)[3]	Non-systematic review
Huang et al.(2010)[4]	The control group not meet the criteria
Jerome Sarris et al.(2011)[5]	Not providing sufficient information
Bu (2011)[6]	The intervention does not meet the criteria
Yeung et al.(2012)[7]	The intervention does not meet the criteria
Lee et al.(2012)[8]	The object of study does not meet the criteria
Huang et al.(2012)[9]	Not providing sufficient information
Hollenbach et al.(2013)[10]	The intervention does not meet the criteria
Grabska-Kobyłecka et al.(2014)[11]	Non-Chinese/English
Wang et al.(2014)[12]	Non-systematic review
Tan et al.(2014)[13]	The intervention does not meet the criteria
Chen et al.(2015)[14]	Summary of the meeting
Lan et al.(2015)[15]	The intervention does not meet the criteria
A. G. Bezerra et al.(2015)[16]	Inclusion studies not just RCT
Huang et al.(2015)[17]	The intervention does not meet the criteria
Yang et al.(2015)[18]	The intervention does not meet the criteria
Liu et al.(2015)[19]	The control group not meet the criteria
Zuo et al.(2016)[20]	The intervention does not meet the criteria
Liu et al.(2016)[21]	The control group not meet the criteria
Kim et al.(2016)[22]	Non-Chinese/English
Chen et al.(2016)[23]	The intervention does not meet the criteria
Dimitriou et al.(2017)[24]	The intervention does not meet the criteria

Wang et al.(2017)[25]	The intervention does not meet the criteria
Yu et al.(2017)[26]	The intervention does not meet the criteria
Liu et al.(2017)[27]	The intervention does not meet the criteria
Chen (2017)[28]	Not providing sufficient information
Zhang (2017)[29]	The control group not meet the criteria
You (2017)[30]	Not providing sufficient information
Guo et al.(2018)[31]	Not providing sufficient information
Zhang et al.(2018)[32]	Case and control group not meet the criteria
Li et al.(2018)[33]	Not providing sufficient information
Chen et al.(2018)[34]	Not providing sufficient information
He et al.(2018)[35]	Non-systematic review
Li et al.(2018)[36]	Non-systematic review
Huang et al.(2018)[37]	The intervention does not meet the criteria

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