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Comparing acupoint catgut embedding and acupuncture therapies for simple obesity

A protocol for systematic review and meta-analysis

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Abstract

Background: This systematic review aimed to assess the effectiveness and safety of acupoint catgut embedding (ACE), which is widely used in simple obese patients.

Methods: Nine electronic databases and 2 trial registries were searched from inception to September 2021 without language limitations. All randomized controlled trials involving ACE therapies for simple obesity were included. Assessment of Cochrane's risk of bias and meta-analysis, as well as GRADE evaluation, were also performed.

Results: A total of 73 randomized clinical trials involving 5872 participants were included. The overall risk of bias was high or unclear. ACE showed higher efficacy in total effective rate, body mass index, and body weight than manual acupuncture. In addition, ACE is more beneficial in total effective rate than electroacupuncture (EA). Moreover, combination therapy of ACE with EA is more effective in total body mass index and body weight than EA alone.

Conclusions: Despite some potential improvement, the evidence regarding the effectiveness and efficacy of ACE for simple obesity is inconclusive due to the poor quality of evidence. Further well-designed randomized controlled trials are needed to confirm the effectiveness of ACE for simple obesity.

Abbreviations: AA = auricular acupressure, ACE = acupoint catgut embedding, BFP = body fat percentage, BMI = body mass index, BW = body weight, CIs = confidence intervals, CMT = Chuna manual therapy, EA = electroacupuncture, GRADE = Grading of Recommendations Assessment, Development and Evaluation, HC = hip circumference, MA = manual acupuncture, MD = mean difference, RCTs = randomized controlled trials, RRs = risk ratios, SMD = standardized mean difference, SR = systematic reviews, TC = total cholesterol, WC = waist circumference, WHR = waist-hip ratio.

Keywords: acupoint catgut embedding, meta-analysis, simple obesity, systematic review, thread embedding

1. Introduction

Obesity has become a worldwide epidemic with rapidly increasing morbidity and a huge burden on personal and public health.[1,2] Simple obesity is defined as increased body weight (BW) and accumulation of body fat without obvious disease. A recent study stated that 51% of the population will develop simple obesity by 2030 according to the National Health and Nutrition Examination Survey in U.S.[3] Moreover, simple obesity is associated with a major risk of comorbid chronic diseases, such as cardiovascular diseases, cancer, and diabetes.[4] Therefore, with the rapid development of medical technology, the treatment of simple obesity has become a targeted intervention based on the individual differences of patients.[5]

Currently, obesity treatment methods mainly include lifestyle modification, drugs, and surgical treatment.[6] However, changing one's lifestyle and engaging in physical exercise require high self-control and economic resources.[7] Furthermore, the long-term use of anti-obesity drugs, namely rimonabant, is restricted in many countries because it can cause anxiety and depression.[8] Thus, pharmacological and non-pharmacological treatments have not achieved satisfactory results.

Acupoint catgut embedding (ACE) is an alternative medicine that has been widely used for treating a variety of diseases, such as obesity, stomach disease, and migraine.[9] Multiple studies have demonstrated the amelioration of weight after the use of ACE.[10,11] Although two systematic reviews (SR)s were

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All data generated or analyzed during this study are included in this published article [and its supplementary information files].

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conducted to establish the effect of ACE on obesity,[12,13] there were language limitations. Additionally, many randomized controlled trials (RCTs) of ACE and related therapies published in recent years have not been included in previous SRs. For example, an RCT published in 2020 found that participants who received ACE experienced a significant reduction in BW.[14,15] Of note, there are many kinds of alternative medicine interventions, which can treat simple obesity, such as Chuna manual therapy (CMT), auricular acupressure (AA), manual acupuncture (MA), and electroacupuncture (EA).[16,17] Therefore, it is important to perform a SR to appraise and compare all available evidence and to reach a better conclusion about ACE. The specific research questions addressed herein were as follows: Is ACE associated with reduction in obesity compared with MA or EA? and In clinical practice, is the combination of ACE and other therapies a good choice for treating obesity?

2. Materials and Methods

2.1. Protocol registration

This review followed the Preferred Reporting Items for Systematic Reviews and Meta-analyses (PRISMA) guidelines.[18] The checklist was shown in Table S1, Supplemental Digital Content 1, http://links.lww.com/MD/H822. The protocol was published in Medicine®: Case Reports and Study Protocols (Medicine Case Reports and Study Protocols 2021;2:11:e0194, doi: 10.1097/MD9.0000000000000194).[19]

2.2. Inclusion criteria for study selection

2.2.1. Type of study. Only RCTs of ACE for obesity without restrictions on publication status were eligible for inclusion. Trials were excluded based on the following criteria: animal studies, literature review, and non-RCTs.

2.2.2. Type of participants. Participants were diagnosed with simple obesity using clearly defined or internationally recognized criteria, regardless of sex, age, or race.

2.2.3. Type of intervention. ACE therapy alone or in combination with other interventions, such as MA, EA, AA, cupping therapy, and CMT. Other interventions, such as Western medicine, herbal medicine, usual care and practice, and sham ACE, were excluded.

2.2.4. Type of comparisons. The comparison interventions included MA, EA, AA, cupping therapy, and CMT.

2.2.5. Treatment period. Not specified.

2.2.6. Outcome measures. Total effective rate, body mass index (BMI), BW, waist circumference (WC), hip circumference (HC), waist-hip ratio (WHR), and body fat percentage (BFP) were the primary outcomes. Levels of metabolic markers, such as triglyceride and total cholesterol (TC) levels, and adverse events were considered the secondary outcomes.

2.3. Search method for identification of studies

2.3.1. Electronic data sources. The following nine electronic databases were searched to identify RCTs published from inception to September 2021: PubMed, EMBASE, the Cochrane Central Register of Controlled Trials, the Cumulative Index to Nursing and Allied Health Literature, Oriental Medicine Advanced Searching Integrated System, Science-ON, KoreaMed, China Network Knowledge Infrastructure, and CiNii. We did not apply language restrictions.

2.3.2. Searching other resources. The reference lists of potentially missing eligible studies were searched from the ongoing trial databases such as Clinicaltrials.gov and the World Health Organization International Clinical Trials Registry Platform. The referenced reviews and retrieved articles of all included studies were scanned.

2.3.3. Search strategy. The following keywords were used: obesity (e.g., "obesity" or "weight gain"); catgut embedding (e.g., "catgut" or "thread"); RCT (e.g., "randomized controlled trial"). We used the search strategy described in a previous protocol.[19]

2.4. Date collection and analysis

2.4.1. Selection of studies. Two investigators (Zhao HY and Son MJ) reviewed and screened the articles independently by checking the titles and abstracts. If there was any disagreement, either a consensus was reached or a third party (Kim S) was involved. Supplemental Digital Content 2, http://links.lww.com/MD/H823 presents a PRISMA 2020 flow diagram of the study selection process.

2.4.2. Data extraction. Two reviewers independently extracted data using a standard data extraction form. The following data were extracted: the first author, year of publication, interventions and comparison treatment, duration, follow-up, outcome measurements, results, adverse events, and other information. A third reviewer was selected to conduct a discussion and to address disagreements during the extraction process.

2.4.3. Quality assessment. The risk of bias was determined according to the Cochrane Handbook for SR of Interventions (version 6.2). Two reviewers independently assessed the following characteristics of the included studies: random sequence generation, allocation concealment, blinding of participants and personnel, blinding of outcome assessment, incomplete outcome data, and selective reporting and other bias.[20] All differences were resolved by consensus or after discussion with the third reviewer.

2.4.4. Assessment of quality of evidence. The Grading of Recommendations Assessment, Development and Evaluation (GRADE) method was used to assess the quality of the evidence for the primary and secondary outcomes.[21] The evidences were divided according to the four levels of evidence quality, namely high, moderate, low, and very low, in terms of the following five major domains: inconsistency, limitations, imprecision, indirectness, and publication bias.

2.4.5. Statistical analysis. All statistical analyses were performed using Reviewer Manager Software, version 5.4. (RevMan, the Cochrane Collaboration, London, England, 2020). We considered the clinical heterogeneity among studies, and a random-effects model was used to determine the estimates of treatment effects. The weights of individual trials were determined by inverse variance and Mantel–Haenszel methods for continuous and dichotomous outcomes, respectively. For continuous data, we calculated the mean difference (MD) or standardized mean difference (SMD), whereas dichotomous outcomes are expressed as risk ratios (RRs) with 95% confidence intervals (CIs). The statistical heterogeneity was analyzed using I^2 test; I^2 of 0% to 50% was considered low, 50% to 75%, serious, and >75%, very serious. Moreover, subgroup analyses were conducted to detect the potential for heterogeneity and when possible, included the type of treatment and treatment period.

3. Results

The database searches yielded 55 studies from PubMed, 172 from EMBASE, 251 from Cochrane Central Register of Controlled Trials, 54 from CINAHL, 285 from China Network Knowledge Infrastructure, 0 from CiNii, 58 from SCIENCE ON, 0 from KoreaMed, 8 from Oriental Medicine Advanced Searching Integrated System, 1 from Clinicaltrials.gov, and 4 from International Clinical Trials Registry Platform. After the duplicates were removed, 818 studies remained. After the first review, which was based on the title and abstract, 195 studies remained. A total of 195 studies were selected for full text review and data processing; 121 studies were excluded as per the pre-defined eligibility criteria. Ultimately, 73 RCTs were included (including 4 three-armed studies) in the meta-analysis.

3.1. Study characteristics

The characteristics of the included trials are listed in Table 1. All trials were conducted in China; 72 were written in Chinese and one in English. A total of 5872 patients with obesity were involved in this meta-analysis, with sample sizes ranging from 21 to 200, and the duration of treatment was from 12 days to 6 months. Fifty-five trials included patients with simple obesity;[15,22,23,25–28,32–34,36–41,43–46,49–51,54,56–59,61–63,65–67,69–73,75–80,82–90,92] six included patients with abdominal obesity;[14,31,47,52,68,74] one included a patient with central obesity;[24] one included a patient with lower body obesity;[91] the remaining ten trials did not mention the type of obesity.[29,30,35,42,48,53,55,60,64,81] The other detail of treatment was showed in Supplemental Digital Content 3, http://links.lww.com/MD/H824.

All included studies were divided into seven groups based on the intervention and comparison groups: ACE versus MA (n = 30),[14,22,27,29,31,32,34,37,44,45,48–51,56–58,60–62,64,69,72,73,76,84,85,88–90] ACE versus EA (n = 25),[15,25,28,30,36,39–41,43,46,47,52–54,59,63,65,71,74,79,82,83,86,87,91] ACE plus MA versus MA (n = 6),[26,31,38,42,50,78] ACE plus EA versus EA (n = 10),[23,24,33,47,54,67,70,75,80,92] ACE plus AA versus AA (n = 2),[35,77] ACE plus CMT versus CMT (n = 3),[66,68,81] and ACE plus cupping therapy versus cupping therapy (n = 1).[55]

3.2. Quality of the included studies

Figure 1 shows the risk of bias of the included studies. All 73 studies mentioned randomization in the trials; however, 16 studies used the visiting sequence, which is considered to have high risk of bias for random sequence generation;[28,43,53,54,58,59,61,62,65,70,73,75,82,83,87,88] 36 studies provided information on allocation concealment,[14,15,22–24,28,29,31,35–40,42–46,52,54,57,63,68,74–76,79,80,83,85–87,90–92] and the remainder of the studies did not report allocation concealment, resulting in an unclear risk of bias. All trials were judged to have a high risk of bias with respect to the blinding of participants, given that it was impossible to blind the participants in studies comparing the ACE intervention with other therapies. Considering that the outcomes of all evaluations are objective in the study, we judged the outcome measurement as being unlikely to be affected by the lack of blinding. Incomplete outcome data were reported in five studies owing to the number of drop-outs in the trial,[14,36,64,79,80] and no study reported data with a low risk of bias. All RCTs had unclear bias in terms of blinding.

3.3. Synthesis of results

3.3.1. ACE versus MA.

3.3.1.1. Total effective rate. Twenty-nine studies[14,22,27,29,31,32,34,37,44,48–51,56–58,60–62,64,69,72,73,76,84,85,88–90] out of 30 including 2100 participants (1060 in the experiment group and 1040 in the comparison group) were included in the meta-analysis to synthesize the total effective rate. As shown in Figure 2A, the pooled results showed that ACE was more effective than MA (RR = 1.12 [1.07, –1.18]; $P < .00001$, $I^2 = 45\%$).

3.3.1.2. BMI. Eighteen studies[14,22,29,34,37,44,45,48–50,57,64,72,76,85,88–90] assessed the benefit of ACE in reducing the BMI. However, the results showed serious heterogeneity ($I^2 = 86\%$). We conducted a subgroup analysis, and the pooled result showed that after using similar acupoints ST25, ST36, ST40, SP6, SP9, and CV12, ACE was more effective than MA in reducing BMI (MD = –1.06 [–1.72, –0.39]; $P = .002$, $I^2 = 0$) (Fig. 2B).

3.3.1.3. BW. We pooled data from 19 studies[14,22,27,31,34,37,44,45,48,49,56,57,64,72,76,85,88–90] reporting on BW between the intervention and comparison groups. We found that ACE was beneficial for reducing BW (n = 1298, MD = –2.28 [–3.16, –1.41]; $P < .00001$, $I^2 = 51\%$) (Fig. 2C).

3.3.1.4. WC. We included the results of 15 studies[14,27,34,37,44,48,49,56,64,72,76,85,88–90] and demonstrated a significant difference in the WC data between the intervention and control groups with moderate heterogeneity ($I^2 = 68\%$). We conducted a subgroup analysis, and the results showed that ACE was more effective than MA in reducing WC when using similar acupoints such as ST25, ST36, ST40, SP6, SP9, and CV12 (MD = –4.53 [–5.88, –3.18]; $P < .00001$, $I^2 = 0\%$) (Fig. 2D).

3.3.1.5. HC. Comparisons of 10 studies[27,34,37,48,49,72,85,88–90] showed that ACE was significantly different with high heterogeneity ($I^2 = 73\%$). When we used a similar acupoint routine as mentioned above, the results had no heterogeneity (MD, –3.08 [–5.20, –0.96]; $P = .004$, $I^2 = 0$).

3.3.1.6. WHR. On pooling the studies[34,50,88,90] that examined the reduction in obesity with ACE versus MA, a pooled SMD of –0.13 ([–0.34, 0.08]; $P = .22$, $I^2 = 0$) was obtained in favor of ACE.

3.3.1.7. BFP. Six studies,[14,29,49,50,88,90] with 506 participants, were pooled for this analysis. The pooled results showed serious heterogeneity ($I^2 = 90\%$). A subgroup analysis of data reported after using similar acupoints showed that ACE was more effective than MA (MD = –1.78 [–2.57, 0.99]; $P < .00001$, $I^2 = 0\%$).

3.3.2. ACE versus EA.

3.3.2.1. Total effective rate. Twenty-four studies[15,25,28,30,36,40,41,43,46,47,52–54,59,63,65,71,74,79,82,83,86,87,91] reported data on ACE versus EA. The result showed a significant difference between ACE and EA (n = 1825, RR = 1.06 [1.02, 1.10]; $P = .005$, $I^2 = 24\%$) (Fig. 3).

3.3.2.2. BMI. BMI was assessed in 20 studies,[15,25,28,30,36,40,43,46,47,52–54,63,65,74,79,82,83,86,87] and borderline differences were observed between the ACE and EA (n = 1505, MD = –0.30 [–0.80, 0.20]; $P = .23$, $I^2 = 70\%$).

3.3.2.3. BW. We compared the effects of ACE and EA on BMI data.[15,25,28,36,40,43,46,47,52,53,63,65,74,82,83,86,87] There was no significant difference between the two groups (n = 1246, MD = 0.18 [–0.85, 1.21]; $P = .73$, $I^2 = 20\%$).

3.3.2.4. WC. In total, 14 studies[15,25,36,40,43,46,47,52,54,63,65,74,82,86] assessed WC with ACE and with EA alone, and there were no significant differences in their effect (n = 1029, MD = –0.86 [–1.84, 0.11]; $P = .08$, $I^2 = 19\%$).

3.3.2.5. HC. The results of nine studies[25,40,43,46,47,52,54,63,74] showed borderline differences between the two groups (n = 698, MD = 0.51 [–0.90, 1.91]; $P = .48$, $I^2 = 62\%$).

3.3.2.6. WHR. Eight studies[30,40,43,47,52,54,63,87] reported reduced outcomes for obesity with ACE and EA. The pooled result did

Table 1

Characteristics of included studies.

First author (year) Country	Type of obesity	Age (mean ± SD) (range)	Duration	Acupoints of ACE	Experimental intervention	Control intervention	Sample size	Outcome measure	Effects estimates	Adverse events
Chen (2007) China[22]	Simple obesity	(A) 43.1 ± 13.6 (n.r.) (B) 44.6 ± 10.3 (n.r.)	1 mo	ST34, CV12, ST25, CV9, ST40	(A) ACE	(B) MA	(A) 40 (B) 40	Total effective rate BMI BW FBG FINS HOMA-IR TNF-α	RR, 1.03 [0.88, 1.20], $P = .72$ MD, −0.59 [−1.92, 0.74], $P = .38$ MD, 1.48 [−1.07, 4.03], $P = .26$ MD, −0.01 [−0.21, 0.19], $P = .92$ MD, 0.51 [−0.08, 1.10], $P = .09$ MD, 0.08 [−0.11, 0.27], $P = .41$ MD, 0.21 [−0.35, 0.77], $P = .46$	n.r.
Chen (2010) China[24]	Simple obesity and central obesity	(A) 45.72 ± 10.02 (n.r.) (B) 44.83 ± 10.13 (n.r.)	8 wk	GB26, CV12, ST25, CV9, ST40	(A) ACE plus EA	(B) EA	(A) 55 (B) 55	Total effective rate BMI TC TG HDL-C LDL-C	RR, 1.04 [0.89, 1.21], $P = .64$ MD, −0.99 [−2.50, 0.52], $P = .20$ MD, −0.07 [−0.39, 0.25], $P = .66$ MD, 0.04 [−0.09, 0.17], $P = .53$ MD, 0.02 [−0.13, 0.17], $P = .80$ MD, 0.05 [−0.26, 0.36], $P = .75$	n.r.
Chen (2010) China[23]	Simple obesity	(A) 31.23 ± 9.46 (n.r.) (B) 33.37 ± 12.08 (n.r.)	3 mo	ST21, ST25, SP15, ST28, ST37	(A) ACE plus EA	(B) EA	(A) 30 (B) 30	Total effective rate BMI BW WC HC	RR, 1.04 [0.90, 1.20], $P = .57$ MD, 0.46 [−0.71, 1.63], $P = .44$ MD, 0.60 [−3.34, 4.54], $P = .77$ MD, −0.43 [−3.49, 2.63], $P = .78$ MD, 0.40 [−1.99, 2.79], $P = .74$	Syncope
Chen (2014) China[25]	Simple obesity	(A) 34.3 ± 3.2 (22–59) (B) 35.2 ± 3.6 (22–60)	3 mo	CV6, CV4, ST25, SP15, CV12, CV10, ST36, SP9, BL18, BL20, BL21, BL23, BL25	(A) ACE	(B) EA	(A) 28 (B) 28	Total effective rate BMI BW WC HC	RR, 1.33 [1.06, 1.65], $P = .01$ MD, −4.00 [−5.32, −2.68], $P < .00001$ MD, −5.72 [−10.88, −0.56], $P = .03$ MD, −4.52 [−8.50, −0.54], $P = .03$ MD, −6.44 [−10.16, −2.72], $P = .0007$	Vertigo, fatigue, vomiting
Chen (2015) China[26]	Simple obesity	n.r. ± n.r. (18–46)	12 wk	LI11, CV13, CV12, CV10, ST25, SP15, ST24, ST26, CV4, ST36, ST40, SP6	(A) ACE plus MA	(B) MA	(A) 40 (B) 40	Total effective rate	RR, 1.12 [0.95, 1.33], $P = .18$	n.r.
Chen (2016) China[27]	Simple obesity	42.8 ± 2.9 (19–68)	8 wk	ST21, ST25, CV6, ST40	(A) ACE	(B) MA	(A) 47 (B) 47	Total effective rate BW WC HC	RR, 1.15 [1.00, 1.33], $P = .05$ MD, −4.60 [−6.76, −2.44], $P < .0001$ MD, −5.80 [−9.66, −1.94], $P = .003$ MD, −7.60 [−10.29, −4.91], $P < .00001$	n.r.
Chen (2018) China[28]	Simple obesity	(A) 35.83 ± 8.54 (21–52) (B) 35.37 ± 8.91 (23–56)	2 mo	CV12, ST25, SP15, GB26, ST36, ST40, SP6, BL18, BL21, BL23	(A) ACE	(B) EA	(A) 30 (B) 30	Total effective rate BMI BW ALT TG	RR, 1.04 [0.80, 1.36], $P = .75$ MD, −0.98 [−1.71, −0.25], $P = .008$ MD, −3.25 [−7.19, 0.69], $P = .11$ MD, −3.99 [−10.99, 3.01], $P = .26$ MD, −0.27 [−0.52, −0.02], $P = .03$	n.r.
Chen (2019) China[29]	Obesity	(A) 39.31 ± 14.13 (16–64) (B) 37.51 ± 13.03 (17–64)	10 wk	SI4, BL22, BL17, GB26, ST25, ST28, ST40	(A) ACE	(B) MA	(A) 35 (B) 35	Total effective rate BMI BFP TC TG HDL-C	RR, 1.42 [1.12, 1.79], $P = .003$ MD, −3.60 [−4.41, −2.79], $P < .00001$ MD, −6.68 [−8.14, 5.22], $P < .00001$ MD, −1.41 [−1.92, −0.90], $P < .00001$ MD, −1.35 [−1.97, −0.73], $P < .0001$ MD, 0.06 [0.03, 0.09], $P < .0001$	n.r.
Chu (2014) China[30]	Obesity	29 ± 5 (22–48) (B) 27 ± 5 (21–41)	2 mo	CV13, CV12, CV10, CV7, CV9, CV4, CV6, ST25, ST24, ST26, SP14, GB26, GB27, LI14, TE13, LI4, LI11, GB31, GB32, ST34, ST36, ST37, ST40, SP6, SP9	(A) ACE	(B) EA	(A) 25 (B) 25	Total effective rate BMI WHR	RR, 0.89 [0.61, 1.30], $P = .55$ MD, −1.42 [−3.85, 1.01], $P = .25$ MD, 0.00 [−0.19, 0.19], $P = 1.00$	n.r.

(*Continued*)

Table 1
(*Continued*)

First author (year) Country	Type of obesity	Age (mean ± SD) (range)	Duration	Acupoints of ACE	Experimental intervention	Control intervention	Sample size	Outcome measure	Effects estimates	Adverse events
Deng (2014) China[31]	Simple obesity and abdominal obesity	(A) 33 ± 8 (n.r.) (B) 33 ± 7 (n.r.) (C) 32 ± 7 (n.r.)	45 d	CV12, ST25, CV7, TE6, CV4, ST36	(A) ACE (B) ACE plus MA	(C) MA	(A) 30 (B) 30 (C) 30	 Total effective rate BW Total effective rate BW	*ACE vs MA* RR, 1.08 [0.62, 1.89], *P* = .80 MD, 2.38 [−1.44, 6.20], *P* = .22 *ACE plus MA vs MA* RR, 1.77 [1.12, 2.79], *P* = .01 MD, −2.24 [−5.15, 0.67], *P* = .13	n.r.
Ding (2006) China[32]	Simple obesity	n.r ± n.r. (16–46)	2 mo	CV12, ST25, ST40, LI11	(A) ACE	(B) MA	(A) 65 (B) 64	Total effective rate	RR, 1.08 [0.94, 1.23], *P* = .27	n.r.
Fan (2010) China[33]	Simple obesity	(A) 31.38 ± 6.71 (18–55) (B) 32.63 ± 6.78 (16–54)	2 mo	CV12, ST25, CV6, CV4, ST34, ST36, SP4, BL15, BL20	(A) ACE plus EA	(B) EA	(A) 40 (B) 40	Total effective rate	RR, 1.17 [0.94, 1.44], *P* = .16	n.r.
Ge (2015) China[34]	Simple obesity	n.r. ± n.r. (n.r.)	8 wk	ST21, ST25, BL17, ST40	(A) ACE	(B) MA	(A) 40 (B) 40	Total effective rate BMI BW WC HC WHR TG TC LDL-C HDL-C FBG FINS HOMA-IR	RR, 1.03 [0.90, 1.18], *P* = .69 MD, −0.34 [−3.20, 2.52], *P* = .82 MD, −0.13 [−4.04, 3.78], *P* = .95 MD, 1.22 [−3.02, 5.46], *P* = .57 MD, 1.27 [−1.95, 4.49], *P* = .44 MD, 0.00 [−0.44, 0.44], *P* = 1.00 MD, 0.03 [−0.05, 0.11], *P* = .48 MD, 0.06 [−0.18, 0.30], *P* = .62 MD, −0.04 [−0.17, 0.09], *P* = .54 MD, −0.04 [−0.08, 0.00], *P* = .06 MD, −0.08 [−0.31, 0.15], *P* = .49 MD, −0.41 [−1.26, 0.44], *P* = .34 MD, 0.14 [−0.24, 0.52], *P* = .47	n.r.
Guo (2011) China[35]	Obesity	(A) 42.73 ± 8.31 (n.r.) (B) 41.53 ± 6.83 (n.r.)	3 mo	CV12, CV9, ST25, SP15, BL20, BL21, ST40, ST36	(A) ACE plus AA	(B) AA	(A) 30 (B) 30	Total effective rate BMI BW WC HC	RR, 1.35 [1.02, 1.79], *P* = .04 MD, −1.70 [−2.74, −0.66], *P* = .001 MD, −3.76 [−9.89, 2.37], *P* = .23 MD, −3.70 [−6.51, −0.89], *P* = .010 MD, −2.23 [−5.09, 0.63], *P* = .13	n.r.
Guo (2013) China[36]	Simple obesity	(A) 34.82 ± 5.56 (n.r.) (B) 33.18 ± 7.68 (n.r.)	2 mo	CV12, ST21, ST25, CV9, BL18, LR8, ST36, ST40, LR3	(A) ACE	(B) EA	(A) 28 (B) 28	Total effective rate BMI BW WC	RR, 1.00 [0.83, 1.20], *P* = 1.00 MD, −0.13 [−1.32, 1.06], *P* = .83 MD, 0.09 [−4.35, 4.53], *P* = .97 MD, 0.78 [−2.13, 3.69], *P* = .60	n.r.
Guo (2014) China[37]	Simple obesity	(A) 34.37 ± 9.16 (n.r.) (B) 30.68 ± 8.33 (n.r.)	2 mo	GB26, ST25, ST36, ST40, SP6, SP9, SP15, CV4, CV12, LI11, ST37	(A) ACE	(B) MA	(A) 35 (B) 34	Total effective rate BMI BW WC HC	RR, 1.04 [0.88, 1.22], *P* = .66 MD, −2.39 [−5.20, 0.42], *P* = .10 MD, −2.84 [−7.89, 2.21], *P* = .27 MD, −4.17 [−8.13, −0.21], *P* = .04 MD, −4.50 [−7.68, −1.32], *P* = .005	n.r.
Hou (2016) China[38]	Simple obesity	(A) 27.1 ± 1.5 (18–46) (B) 26.8 ± 1.2 (19–44)	3 wk	LI11, CV13, CV12, SP15, ST25, ST24, CV4, ST36, ST40, SP6	(A) ACE plus MA	(B) MA	(A) 68 (B) 68	Total effective rate WHR BFP TG	RR, 1.14 [1.01, 1.30], *P* = .04 MD, −1.39 [−1.77, −1.02], *P* < .00001 MD, −4.40 [−5.65, −3.15], *P* < .00001 MD, −1.20 [−2.38, −0.02], *P* = .05	n.r.
Hu (2013) China[39]	Simple obesity	(A) n.r. ± n.r. (22–53) (B) n.r. ± n.r. (21–54)	4 mo	SP6, ST36, ST40, ST36, SP15, CV12, CV6, ST28	(A) ACE	(B) EA	(A) 30 (B) 30	TC TG HDL-C LDL-C	MD, −0.50 [−0.98, −0.02], *P* = .04 MD, −0.06 [−0.47, 0.35], *P* = .77 MD, 0.06 [−0.14, 0.26], *P* = .56 MD, −0.54 [−0.76, −0.32], *P* < .00001	n.r.

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Table 1

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First author (year) Country	Type of obesity	Age (mean ± SD) (range)	Duration	Acupoints of ACE	Experimental intervention	Control intervention	Sample size	Outcome measure	Effects estimates	Adverse events
Hu (2014) China[40]	Simple obesity	(A) 33.48 ± 3.38 (20–58) (B) 37.26 ± 4.64 (21–60)	4 mo	SP9, ST40, SP6, GB26, ST25, SP15, CV12, CV4, ST28, BL20, BL22, ashi acupuncture point	(A) ACE	(B) EA	(A) 30 (B) 30	Total effective rate BMI BW WC HC WHR TC TG HDL-C LDL-C Leptin	RR, 1.04 [0.84, 1.29], $P=.72$ MD, 0.17 [−0.61, 0.95], $P=.67$ MD, 1.35 [−0.22, 2.92], $P=.09$ MD, −2.34 [−3.97, −0.71], $P=.005$ MD, −0.06 [−0.91, 0.79], $P=.89$ MD, −0.05 [−0.09, −0.01], $P=.006$ MD, −0.07 [−0.34, 0.20], $P=.62$ MD, −0.03 [−0.22, 0.16], $P=.76$ MD, 0.02 [−0.07, 0.11], $P=.66$ MD, −0.02 [−0.24, 0.20], $P=.86$ MD, −0.25 [−1.31, 0.81], $P=.64$	Contusion and nodule formation
Huang (2007) China[41]	Simple obesity	n.r. ± n.r. (18–40)	4 wk	ST25, ST24, ST26, CV9, CV12, SP10, ST36, LI11, GB26	(A) ACE	(B) EA	(A) 30 (B) 30	Total effective rate	RR, 1.32 [0.96, 1.80], $P=.09$	n.r.
Huang (2009) China[42]	Obesity	(A) 28.00 ± 5.87 (n.r.) (B) 27.30 ± 6.02 (n.r.)	3 mo	ST21, ST25, ST29, CV4, SP10, ST40, SP6	(A) ACE plus MA	(B) MA	(A) 30 (B) 30	Total effective rate BMI BW WC HC FSH LH E2 LH/FSH T	RR, 1.17 [0.95, 1.43], $P=.14$ MD, 1.44 [0.45, 2.43], $P=.004$ MD, −4.62 [−9.87, 0.63], $P=.08$ MD, −2.33 [−6.31, 1.65], $P=.25$ MD, −2.26 [−5.16, 0.64], $P=.13$ MD, −0.26 [−1.61, 1.09], $P=.71$ MD, 0.45 [−0.60, 1.50], $P=.40$ MD, 110.00 [64.44, 155.56], $P<.00001$ MD, −0.17 [−0.50, 0.16], $P=.31$ MD, −0.08 [−0.27, 0.11], $P=.41$	Syncope and nodule formation
Huang (2009) China[43]	Simple obesity	n.r. ± n.r. (18–65)	8 wk	CV12, ST25, SP15, CV9, CV4, ST36, ashi acupuncture point	(A) ACE	(B) EA	(A) 30 (B) 30	Total effective rate BMI BW WC HC WHR TC TG HDL-C LDL-C	RR, 1.04 [0.86, 1.25], $P=.69$ MD, 0.81[−0.72, 2.34], $P=.30$ MD, 0.65 [−3.56, 4.86], $P=.76$ MD, 2.77 [−1.86, 7.40], $P=.24$ MD, 1.27 [−1.98, 4.52], $P=.44$ MD, 0.02 [−0.01, 0.05], $P=.20$ MD, −0.03 [−0.40, 0.34], $P=.87$ MD, 0.15 [−0.18, 0.48], $P=.38$ MD, −0.09 [−0.19, 0.01], $P=.08$ MD, 0.15 [−0.18, 0.48], $P=.37$	Nodule formation and vascular trauma
Huang (2019) China[44]	Simple obesity	(A) 34.36 ± 7.56 (n.r.) (B) 35.21 ± 7.25 (n.r.)	8 wk	CV12, ST25, BL25, BL20, BL21, LR13, BL22, CV5, ST26, GB26, ashi acupuncture point	(A) ACE	(B) MA	(A) 33 (B) 33	Total effective rate BMI BW WC	RR, 1.50 [1.12, 2.02], $P=.007$ MD, −2.70 [−3.74, −1.66], $P<.00001$ MD, −2.81 [−4.13, −1.49], $P<.0001$ MD, −2.79 [−3.82, −1.76], $P<.00001$	n.r.
Huang (2020) China[45]	Simple obesity	(A) 38.27 ± 2.52 (21–53) (B) 37.34 ± 2.57 (22–54)	3 mo	CV12, ST36, ST25, ST40, ST37	(A) ACE	(B) MA	(A) 39 (B) 39	BMI BW TC TG	MD, −2.26 [−3.17, −1.35], $P<.00001$ MD, −5.38 [−9.27, −1.49], $P=.007$ MD, −0.64 [−0.72, −0.56], $P<.00001$ MD, −0.22 [−0.39, −0.05], $P=.01$	n.r.

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Table 1

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First author (year) Country	Type of obesity	Age (mean ± SD) (range)	Duration	Acupoints of ACE	Experimental intervention	Control intervention	Sample size	Outcome measure	Effects estimates	Adverse events
Kang (2007) China[46]	Simple obesity	(A) 28.74 ± 6.3 (n.r.) (B) 30.19 ± 7.97 (n.r.)	3 mo	CV12, ST25, CV6, ST37	(A) ACE	(B) EA	(A) 30 (B) 30	Total effective rate	RR, 1.05 [0.73, 1.53], *P* = .79	n.r.
								BMI	MD, 0.88 [−0.81, 2.57], *P* = .31	
								BW	MD, 3.55 [−3.42, 10.52], *P* = .32	
								WC	MD, −0.89 [−5.51, 3.73], *P* = .71	
								HC	MD, 1.26 [−2.48, 5.00], *P* = .51	
								IR	MD, 0.21 [−0.46, 0.88], *P* = .54	
								FINS	MD, −0.15 [−5.39, 5.09], *P* = .96	
								TC	MD, −0.25 [−0.56, 0.06], *P* = .11	
								TG	MD, 0.03 [−0.60, 0.66], *P* = .93	
								HDL	MD, −0.08 [−0.45, 0.29], *P* = .67	
								LDL	MD, −0.05 [−0.53,0.43], *P* = .84	
								FBG	MD, −0.06 [−0.52, 0.40], *P* = .80	
Lan (2016) China[47]	Simple obesity and abdominal obesity	n.r. ± n.r. (22–55)	12 wk	(1) CV12, CV6, ST24, ST26, SP13, SP15, BL20, BL21 (2) CV9, BL26, ST28, SP14, GB26, ST36, ST40	(A) ACE (B) ACE plus EA	(C) EA	(A) 100 (B) 100 (C) 100		*ACE vs EA*	n.r.
								Total effective rate	RR, 0.99 [0.95, 1.03], *P* = .65	
								BMI	MD, 0.57 [−0.37, 1.51], *P* = .23	
								BW	MD, 1.21 [−1.47, 3.89], *P* = .38	
								WC	MD, 0.67 [−1.47, 2.81], *P* = .54	
								HC	MD, 2.72 [0.84, 4.60], *P* = .005	
								WHR	MD, −0.02 [−0.04, −0.00], *P* = .03	
									ACE plus EA vs EA	
								Total effective rate	RR, 1.01 [0.98, 1.05], *P* = .56	
								BMI	MD, −3.23 [−4.20, −2.26], *P* < .00001	
								BW	MD, −8.74 [−11.51, −5.97], *P* < .00001	
								WC	MD, −6.07 [−8.39, −3.75], *P* < .00001	
								HC	MD, −1.28 [−3.57, 1.01], *P* = .27	
								WHR	MD, −0.06 [−0.08, −0.04], *P* < .00001	
Li (2005) China[48]	Obesity	(A) 38.2 ± 3.79 (13–73) (B) 36.4 ± 4.12 (21–60)	8 wk	ST21, ST24, CV6, ST40	(A) ACE	(B) MA	(A) 30 (B) 21	Total effective rate	RR, 0.98 [0.86, 1.12], *P* = .77	n.r.
								BMI	MD, 1.14 [−0.58, 2.86], *P* = .19	
								BW	MD, −1.45 [−4.87, 1.97], *P* = .41	
								WC	MD, −1.31 [−7.52, 4.90], *P* = .68	
								HC	MD, −7.23 [−12.59, −1.87], *P* = .008	
								Leptin	MD, 0.37 [−3.26, 4.00], *P* = .84	
								GLU	MD, 0.17 [−0.22, 0.56], *P* = .39	
								TG	MD, −0.08 [−0.15, −0.01], *P* = .03	
								TC	MD, 0.17 [−0.02, 0.36], *P* = .08	
								LDL-C	MD, −0.02 [−0.16, 0.12], *P* = .78	
								HDL-C	MD, 0.14 [0.06, 0.22], *P* = .0007	
Li (2007) China[49]	Simple obesity	(A) 37.2 ± 5.60(n.r.) (B) 38.64 ± 6.21 (n.r.)	18 wk	(1) CV12, ST25, SP15, ST37, ST39, ST40, LI11, BL21, ST36 (2) CV12, BL20, ST36, SP9, SP6, BL24, BL26 (3) BL18, LR14, TE6, BL20, SP9, SP10	(A) ACE	(B) MA	(A) 36 (B) 36	Total effective rate	RR, 0.97 [0.86, 1.10], *P* = .64	n.r.
								BMI	MD, −1.05 [−3.11, 1.01], *P* = .32	
								BW	MD, −3.10 [−6.59, 0.39], *P* = .08	
								WC	MD, −3.85 [−8.18, 0.48], *P* = .08	
								HC	MD, −1.60 [−6.53, 3.33], *P* = .53	
								BFP	MD, −1.87 [−3.98, 0.24], *P* = .08	

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Table 1
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First author (year) Country	Type of obesity	Age (mean ± SD) (range)	Duration	Acupoints of ACE	Experimental intervention	Control intervention	Sample size	Outcome measure	Effects estimates	Adverse events
Li (2009) China[50]	Simple obesity	34.62 ± 15.28 (22–56)	24 wk	(1) LI11, ST25, ST34, BL25, CV12, BL20, ST37 (2) BL20, ST25, CV6, ST40, CV12, SP9, ST36 (3) BL20, ST25, CV12, CV4, SP9, ST36 (4) BL23, CV4, ST36, BL20, SP9	(A) ACE (B) ACE plus MsA	(C) MA	(A) 72 (B) 70 (C) 68	 Total effective rate BMI WHR BFP TC TG HDL-C LDL-C Total effective rate BMI WHR BFP TC TG HDL-C LDL-C	*ACE vs MA* RR, 0.96 [0.86, 1.08], $P = .48$ MD, 0.05 [−1.06, 1.16], $P = .93$ MD, −0.18 [−0.51, 0.15], $P = .29$ MD, 0.66 [−1.19, 2.51], $P = .48$ MD, −0.10 [−0.17, −0.03], $P = .007$ MD, 0.10 [−0.07, 0.27], $P = .24$ MD, 0.20 [0.12, 0.28], $P < .00001$ MD, 0.10 [−0.01, 0.21], $P = .06$ *ACE plus MA vs MA* RR, 0.99 [0.89, 1.10], $P = .81$ MD, −0.08 [−1.20, 1.04], $P = .89$ MD, −0.20 [−0.53, 0.14], $P = .25$ MD, −0.58 [−1.80, 0.64], $P = .35$ MD, 0.00 [−0.19, 0.19], $P = 1.00$ MD, 0.00 [−0.13, 0.13], $P = 1.00$ MD, 0.00 [−0.09, 0.09], $P = 1.00$ MD, −0.10 [−0.21, 0.01], $P = .06$	n.r.
Li (2012) China[51]	Simple obesity	(A) 33.37 ± 3.68 (19–59) (B) 32.82 ± 2.96 (18–57)	6 mo	CV12, ST25, CV6, ST36, ST40	(A) ACE	(B) MA	(A) 45 (B) 45	Total effective rate	RR, 1.19 [1.02, 1.40], $P = .03$	n.r.
Li (2014) China[52]	Simple obesity and abdominal obesity	(A) 48 ± 9 (26–65) (B) 49 ± 10 (28–62)	2 mo	GB26, ST25, SP15, CV6	(A) ACE	(B) EA	(A) 41 (B) 41	Total effective rate BMI BW WC HC WHR WHtR BFP	RR, 1.03 [0.79, 1.36], $P = .81$ MD, 0.66 [−0.94, 2.26], $P = .42$ MD, 4.87 [−1.30, 11.04], $P = .12$ MD, −1.84 [−6.79, 3.11], $P = .47$ MD, 1.13 [−1.86, 4.12], $P = .46$ MD, 0.00 [−0.03, 0.03], $P = 1.00$ MD, −0.02 [−0.05, 0.01], $P = .13$ MD, −1.94 [−4.54, 0.66], $P = .14$	n.r.
Li (2016) China[53]	Obesity	(A) 35.2 ± 12.6 (n.r.) (B) 36.7 ± 11.8 (n.r.)	8 wk	ST21, CV12, BL20, ST36	(A) ACE	(B) EA	(A) 50 (B) 50	Total effective rate BMI BW	RR, 1.25 [1.08, 1.44], $P = .002$ MD, −0.41 [−1.82, 1.00], $P = .57$ MD, −2.10 [−8.94, 4.74], $P = .55$	n.r.
Li (2020) China[14]	Simple obesity and abdominal obesity	(A) 32.54 ± 7.47 (22–47) (B) 31.80 ± 6.67 (21–43)	2 mo	CV12, CV9, ST25, SP15, GB25, ST28, ST36, ST40, SP9, SP6	(A) ACE	(B) MA	(A) 49 (B) 49	Total effective rate BMI BW WC BFP TC TG LDL-C HDL-C	RR, 1.36 [1.10, 1.69], $P = .004$ MD, −1.06 [−1.91, −0.21], $P = .01$ MD, −3.76 [−5.95, −1.57], $P = .0007$ MD, −5.46 [−7.36, −3.56], $P < .00001$ MD, −2.10 [−3.63, −0.57], $P = .007$ MD, −0.48 [−0.65, −0.31], $P < .00001$ MD, −0.28 [−0.54, −0.02], $P = .03$ MD, −0.38 [−0.61, −0.15], $P = .001$ MD, 0.34 [0.26, 0.42], $P < .00001$	n.r.

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Table 1
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First author (year) Country	Type of obesity	Age (mean ± SD) (range)	Duration	Acupoints of ACE	Experimental intervention	Control intervention	Sample size	Outcome measure	Effects estimates	Adverse events
Lin (2012) China[54]	Simple obesity	(A) 26.38 ± 8.41 (n.r.) (B) 27.32 ± 7.65 (n.r.) (C) 25.58 ± 9.26 (n.r.)	40 d	(1) CV12, GB26, ST36 (2) PC6, ST36, SP6	(A) ACE plus EA (B) ACE	(C) EA	(A) 30 (B) 30 (C) 30	 Total effective rate BMI WC HC WHR BFP TC TG HDL-C LDL-C Total effective rate BMI WC HC WHR BFP TC TG HDL-C LDL-C	*ACE vs EA* RR, 0.92 [0.71, 1.19], *P* = .52 MD, 1.08 [−1.10, 3.26], *P* = .33 MD, 1.08 [−5.87, 8.03], *P* = .76 MD, 0.89 [−2.72, 4.50], *P* = .63 MD, 0.00 [−0.27, 0.27], *P* = 1.00 MD, 0.21 [−1.39, 1.81], *P* = .80 MD, −0.07 [−0.36, 0.22], *P* = .63 MD, 0.08 [−0.17, 0.33], *P* = .53 MD, −0.11 [−0.38, 0.16], *P* = .42 MD, 0.16 [0.02, 0.30], *P* = .03 *ACE plus EA vs EA* RR, 1.08 [0.88, 1.32], *P* = .45 MD, −2.58 [−4.65, −0.51], *P* = .01 MD, −6.75 [−12.39, −1.11], *P* = .02 MD, 1.15 [−2.64, 4.94], *P* = .55 MD, −0.24 [−0.43, −0.05], *P* = .01 MD, −2.50 [−3.92, −1.08], *P* = .0006 MD, −0.15 [−0.43, 0.13], *P* = .29 MD, 0.01 [−0.18, 0.20], *P* = .92 MD, 0.20 [0.01, 0.39], *P* = .04 MD, 0.09 [−0.17, 0.35], *P* = .50	n.r.
Lin (2015) China[55]	Obesity	n.r. ± n.r. (20–50)	1 mo	(1) LI11, LI4, TE14, CV12, ST25, CV6, ST28, BL20, GB31, ST36, ST40 (2) LI10, TE6, LI15, CV13, SP15, CV4, ST24, BL21, SP10, ST37, SP6 (3) LI13, HT5, GB21, CV10, SP14, CV3, ST21, BL25, ST34, ST39, SP9	(A) ACE plus cupping	(B) Cupping	(A) 50 (B) 50	Total effective rate	RR, 1.31 [1.08, 1.60], *P* = .007	Blister and nodule formation
Liu (2007) China[56]	Simple obesity	n.r. ± n.r. (18–50)	4 wk	ST25, CV4, CV9, ST36, ST40, SP6	(A) ACE	(B) MA	(A) 32 (B) 32	Total effective rate BW WC	RR, 1.04 [0.87, 1.23], *P* = .69 MD, 0.34 [−5.32, 6.00], *P* = .91 MD, 0.34 [−1.77, 2.45], *P* = .75	n.r.
Liu (2009) China[57]	Simple obesity	(A) 36.4 ± 1.71 (24–49) (B) 35.3 ± 2.01 (25–49)	8 wk	CV13, CV4, CV12, CV6, SP15, ST25, ST40	(A) ACE	(B) MA	(A) 30 (B) 30	Total effective rate BMI BW	RR, 1.17 [0.95, 1.43], *P* = .14 MD, −3.37 [−4.63, −2.11], *P* < .00001 MD, −3.57 [−4.83, −2.31], *P* < .00001	n.r.
Luo (2016) China[58]	Simple obesity	(A) 31.6 ± 4.3 (18–50) (B) 32.8 ± 3.6 (18–50)	1 mo	CV9, CV12, CV4, ST25, SP15, CV6, ST36	(A) ACE	(B) MA	(A) 30 (B) 30	Total effective rate	RR, 1.32 [1.05, 1.65], *P* = .02	n.r.
Lv (2006) China[59]	Simple obesity	(A) 32.33 ± 10.2 (16–60) (B) 34.67 ± 12.11 (18–55)	9 wk	CV12, CV4, SP15, CV10, CV6, ST25, ST24, ST26	(A) ACE	(B) EA	(A) 45 (B) 45	Total effective rate	RR, 1.26 [1.00, 1.58], *P* = .05	n.r.
Mai (2013) China[60]	Obesity	29.47 ± 3.61 (22–44)	3 mo	CV6, SP15, CV12, CV4, ST25, CV9	(A) ACE	(B) MA	(A) 32 (B) 32	Total effective rate	RR, 1.35 [1.08, 1.69], *P* = .009	n.r.
Meng (2005) China[61]	Simple obesity	n.r. ± n.r. (n.r.)	3 mo	ST37, ST40, SP6, SP4, ST34, ST25, BL20, BL21, BL25	(A) ACE	(B) MA	(A) 48 (B) 48	Total effective rate	RR, 1.12 [0.88, 1.43], *P* = .36	n.r.
Qiao (2016) China[62]	Simple obesity	n.r. ± n.r. (n.r.)	2 mo	ST37, ST40, SP6, SP4, ST34, ST25, BL20, BL21, BL25	(A) ACE	(B) MA	(A) 30 (B) 30	Total effective rate	RR, 1.27 [1.01, 1.61], *P* = .05	n.r.

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Table 1
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First author (year) Country	Type of obesity	Age (mean ± SD) (range)	Duration	Acupoints of ACE	Experimental intervention	Control intervention	Sample size	Outcome measure	Effects estimates	Adverse events
Qin (2008) China[63]	Simple obesity	(A) 37.60 ± 12.02 (n.r.) (B) 37.53 ± 10.57 (n.r.)	12 wk	CV12, CV4, ST25, ST36	(A) ACE	(B) EA	(A) 30 (B) 30	Total effective rate BMI BW WC HC WHR	RR, 0.96 [0.80, 1.16], P = .69 MD, 0.28 [−0.45, 1.01], P = .45 MD, 2.36 [−0.46, 5.18], P = .10 MD, 0.46 [−3.64, 4.56], P = .83 MD, 1.07 [−1.90, 4.04], P = .48 MD, 0.00 [−0.03, 0.03], P = 1.00	Scleroma and contusion
Ren (2009) China[64]	Obesity	(A) 37.05 ± 11.10 (n.r.) (B) 35.38 ± 10.47 (n.r.)	3 mo	BL13, BL20, LR13, BL23, CV12, BL21, CV5, BL22, GB25, LU1	(A) ACE	(B) MA	(A) 22 (B) 22	Total effective rate BMI BW WC TC TG HDL-C LDL-C	RR, 1.50 [0.77, 2.94], P = .24 MD, −0.27 [−1.62, 1.08], P = .70 MD, −1.56 [−6.20, 3.08], P = .51 MD, −6.77 [−12.80, −0.74], P = .03 MD, −0.39 [−1.11, 0.33], P = .29 MD, −0.18 [−0.76, 0.40], P = .54 MD, −0.13 [−0.62, 0.36], P = .60 MD, 0.11 [−0.23, 0.45], P = .52	n.r.
Ren (2016) China[65]	Simple obesity	(A) 32 ± 10 (18–55) (B) 32 ± 9 (19–54)	8 wk	ST21, ST25, CV6, ST40	(A) ACE	(B) EA	(A) 36 (B) 36	Total effective rate BMI BW WC	RR, 1.10 [0.91, 1.34], P = .33 MD, −0.35 [−2.05, 1.35], P = .69 MD, −1.18 [−6.32, 3.96], P = .65 MD, −1.50 [−4.22, 1.22], P = .28	n.r.
Shang (2016) China[66]	Simple obesity	(A) n.r. ± n.r. (28–46) (B) n.r. ± n.r. (25–45)	1 mo	BL20, LR13, SP9, ST36	(A) ACE plus Chuna	(B) Chuna	(A) 40 (B) 40	Total effective rate BMI BW WC TC TG FBG	RR, 1.65 [1.25, 2.18], P = .0004 MD, −2.20 [−2.32, −2.08], P < .00001 MD, −9.90 [−14.50, −5.30], P < .0001 MD, −4.10 [−6.52, −1.68], P = .0009 MD, −0.60 [−0.71, −0.49], P < .00001 MD, −0.30 [−0.39, −0.21], P < .00001 MD, −0.74 [−0.83, −0.65], P < .00001	Nodule formation contusion, fever
Shen (2012) China[67]	Simple obesity	(A) n.r. ± n.r. (18–55) (B) n.r. ± n.r. (16–53)	2 mo	ST25, BL25, CV12, BL21, CV4, BL27	(A) ACE plus EA	(B) EA	(A) 30 (B) 30	Total effective rate	RR, 1.20 [0.88, 1.64], P = .25	n.r.
Song (2018) China[68]	Simple obesity and abdominal obesity	(A) 33.2 ± 2.6 (n.r.) (B) 33.5 ± 2.5 (n.r.)	2 mo	ST36, SP9, LR13, BL20	(A) ACE plus Chuna	(B) Chuna	(A) 200 (B) 100	Total effective rate BMI BW WC WHR FBG TC TG	RR, 1.41 [1.21, 1.64], P < .00001 MD, −3.81 [−4.18, −3.44], P < .00001 MD, −9.22 [−11.79, −6.65], P < .00001 MD, −6.92 [−9.31, −4.53], P < .00001 MD, −0.11 [−0.16, −0.06], P < .00001 MD, −0.60 [−0.66, −0.54], P < .00001 MD, −0.64 [−0.71, −0.57], P < .00001 MD, −0.31 [−0.34, −0.28], P < .00001	Fever, contusion, nodule formation
Sun (2020) China[69]	Simple obesity	(A) 26.24 ± 6.2(20–38) (B) 26.15 ± 5.9 (20–38)	21 d	CV12, CV9, CV6, CV4, ST25, SP15, ST24, GB26	(A) ACE	(B) MA	(A) 25 (B) 25	Total effective rate	RR, 1.19 [0.99, 1.43], P = .07	n.r.
Tang (2009) China[70]	Simple obesity	(A) 37.8 (21–54) (B) 36.41 (22–55)	45 d	CV12, ST25, CV6, CV4, ST34, ST36, SP4, BL15, BL20	(A) ACE plus EA	(B) EA	(A) 33 (B) 32	Total effective rate BMI BW WC WHR	RR, 1.11 [0.94, 1.32], P = .22 MD, −1.15 [−1.94, −0.36], P = .004 MD, −1.88 [−6.21, 2.45], P = .39 MD, −2.15 [−5.55, 1.25], P = .21 MD, −0.01 [−0.05, 0.03], P = .64	n.r.
Wang (2001) China[71]	Simple obesity	n.r. ± n.r. (18–45)	3 mo	CV9, CV7, ST25, ST40	(A) ACE	(B) EA	(A) 60 (B) 30	Total effective rate	RR, 1.09 [0.97, 1.24], P = .16	n.r.

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Table 1

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First author (year) Country	Type of obesity	Age (mean ± SD) (range)	Duration	Acupoints of ACE	Experimental intervention	Control intervention	Sample size	Outcome measure	Effects estimates	Adverse events
Wang (2006) China[72]	Simple obesity	(A) 37.3 ± 3.67 (15–68) (B) 38.7 ± 4.2 (19–65)	8 wk	CV12, CV6, ST21, ST25, BL17, EX-B3, ST40	(A) ACE	(B) MA	(A) 31 (B) 26	Total effective rate BMI BW WC HC FBG FINS IR TG TC LDL-C HDL-C	RR, 1.01 [0.88, 1.17], P = .86 MD, 1.06 [−1.11, 3.23], P = .34 MD, 0.77 [−3.14, 4.69], P = .70 MD, 0.12 [−4.93, 5.17], P = .96 MD, −0.33 [−6.02, 5.36], P = .91 MD, −0.21 [−0.50, 0.08], P = .16 MD, −0.41 [−1.99, 1.17], P = .61 MD, −0.71 [−2.61, 1.19], P = .46 MD, −0.07 [−0.17, 0.03], P = .16 MD, 0.06 [−0.22, 0.34], P = .68 MD, 0.13 [−0.05, 0.31], P = .17 MD, −0.02 [−0.08, 0.04], P = .55	n.r.
Wang (2006) China[73]	Simple obesity	n.r. ± n.r. (n.r.)	8 wk	ST37, ST40, SP6, SP4, ST34, ST25, BL20, BL21, BL25	(A) ACE	(B) MA	(A) 30 (B) 30	Total effective rate	RR, 1.27 [1.01, 1.61], P = .05	n.r.
Wang (2008) China[74]	Simple obesity and abdominal obesity	(A) 28.54 ± 5.8(n.r.) (B) 30.09 ± 6.97 (n.r.)	3 mo	CV12, ST25, CV6, ST37	(A) ACE	(B) EA	(A) 30 (B) 30	Total effective rate BMI BW WC HC IR FINS TC TG HDL LDL FBG	RR, 1.00 [0.87, 1.14], P = 1.00 MD, 0.88 [−0.89, 2.65], P = .33 MD, 3.44 [−2.44, 9.32], P = .25 MD, −0.89 [−5.20, 3.42], P = .69 MD, 1.26 [−2.48, 5.00], P = .51 MD, 0.21 [−0.27, 0.69], P = .39 MD, −0.15 [−3.91, 3.61], P = .94 MD, −0.25 [−0.56, 0.06], P = .11 MD, 0.03 [−0.43, 0.49], P = .90 MD, −0.08 [−0.34, 0.18], P = .55 MD, −0.03 [−0.37, 0.31], P = .86 MD, −0.09 [−0.42, 0.24], P = .59	Syncope
Wang (2011) China[75]	Simple obesity	(A) 31.38 ± 6.71 (18–55) (B) 32.63 ± 6.78 (16–54)	2 mo	ST25, CV12, CV4, BL25, BL20, ST24, ST26, CV9, CV7	(A) ACE plus EA	(B) EA	(A) 40 (B) 40	TG FBG FINS HOMA-IR	MD, −0.16 [−0.31, −0.01], P = .04 MD, 0.08 [−0.14, 0.30], P = .47 MD, −0.72 [−1.58, 0.14], P = .10 MD, −0.05 [−0.10, −0.00], P = .03	n.r.
Wang (2013) China[76]	Simple obesity	(A) 31.20 ± 1.34 (20–46) (B) 31.20 ± 1.04 (21–52)	6 wk	CV12, ST25, CV4, ST28, GB26	(A) ACE	(B) MA	(A) 30 (B) 30	Total effective rate BMI BW WC	RR, 1.21 [0.86, 1.69], P = .27 MD, −1.07 [−1.35, −0.79], P < .00001 MD, −2.49 [−3.95, −1.03], P = .0008 MD, −0.72 [−1.66, 0.22], P = .13	Contusion, allergy, nodule formation
Wang (2013) China[77]	Simple obesity	(A) 41.5 ± n.r. (23–60) (B) 40.5 ± n.r. (20–61)	2 mo	ST21, ST28, ST36, CV9, ST27, GB26, ashi acupuncture point	(A) ACE plus AA	(B) AA	(A) 30 (B) 30	Total effective rate	RR, 1.27 [1.01, 1.61], P = .05	n.r.
Wen (2013) China[78]	Simple obesity	n.r. ± n.r. (n.r.)	45 d	CV12, ST25, CV4, ST28, SP15, ST36, ST37, SP10, SP6, ST40, SP9	(A) ACE plus MA	(B) MA	(A) 50 (B) 50	Total effective rate	RR, 1.29 [1.00, 1.67], P = .05	n.r.
Wu (2017) China[79]	Simple obesity	(A) 41.06 ± 12.05 (21–64) (B) 43.27 ± 11.0 (24–54)	12 wk	CV12, ST25, SP15, CV4, CV6, ST28, ST29, BL18, BL19, BL20, BL21, BL22, BL23, BL25, GB26	(A) ACE	(B) EA	(A) 76 (B) 73	Total effective rate BMI	RR, 1.07 [0.93, 1.24], P = .32 MD, −0.52 [−2.51, 1.47], P = .61	n.r.

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Table 1
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First author (year) Country	Type of obesity	Age (mean ± SD) (range)	Duration	Acupoints of ACE	Experimental intervention	Control intervention	Sample size	Outcome measure	Effects estimates	Adverse events
Xu (2015) China[80]	Simple obesity	(A) 33.26 ± 8.82 (19–47) (B) 33.66 ± 9.28 (19–47)	6 wk	CV12, GB26, ST36	(A) ACE plus EA	(B) EA	(A) 31 (B) 29	Total effective rate BMI BW WC HC BFP	RR, 1.01 [0.81, 1.27], $P = .91$ MD, −0.12 [−1.18, 0.94], $P = .82$ MD, 1.05 [−0.38, 2.48], $P = .15$ MD, 0.60 [−0.72, 1.92], $P = .37$ MD, −0.18 [−1.40, 1.04], $P = .77$ MD, −0.20 [−1.13, 0.73], $P = .67$	n.r.
Xue (2017) China[81]	Obesity	(A) n.r. ± n.r. (29–48) (B) n.r. ± n.r. (28–49)	10 wk	ST25, SP9, ST40, ST36, TE6, CV12, SP6, BL20, BL21	(A) ACE plus Chuna	(B) Chuna	(A) 25 (B) 25	Total effective rate BMI BW WC TC TG FBG	RR, 1.28 [0.98, 1.67], $P = .08$ MD, −1.79 [−1.94, −1.64], $P < .00001$ MD, −7.92 [−13.74, −2.10], $P = .008$ MD, −5.04 [−8.19, −1.89], $P = .002$ MD, −0.74 [−0.87, −0.61], $P < .00001$ MD, −0.31 [−0.41, −0.21], $P < .00001$ MD, −0.49 [−0.56, −0.42], $P < .00001$	n.r.
Yan (2015) China[82]	Simple obesity	(A) 32.35 ± 11.93 (n.r.) (B) 33.74 ± 9.44 (n.r.)	40 d	CV12, CV9, ST25, GB26, TE6, LI11, SP9, ST36, ST40, SP6, SP15	(A) ACE	(B) EA	(A) 27 (B) 26	Total effective rate BMI BW WC	RR, 1.00 [0.86, 1.17], $P = .97$ MD, 0.29 [−1.60, 2.18], $P = .76$ MD, −0.61 [−6.43, 5.21], $P = .84$ MD, −0.10 [−3.55, 3.35], $P = .95$	n.r.
Yang (2014) China[83]	Simple obesity	(A) 32.35 ± 11.83 (n.r.) (B) 34.74 ± 9.54 (n.r.)	1 mo	CV12, CV9, ST25, SP15, GB26, ST28, LI11, TE6, SP9, ST36, ST40, SP6	(A) ACE	(B) EA	(A) 29 (B) 28	Total effective rate BMI BW BFP	RR, 0.97 [0.77, 1.21], $P = .76$ MD, −1.60 [−2.45, −0.75], $P = .0002$ MD, −0.66 [−3.30, 1.98], $P = .62$ MD, −1.76 [−3.48, −0.04], $P = .04$	n.r.
Yin (2013) China[84]	Simple obesity	(A) 68.5 ± n.r. (61–76) (B) 65.8 ± n.r. (60–74)	3 mo	CV12, ST25, SP15, LI11, TE6, ST44, ST40, ST37, SP9	(A) ACE	(B) MA	(A) 30 (B) 28	Total effective rate	RR, 1.40 [0.91, 2.15], $P = .12$	n.r.
You (2009) China[85]	Simple obesity	n.r. ± n.r. (n.r.)	8 wk	CV12, CV9, ST25, ST21, CV6, ST40	(A) ACE	(B) MA	(A) 30 (B) 30	Total effective rate BMI BW WC HC TC TG HDL-C LDL-C	RR, 0.96 [0.78, 1.19], $P = .72$ MD, 0.93 [−0.82, 2.68], $P = .30$ MD, −3.55 [−10.68, 3.58], $P = .33$ MD, −1.06 [−5.62, 3.50], $P = .65$ MD, −0.13 [−3.89, 3.63], $P = .95$ MD, 0.00 [−0.36, 0.36], $P = 1.00$ MD, 0.01 [−0.18, 0.20], $P = .92$ MD, −0.02 [−0.23, 0.19], $P = .85$ MD, 0.05 [−0.40, 0.50], $P = .83$	n.r.
Zhang (2011) China[86]	Simple obesity	(A) 31.29 ± 9.92 (19–51) (B) 29.47 ± 8.85 (n.r.)	4 mo	(1) ST25, GB26, ST28, CV12, CV4, ST40 (2) BL20, BL21, BL25, BL22, ST37	(A) ACE	(B) EA	(A) 30 (B) 30	Total effective rate BMI BW WC	RR, 1.12 [0.95, 1.30], $P = .17$ MD, −1.94 [−4.00, 0.12], $P = .07$ MD, −0.27 [−4.18, 3.64], $P = .89$ MD, 0.68 [−2.86, 4.22], $P = .71$	n.r.
Zhang (2016) China[87]	Simple obesity	(A) 38.93 ± 14.46 (n.r.) (B) 41.73 ± 14.42 (n.r.)	8 wk	CV12, GB26, ST36	(A) ACE	(B) EA	(A) 30 (B) 30	Total effective rate BMI BW WHR BFP	RR, 1.04 [0.82, 1.32], $P = .74$ MD, −0.38 [−0.97, 0.21], $P = .21$ MD, −2.00 [−5.91, 1.91], $P = .32$ MD, 0.00 [−0.03, 0.03], $P = 1.00$ MD, −0.01 [−1.21, 1.19], $P = .99$	Pain, irritation

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Table 1
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First author (year) Country	Type of obesity	Age (mean ± SD) (range)	Duration	Acupoints of ACE	Experimental intervention	Control intervention	Sample size	Outcome measure	Effects estimates	Adverse events
Zhang (2017) China[88]	Simple obesity	(A) 45.83 ± 11.90 (18–55) (B) 42.75 ± 12.21 (18–55)	3 mo	CV12, CV6, CV9, ST36, ST40, SP9, SP6, BL20, BL21, JiaJi point	(A)ACE	(B) MA	(A) 33 (B) 33	Total effective rate BMI BW WC HC BFP WHR TC TG LDL-C HDL-C	RR, 1.20 [0.96, 1.50], *P* = .11 MD, −0.73 [−2.11, 0.65], *P* = .30 MD, −3.30 [−4.74, −1.86], *P* < .00001 MD, −3.26 [−5.80, −0.72], *P* = .01 MD, −2.12 [−5.60, 1.36], *P* = .23 MD, −1.62 [−2.65, −0.59], *P* = .002 MD, −0.31 [−0.79, 0.18], *P* = .21 MD, −0.08 [−0.62, 0.46], *P* = .77 MD, −0.18 [−0.37, 0.01], *P* = .06 MD, −0.20 [−0.40, −0.00], *P* = .05 MD, 0.12 [0.00, 0.24], *P* = .05	n.r.
Zhang (2017) China[89]	Simple obesity	(A) 61.35 ± 3.11 (n.r.) (B) 61.26 ± 3.07 (n.r.)	3 mo	CV12, ST25, CV6, ST37	(A) ACE	(B) MA	(A) 40 (B) 40	Total effective rate BMI BW WC HC TC TG HDL-C LDL-C	RR, 1.22 [1.04, 1.43], *P* = .02 MD, −0.69 [−4.36, 2.98], *P* = .71 MD, −5.45 [−10.34, −0.56], *P* = .03 MD, −4.23 [−6.86, −1.60], *P* = .002 MD, −0.14 [−3.18, 2.90], *P* = .93 MD, −0.03 [−0.08, 0.02], *P* = .25 MD, 0.02 [−0.13, 0.17], *P* = .79 MD, 0.06 [−0.06, 0.18], *P* = .31 MD, −0.03 [−0.19, 0.13], *P* = .72	n.r.
Zheng (2013) China[90]	Simple obesity	n.r. ± n.r. (n.r.)	8 wk	CV12, ST25, CV6, GB26, LI11, ST36, SP6	(A) ACE	(B) MA	(A) 30 (B) 30	Total effective rate BMI BW WC HC BFP WHR GLU INS TC TG	RR, 1.05 [0.74, 1.48], *P* = .78 MD, 0.22 [−0.23, 0.67], *P* = .34 MD, −0.37 [−2.71, 1.97], *P* = .76 MD, −0.79 [−2.45, 0.87], *P* = .35 MD, 0.26 [−2.10, 2.62], *P* = .83 MD, −1.28, [−2.51, −0.05], *P* = .04 MD, 0.00 [−0.50, 0.51], *P* = 1.00 MD, 0.58 [0.30, 0.86], *P* < .0001 MD, 0.18 [−0.12, 0.48], *P* = .25 MD, 0.08 [−0.21, 0.37], *P* = .58 MD, −0.02 [−0.20, 0.16], *P* = .83	n.r.
Zhou (2016) China[91]	Simple obesity and lower body obesity	34.56 ± 4.24 (22–51)	12 d	ST36, GB26, SP10, CV9, CV7, ST36, LI11	(A) ACE	(B) EA	(A) 40 (B) 40	Total effective rate BFP	RR, 1.11 [0.98, 1.27], *P* = .10 MD, −5.37 [−7.57, −3.17], *P* < .00001	n.r.
Zhou (2020) China[15]	Simple obesity	n.r. (20–45)	2 mo	CV12, CV9, ST25, SP15, ST28, LI11, TE6, SP9, ST36, ST40, SP6	(A) ACE	(B) EA	(A) 45 (B) 45	Total effective rate BMI BW WC BFP	RR, 1.03 [0.88, 1.20], *P* = .75 MD, 0.47 [−0.96, 1.90], *P* = .52 MD, −1.24 [−5.58, 3.10], *P* = .58 MD, −3.12 [−6.18, −0.06], *P* = .05 MD, −0.67 [−4.46, 3.12], *P* = .73	n.r.

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Table 1

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First author (year) Country	Type of obesity	Age (mean ± SD) (range)	Duration	Acupoints of ACE	Experimental intervention	Control intervention	Sample size	Outcome measure	Effects estimates	Adverse events
Zong (2009) China[92]	Simple obesity	(A) 29.54 ± 5.80 (n.r.) (B) 30.09 ± 6.97 (n.r.)	3 mo	CV12, ST25, CV6, ST37	(A) ACE plus EA	(B) EA	(A) 50 (B) 50	Total effective rate	RR, 1.09 [0.98, 1.20], *P* = .10	Syncope
								BMI	MD, −3.14 [−4.43, −1.85], *P* < .00001	
								BW	MD, −7.07 [−11.45, −2.69], *P* = .002	
								WC	MD, −5.79 [−9.15, −2.43], *P* = .0007	
								HC	MD, −1.59 [−4.48, 1.31], *P* = .28	
								IR	MD, 0.28 [−1.50, 2.06], *P* = .76	
								FINS	MD, 0.23 [−0.25, 0.71], *P* = .35	
								TC	MD, −0.26 [−0.57, 0.05], *P* = .10	
								TG	MD, −0.31[−0.56, −0.06], *P* = .01	
								HDL	MD, 0.10 [−0.00, 0.20], *P* = .05	
								LDL	MD, −0.37 [−0.71, −0.03], *P* = .03	
								FBG	MD, −0.04 [−0.28, 0.20], *P* = .74	

AA = auricular acupressure, ACE = acupoint catgut embedding, ALT = alanine transaminase, BFP = body fat percentage, BMI = body mass index, BW = body weight, E2 = estradiol 2, EA = electroacupuncture, FBG = fibrinogen, FINS = fasting serum insulin, FSH = follicle-stimulating hormone, GLU = glucose, HC = hip circumference, HDL = high-density lipoprotein, HDL-C = high-density lipoprotein cholesterol, HOMA-IR = homeostasis model assessment insulin resistance, INS = insulin, IR = insulin resistance, LDL = low-density lipoprotein, LDL-C = low-density lipoprotein cholesterol, LH = luteinizing hormone, MA = manual acupuncture, MD = mean difference, n.r. = not reported, RR = risk ratio, T = testosterone, TC = total cholesterol, TG = triglyceride, TNF-α = tumor necrosis factor alpha, WC = waist circumference, WHR = waist-to-hip ratio, WHtR = waist-height radio.

not reach statistical significance, with low heterogeneity (n = 623, MD = −0.01 [−0.02, 0.01]; P = .29, I^2 = 36%).

3.3.2.7. BFP. Six studies[15,50,54,83,87,91] compared ACE with EA in terms of BFP. The pooled result indicated that ACE was more effective than EA, although there was no statistically significant difference between the two treatments (n = 399, MD = −1.53 [−3.17, 0.11]; P = .07, I^2 = 76%).

3.3.3. ACE plus MA versus MA.

3.3.3.1. Total effective rate. The outcomes for ACE plus MA versus MA were reported in six studies.[26,31,38,42,50,78] The pooled data favored ACE plus MA (n = 574, RR = 1.15 [1.02, 1.29]; P = .02, I^2 = 60%).

3.3.3.2. BMI. Two trials[42,50] studied the effect of ACE plus MA on BMI. In all, 198 participants showed an improvement in this outcome; however, the results showed boundary differences between ACE plus MA and MA (n = 198, MD = 0.70 [−0.79, 2.19]; P = .35, I^2 = 75%).

3.3.3.3. BW. Two studies[31,42] reported BW data for ACE plus MA. Moreover, meta-analyses revealed that ACE plus MA was more beneficial for losing weight than MA (n = 120, MD = −2.80 [−5.34, −0.26]; P = .03, I^2 = 0).

3.3.3.4. WC. Only one study[42] assessed WC data, and it found a borderline difference between the two groups (MD = −2.33 [−6.31, 1.65]; P = .25).

3.3.3.5. HC. Only one study[42] assessed HC data; combination therapy had no significant effect on HC (n = 60, MD = −2.26 [−5.16, 0.64]; P = .13).

3.3.3.6. WHR. Two studies[38,50] reported that WHR was better in the ACE plus MA group than in the MA group, although there was no statistically significant difference (n = 274, SMD = −0.79 [−1.96, 0.38], P = .19).

3.3.3.7. BFP. Two studies,[38,50] with 274 participants, were included in this group. There were borderline differences between the groups (MD = −2.49 [−6.23, 1.26]; P = .19, I^2 = 95%).

3.3.4. ACE plus EA versus EA.

3.3.4.1. Total effective rate. Nine studies[23,24,33,47,54,67,70,80,92] compared the total effective rate of ACE plus EA to that of EA. The pooled analysis showed that ACE plus EA was superior to EA alone (n = 795, RR = 1.05 [1.00, 1.11]; P = .05, I^2 = 29%).

3.3.4.2. BMI. Seven trials[23,24,47,54,70,80,92] involving a total of 655 participants reported BMI as an outcome. Significant heterogeneity was observed between the studies (I^2 = 84%). Subgroup analyses of similar age groups (20s) between the treatment and comparison groups were performed. Three compared the effect of ACE plus EA with EA alone; there were significant differences between the groups, with ACE plus EA being favored (n = 360, MD = −3.12 [−2.16, −2.39]; P < .00001, I^2 = 0) (Fig. 4A).

3.3.4.3. BW. We analyzed the data of five studies[23,47,70,80,92] that reported on BW data. Our pooled analysis showed borderline differences between the two groups (MD = −3.16 [−7.73, 1.41]; P = .18, I^2 = 91%).

3.3.4.4. WC. Six studies[23,47,54,70,80,92] evaluated WC data. Significant heterogeneity was noticed among the studies (I^2 = 86%). Therefore, we conducted subgroup analysis; combination therapy was more effective than EA alone in similar age range (20s) (n = 360, MD = −6.06 [−7.87, −4.25], P < .00001, I^2 = 0) (Fig. 4B).

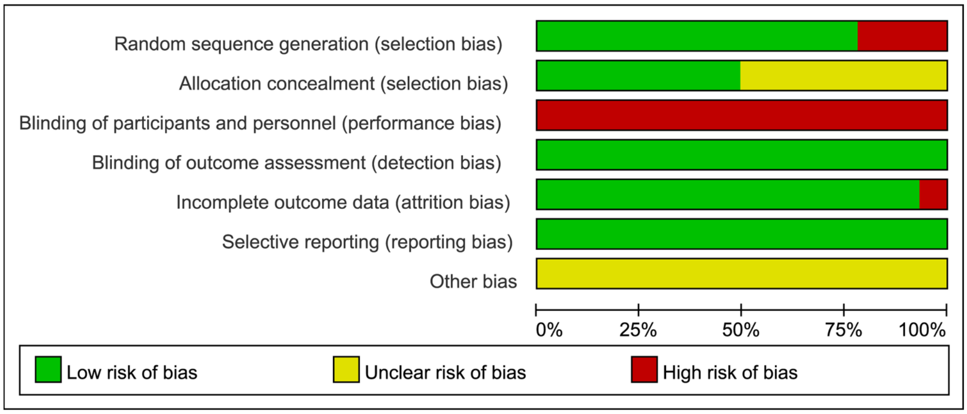

Figure 1. Risk of bias for included studies.

3.3.4.5. HC. Five studies[23,47,51,80,92] compared ACE plus EA with EA alone. The results showed that ACE plus EA led to a greater reduction in obesity than EA alone; however, the effect size was not statistically significant (n = 480, MD = −0.33 [−1.23, 0.58]; P = .47, I^2 = 0).

3.3.4.6. WHR. Three studies[47,54,70] reported a reduction in WHR with ACE plus EA compared with EA. The combined result showed that combination therapy reduced the WHR, but the effect was not statistically significant (n = 325, MD = −0.05 [−0.11, 0.00]; P = .07, I^2 = 76%).

3.3.4.7. BFP. Two studies[54,80] reported on BFP. There was no significant difference in BFP effect size (n = 120, MD = −1.28 [−3.53, 0.97]; P = .26, I^2 = 86%).

3.3.5. ACE plus AA versus AA.

3.3.5.1. Total effective rate. Two studies[35,77] that examined the total effective rate of treating obesity with ACE plus AA versus AA were analyzed using a random-effects model; the pooled result favored ACE plus AA (n = 120, RR = 1.30 [1.09, 1.56]; P = .004, I^2 = 0).

3.3.5.2. BMI. Only one study[35] reported BMI data pertaining to ACE plus AA versus AA alone. A significant difference was observed between the two therapies (n = 60, MD = −1.70 [−2.74, −0.66]; P = .0001).

3.3.5.3. BW. Only one study[35] reported BW data. However, there was a borderline difference between the two groups (n = 60, MD = −3.76 [−9.89, 2.37]; P = .23).

3.3.5.4. WC. Only one study[35] assessed WC data; there was a significant difference between the two methods (n = 60, MD = −3.70 [−6.51, −0.89]; P = .010).

3.3.5.5. HC. Only one study[35] compared ACE plus AA and AA alone; there was a significant difference between the treatment and control groups (n = 60, MD = −2.23 [−5.09, 0.63]; P = .13).

3.3.6. ACE plus cupping therapy versus cupping therapy.

3.3.6.1. Total effective rate. One study[55] reported a significant improvement in obesity with ACE plus cupping compared with cupping alone (n = 100, RR = 1.13 [1.08, 1.60]; P = .007).

3.3.7. ACE plus CMT versus CMT.

3.3.7.1. Total effective rate. Three studies[66,68,81] evaluated ACE plus CMT versus CMT for the treatment of obesity. The results showed that ACE plus CMT was better than CMT alone (n = 430, RR = 1.42 [1.26, 1.60]; P < .00001, I^2 = 0).

3.3.7.2. BMI. Three studies[66,68,81] reported BMI data; ACE plus CMT was better than CMT alone (n = 430, MD = −2.57 [−3.29, −1.85]; P < .00001, I^2 = 98%).

3.3.7.3. BW. We pooled data from three studies[66,68,81] that reported BW data. The meta-analysis indicated that ACE plus CMT had a better effect than CMT (MD = −9.19 [−11.28, −7.10]; P < .00001, I^2 = 0).

3.3.7.4. WC. The pooled data of three studies[66,68,81] showed that ACE plus CMT was beneficial for WC (n = 430, MD = −5.40 [−7.16, −3.64]; P < .00001, I^2 = 26%).

3.3.7.5. WHR. Only one study[68] evaluated the effect of ACE plus CMT on WHR, and it found a significant difference between the two groups (n = 300, MD = −0.11 [−0.16, −0.06]; P < .00001).

3.3.8. Secondary outcomes. Our meta-analyses revealed that ACE was more beneficial for the recovery of metabolic markers. ACE had a beneficial effect on TC and triglyceride levels (MD = −0.20 [−0.39, −0.01]; P = .04, I^2 = 95%; MD = −0.08 [−0.16, 0.00]; P = .05, I^2 = 68% respectively.) When we compared ACE with EA, TC levels were significantly different between the two groups (n = 360, MD = −0.16 [−0.29, −0.03]; P = .02, I^2 = 0), whereas triglyceride levels were not significantly different (n = 371, MD = −0.03 [−0.14, 0.08]; P = .55, I^2 = 0). Moreover, when we compared ACE plus MA to MA, the combination therapy was more effective than MA alone in improving triglyceride levels. However, there was no statistical difference (n = 274, MD = −0.45 [−1.59, 0.69]; P = .44, I^2 = 74%). On analyzing the effect of ACE plus EA and EA, similar effects on TC and triglyceride levels were observed (n = 261, MD = −0.16 [−0.33, 0.01]; P = .07, I^2 = 0; n = 341, MD = −0.09 [−0.23, 0.06]; P = .24, I^2 = 65%, respectively). Lastly, when we compared ACE plus CMT and CMT, the combination therapy was more effective than CMT (n = 430, MD = −0.65 [−0.72, −0.58]; P < .00001, I^2 = 22%; n = 430, [−0.34, −0.28]; P < .00001, I^2 = 0, respectively).

3.3.9. Adverse events. Thirteen RCTs reported adverse eve nts.[23,25,40,42,43,55,63,66,68,74,76,87,92] The main common adverse reactions were nodule formation, contusion, syncope, and fever. Fatigue, vomiting, trauma, blister, scleroma, allergy, pain, and irritation were other adverse events. However, no serious adverse events were reported in the studies.

3.3.10. Publication bias. The funnel plots prepared using RevMan software are presented in the Supplemental Digital Content 4 and 5, http://links.lww.com/MD/H825. The overall efficacy was symmetrical and demonstrated no significant publication bias.

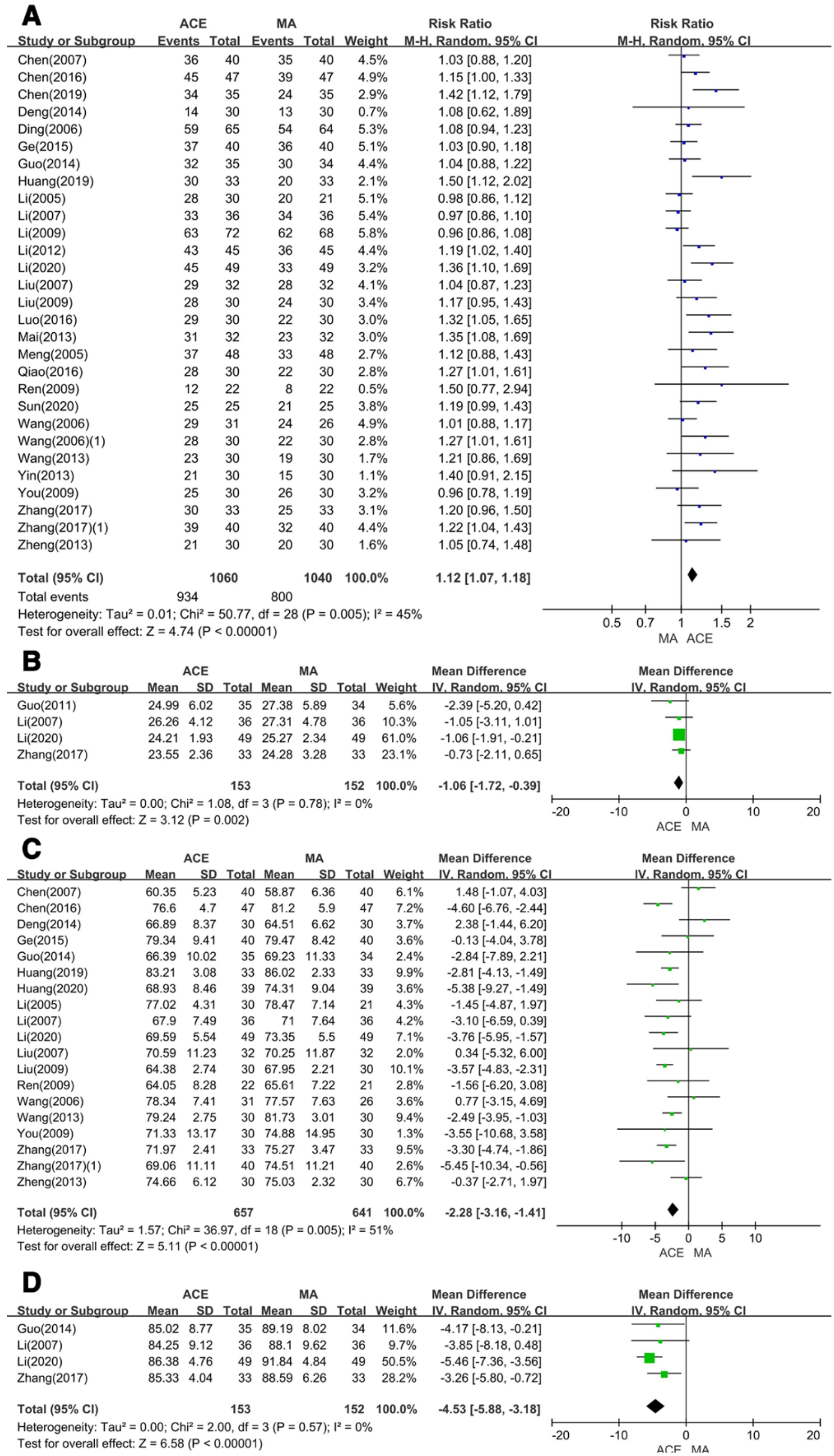

Figure 2. Forest plot of ACE versus MA. (A) Total effective rate, (B) Body mass index, (C) Body weight, (D) Waist circumference. ACE = acupoint catgut embedding, CI = confidence interval, MA = manual acupuncture, SD = standard deviation.

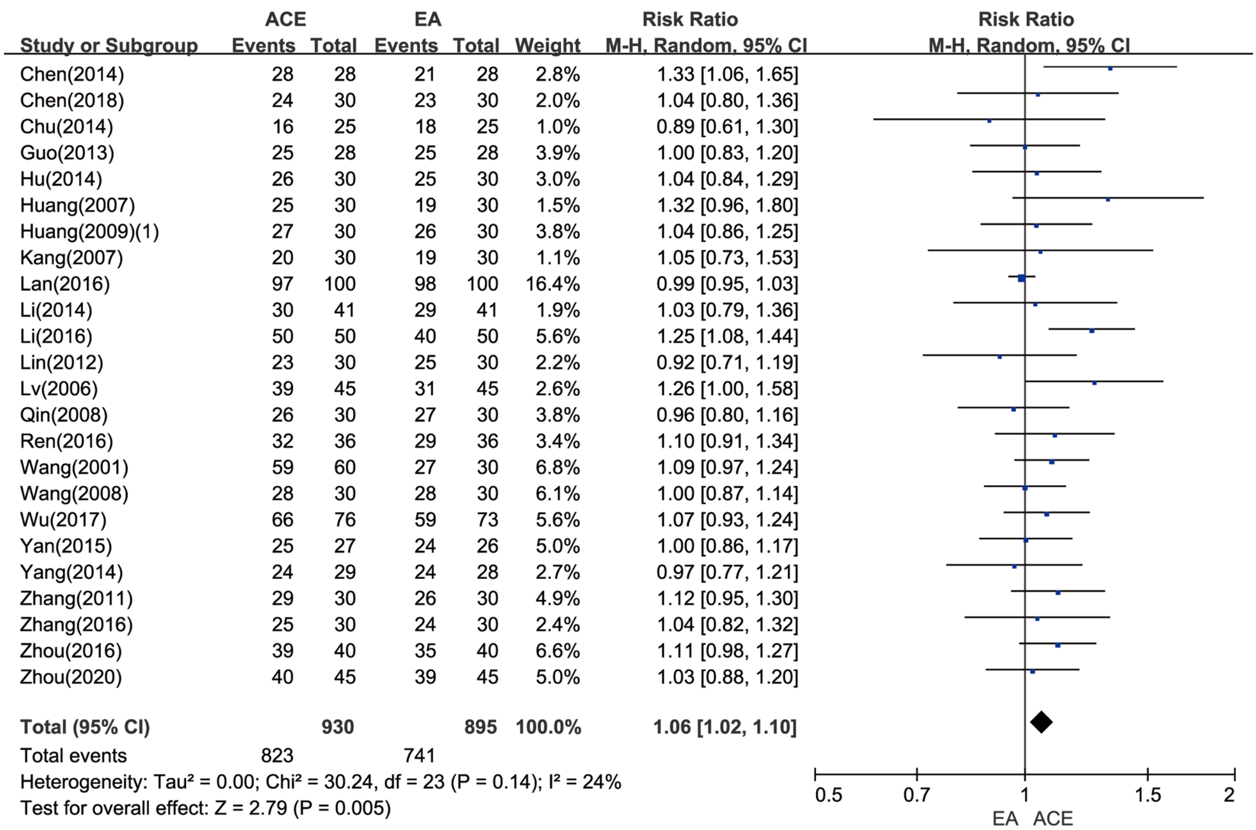

Figure 3. Forest plot of the total effective rate in the comparison ACE versus EA. ACE = acupoint catgut embedding, CI = confidence interval, EA = electroacupuncture.

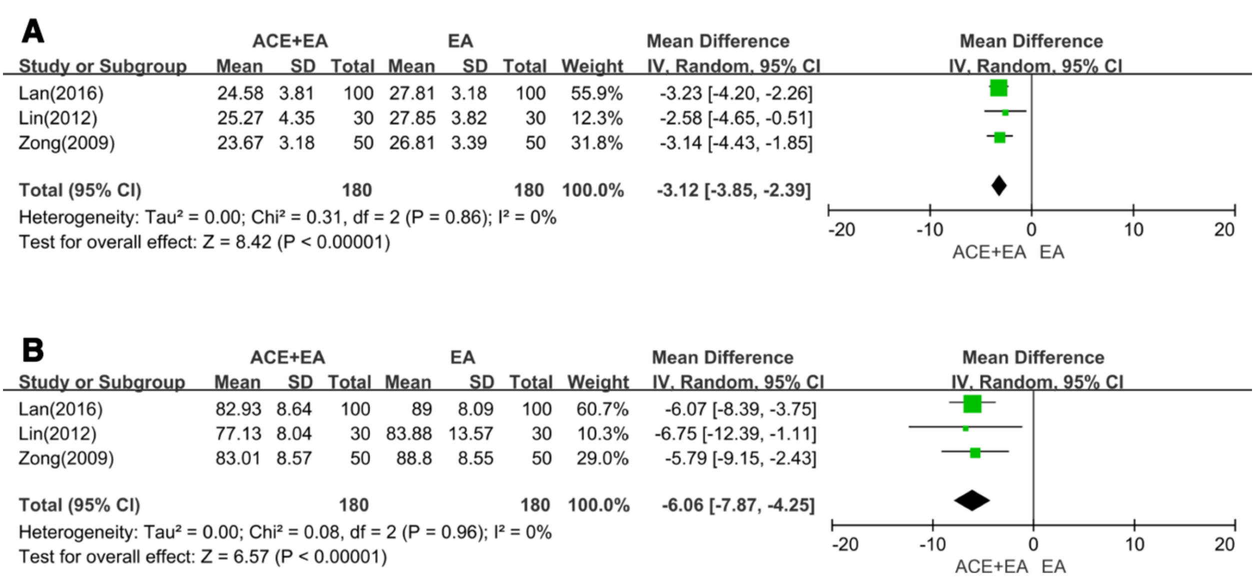

Figure 4. Forest plot of the total effective rate in the comparison ACE plus EA versus EA. (A) Body mass index, (B) Waist circumference. ACE = acupoint catgut embedding, CI = confidence interval, EA = electroacupuncture, SD = standard deviation.

3.3.11. Quality of the evidence. The systematic analysis examined eight outcomes for the intervention and control groups (Supplemental Digital Content 6–11, http://links.lww.com/MD/H826). Total effective rate, BMI, BW, WC, HC, WHR, BFP were the main outcomes, and TC and triglyceride levels were the secondary outcomes. The GRADE profile of all outcomes was moderate, very low, or low.

4. Discussion

4.1. Principal findings

In this SR, we identified 73 studies on ACE for obesity involving 5872 participants. We examined various combinations of ACE, used either alone or as an adjunctive intervention, versus controls for the treatment of obesity, measured by BMI, BW, HC, WC, WHR, BFP, and total effective rate. ACE was clinically effective in reducing obesity when compared with MA alone. This finding is similar to that of a previous study.[12] Moreover, ACE plus EA was better than EA alone. However, there was no significant difference in the other comparison groups. With regard to the comparison of ACE versus EA alone, although we included a relatively large sample size (n = 795), our meta-analysis showed no significant difference in some outcomes. The reason might be that EA involves the use of pulse currents sent by specific instruments to achieve a therapeutic effect. In the presence of acupuncture, the pulse current can be increased with continuous stimulation of the needle. A strong stimulation has a qi equivalent to the effect of acupuncture.[82] Further, ACE plus MA was better in reducing obesity than MA in terms of the total effective rate with a large sample size (n = 574) but the other outcomes were not statistically significant since only two studies reported the desired outcomes. With regard to ACE plus AA versus AA alone, our meta-analysis showed that ACE plus AA was beneficial for reducing obesity; however, only two studies assessed this aspect. In comparing ACE plus cupping therapy versus cupping therapy, combination therapy appeared better than cupping therapy alone, but there were limited data available to pool. The comparison of ACE plus CMT versus CMT included 430 patients, and ACE plus CMT was better, but only three trials were evaluated. Thus, further analysis is needed.

4.2. Strengths and limitations

This SR and meta-analysis had several strengths. We searched not only international databases but also Chinese, Korean, and Japanese databases to find the included articles. Furthermore, the included studies used common clinical evaluation tools for measuring obesity. Moreover, we provided a comprehensive review of the effects of ACE, while considering possible sources of heterogeneity. We also used GRADEPRO to explore the quality of evidence for each outcome. Two SRs on the efficacy of ACE on obesity have previously been conducted, and they were published in 2015[12] and 2019.[13] However, our SR was different from these two SRs. In particular, the first review[12] analyzed 43 studies by separating the treatment types into ACE, MA, EA, and drugs alone, with a small sample size. The second review[13] analyzed 15 studies, with a focus on abdominal obesity, and did not include simple obesity.

This review has several limitations. First, there was a paucity of high-quality RCTs. Half of the trials did not employ allocation concealments, and none blinded the acupuncturists and participants due to the inherent characteristic of the ACE intervention. These poor-quality studies could lead to imprecise evidence. Second, there was substantial heterogeneity among the pooled trials, and we tried to reduce the heterogeneity by synthesizing the data separately based on the characteristics for subgroup analysis; however, there was unresolved heterogeneity in some comparison groups. The treatment duration, selection of acupoints, and study characteristics could influence the results of the trials and could not resolve the heterogeneity. In addition, ACE involves stimulating acupoints in the skin, which makes patients feel the "qi" gradually; therefore, long-term effects need to be assessed.[93] However, only few trials evaluated the follow-up of patients, underscoring the need for more studies on the long-term effects of ACE.

4.3. Future research and clinical application

Given the above limitations, further well-designed RCTs with high-quality evidence are needed to assess the efficacy of ACE for obesity. First, the RCTs should ensure generation of accurate random sequences and should blind the participants and practitioners to reduce bias. The clinical trials can also be registered with clinical trial platforms in advance. Second, the details of the studies should be reported thoroughly, especially, the results of changes in efficacy. Third, the effect of ACE with sham or placebo must also be explored.

Furthermore, we hope this SR will motivate governments and clinicians to support the use of ACE in the management of obesity. As previously stated, ACE is less costly and more convenient for therapists. However, ACE is not approved by the National Health Insurance program in South Korea, which hinders its use by practitioners. Thus, the government should provide more support to make ACE a popular practice throughout society. In clinical practice, ACE is usually combined with other acupuncture therapies, like MA, EA cupping therapy, or CMT.[94] This review can help guide therapists to strongly recommend the use of ACE alone or ACE plus EA to better manage obesity.

5. Conclusions

Finally, we comprehensively evaluated the treatment effects of ACE and other therapies. ACE had a moderate effect compared to that of MA alone in the treatment of obesity. For combination therapy, ACE and EA are the best choice in clinical practice. Despite some indications of potential improvement of body mass index, body weight and other obesity related outcomes, the evidence regarding the effectiveness and efficacy of ACE for simple is of poor quality and therefore inconclusive. Although our review provided low-quality evidence and heterogeneity, it can serve as a helpful guide for public health practice.

Author contributions

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Supervision: Sungha Kim, Mi Ju Son.
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Writing – review & editing: Sungha Kim, Mi Ju Son.

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