

Original Article

Auricular acupuncture for obesity: a systematic review and meta-analysis

Zhizhong Ruan, Yi Xiang, Jing Li, Xue Zhou, Zhilan Huang, Can Dong

Department of Acupuncture and Moxibustion, Nanjing Hospital of Traditional Chinese Medicine, The Third Affiliated Hospital of Nanjing University of Traditional Chinese Medicine, Nanjing, Jiangsu, China

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Abstract: Introduction: The randomized controlled trials (RCTs) of auricular acupuncture/auricular acupressure (AA) on weight loss were studied for decades. However no systematic review and meta-analysis about this approach was reported. Methods: 22 electronic databases were used to search for RCTs of AA on weight loss up to August 2015 without language restrictions. RCTs for the sole AA, AA combining diet and/or exercise were included. Studies' methodological qualities were assessed using bias of risks in the Cochrane handbook. Pooling of data statistic was performed using a fixed effects model while no heterogeneity existed. Results: Nine RCTs meeting the inclusion criteria were analyzed. The sole AA intervention compared to no treatment or sham AA performed no statistical difference (pooled MD = -0.40 kg, 95% CI = -0.95 to 0.15, $I^2 = 0\%$). AA plus diet was more effective than the sole diet intervention (MD = -0.60, 95% CI = -1.12 to -0.08, $I^2 = 6\%$). Furthermore AA plus diet and exercise performed better effect than diet plus exercise (MD = -0.60, 95% CI = -1.12 to -0.08, $I^2 = 0\%$). AA appeared to be associated with few adverse events reports. Conclusion: This systematic review and meta-analysis suggests the sole AA represents less effect on bodyweight management, but AA plus diet, or AA plus diet plus exercise indeed take more effect comparing with the diet or diet plus exercise.

Keywords: Auricular acupuncture, weight management, systemic review, meta-analysis

Introduction

Obesity is an increasing prevalent chronic condition that is associated with serious morbidity and mortality. Overweight is contributed to several diseases in the world, such as metabolic syndrome, cardiovascular disease, renal failure, sleep apnea and etc. Recent reports from the World Health Organization illustrates that the global overweight and obesity has more than doubled since 1980. In the early of this century, it is said that more than 1.4 billion adults aged 20 and older were overweight with over 500 million of them being obese [1]. Nowadays the global standard for evaluating overweight and obesity is the body mass index (BMI) in clinic. According to the World Health Organization guidelines, a BMI of over 25.00 $\text{kg}\cdot\text{m}^{-2}$ is defined as overweight, 25.00-29.99 $\text{kg}\cdot\text{m}^{-2}$ as pre-obese, and over 30.00 $\text{kg}\cdot\text{m}^{-2}$ as obese; the normal range is 18.50-24.99 $\text{kg}\cdot\text{m}^{-2}$ [2].

Facing to increasingly overweight and obesity, scholars are trying to search all kinds of effective approaches to solve this problem. Health exercise and nutritional diet are considered as the two most effective methods in managing obesity [3]. As everyone knows, both body exercise and diet control have to last a long period. At present, time for people is the most precious possessions. Less of them have enough time to insist on these behaviors. There is a growing tendency for people to turn to complementary and alternative medicine. Auricular acupuncture or auricular acupressure (AA) is a safe, economical, effective process on weight loss [4].

From the perspective of traditional Chinese medicine (TCM), AA has been an essential part of acupuncture theory in addition to somatic acupuncture (SA). The effect of acupuncture for obesity has been proved once more [5-7]. However, patients accepting SA therapy have to ask for a professional acupuncturist, and need

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to go to the clinic and spend a certain amount of times. AA in the experimental study and clinical practice has been evaluated that it has the similar reaction on treating various diseases comparing with SA [8-11]. Based on the view of this principle, AA becomes more and more popular in treating obesity in the world. Patients only need to accept the auricular acupressure at the corresponding points, by *vaccaria* seeds—a small round seed which are commonly used in auricular taping, and get effective treatment [12].

So far this year, despite the reports of AA on obesity are numbers, but less system analysis and enough evidences are able to illustrate the effectiveness of AA on obesity. In the view of published clinical reports, several random controlled trials have been studied. In this system review, the aim of the study was to analyse the effectiveness of AA on obesity by meta-analysis and AA's possible therapeutic values.

Methods

Data sources

The following sources were searched up to August 2015: the Cochrane Library including the Cochrane Central Register of Controlled Trials, MEDLINE, EMBASE, Allied and Complementary Medicine Database (AMED), CINAHL, PsycInfo, Science Citation Index, Korean medical databases (which include the National Assembly Library, Korea Med, Korean Studies Information Service System, DBpia, and Korea Institute of Science Technology Information and Research Information Service System), Japanese database (Japan Science and Technology Information Aggregator Electronic), Chinese database (which include the China Academic Journal, Century Journal Project, China Doctor/Master Dissertation Full Text DB and China Proceedings Conference Full Text DB), African Index Medicus, Australasian Medical Index, Current Controlled Trials, the National Centre for Complementary and Alternative Medicine (NCCAM) at the National Institutes of Health (NIH) and the Complementary and Alternative Medicine Specialist Library at the NHS National Library for Health.

The key-words of research strategy were: (1) 'auricular acupuncture' OR 'electro-auricular acupuncture' OR 'auricular acupressure'; (2) 'obesity' OR 'weight loss' OR 'weight control'

OR 'weight reduction' OR 'overweight' OR 'weight increase' OR 'weight decrease' OR 'weight watch' OR 'overeat' OR 'overfeed' OR 'slim'; (3) 'randomized controlled trial (RCTs)'.

Inclusion and exclusion criteria

This review was restricted to RCTs that compared AA or its other variants with a control group that included no treatment, sham treatment, pharmacological or nonpharmacological treatments, to assess the efficacy of AA on weight loss. No restriction was imposed on studies with respect to blinding and type of design such as parallel or cross-over. Cross-over RCTs of obesity except the first phase data were hereby excluded. No language restriction was made for selecting studies.

Exclusions include preclinical studies, case reports, *in vivo* studies, no data reports and uncontrolled trials, and trials that combined with different interventions.

Data extraction

Two reviewers (Xiang Y and Li, J.) scanned the title and abstract of every report from the literature database. All potentially relevant articles were investigated as full text. For ambiguous or missing information, we contacted the author for full paper. For duplicate publications, the original publication was used.

This included description of studies (author, publication year, location, blinding), characteristics of participants (age, number), details of intervention and control (ingredients/points of each auricular acupuncture, treatment frequency, duration, follow-up period, co-intervention such as diet or exercise), outcome measures (Body weight (BW)), type and frequency of adverse event.

Risk of bias assessment

The quality of the studies was assessed as the principle in the Cochrane Handbook for systematic review of interventions: (1) Sequence generation; (2) Allocation concealment; (3) Blinding of participants, personnel; (4) Blinding of outcome assessors; (5) Incomplete outcome data; (6) Selective outcome reporting; (7) Other sources of bias [13]. The overall quality of the studies is summarized into the following three categories after assessing the above seven areas: (1) Low risk of bias: all the validity criteria were met; (2)

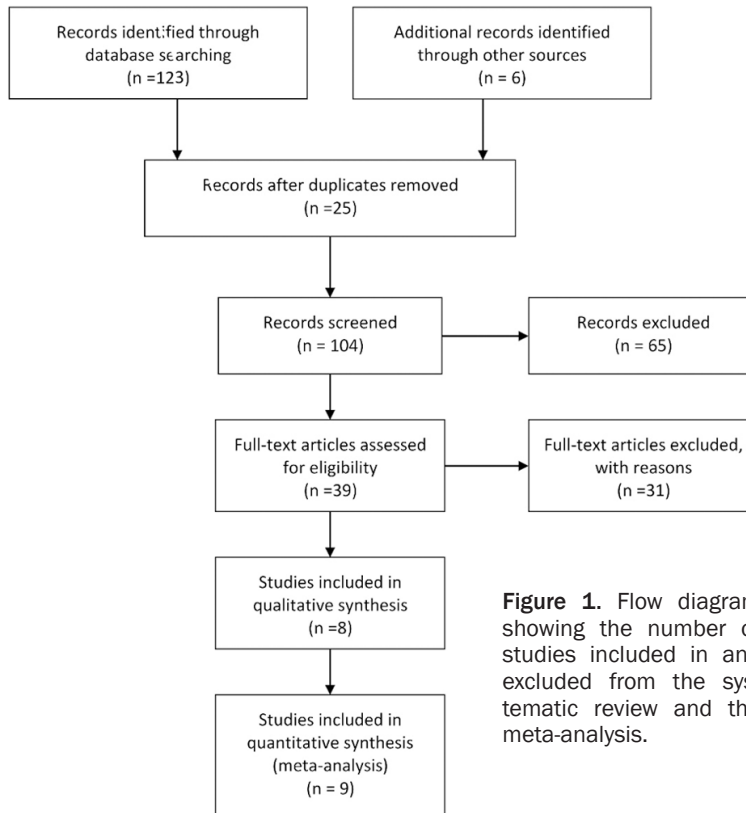
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Table 1. Basic information of the sole AA, the AA plus diet and the AA plus diet plus exercise

First Author (pub. Year, location)	Subjects' mean age (s.d.)	Numbers of patients randomized/analyzed	Type of design; blinding	Intervention type	Treatment frequency	Auricular acupoints	Type of control group	Outcome measure, reported <i>p</i> value	Adverse events reported (n)
The sole AA intervention									
Allison <i>et al.</i> (1995, USA) [18]	44.5 (12.7)	96/69	Parallel, SB	Auricular acupress	12 wks	Six strategically placed points	Placebo (wrist acupress device)	BW, 0.37	Mild redness, pain, discomfort, bleeding in ears
Yeh <i>et al.</i> (2008, Taiwan) [14]	22-50	7/7	Parallel, open	Auricular acupress	9 wks	TF4, CO1, CO4, CO18	None intervention	BW, BMI, BF, WC, HC, WHR, < 0.001	None
Hsu <i>et al.</i> (2009, Taiwan) [9]	16-65	60/55	Parallel, SB	Auricular acupuncture	2 per wk (6 wks)	HP, TF4, CO4, CO18	Sham auricular acupuncture	BW, BMI, WC	None
Lien <i>et al.</i> (2012a, Taiwan) [21]	16-60	90/71	Parallel, SB	Auricular acupuncture	3 per wk (4 wks)	TF4, CO4, HP, CO18	Sham auricular acupuncture	BW, BMI, WC > 0.05	Dizziness
Lien <i>et al.</i> (2012b, Taiwan) [21]	16-60	90/71	Parallel, SB	Auricular acupress	3 per wk (4 wks)	TF4, CO4, HP, CO18	Sham auricular acupress	BW, BMI, WC > 0.05	Dizziness
The AA plus diet intervention									
Abdi <i>et al.</i> (2012, Iran) [19]	18-55	220/204	Parallel, open	Auricular acupress + diet	2 per wk (6 wks)	TF4, CO4, HP, CO1, HX1, CO17	Sham auricular acupress + diet	BW, BF, BMI, WC, HC, < 0.001	NR
Darbandi <i>et al.</i> (2012, Iran) [17]	18-55	90/86	Parallel, open	Auricular acupress + diet	2 per wk (6 wks)	TF4, CO4, HP, CO1, HX1, CO17	Sham auricular acupress + diet	BW, BMI, BFM, < 0.01	None
Hsieh <i>et al.</i> (2011, Taiwan) [22]	18-20	63/55	Parallel, open	Auricular acupress + diet	1 per wk (8 wks)	TF4, CO4, CO6, CO18	Sham auricular acupress + diet	BW, WC, HC, WHR, < 0.001	NR
Yeo <i>et al.</i> (2014, South Korea)a [20]	> 19	91/58	Parallel, SB	Auricular acupress + diet	1 per wk (8 wks)	TF4, CO4, CO10, HP, CO18	Diet	BMI, WC, BW, BFM, PBF, BP < 0.05	NR
Yeo <i>et al.</i> (2014, South Korea)b [20]	> 19	91/58	Parallel, SB	Auricular acupress + diet	1 per wk (8 wks)	HP	Diet	BMI, WC, BW, BFM, PBF, BP < 0.05	NR
The AA plus diet plus exercise									
He <i>et al.</i> (2012, China) [16]	18-54	60/60	Parallel, open	Auricular acupress + diet + exercise	2 per wk (4 wks)	HP, CO4, CO10, CO7, CO18, TF4	Diet + exercise	BW, BMI, WC, < 0.05	NR

Auricular acupuncture-acupress (AA); SB, single blind; TF4, *Shemmen*; CO4, *Stomach*; CO1, *Mouth*; HX1, Center of Ear; CO18, *Endocrine point*; BW, Bodyweight; BF, Body fat; BMI, Body mass index; WC, waist circumference; HC, Hip circumference; NR, Not reported; HP, Hunger point; CO17, *Sanjiao*; BFM, body fat mass; CO6, Small intestine; WHR, Waist-to-hip ratio; CO10, Spleen; WC, waist circumference; PBF, Percentage body fat; BP, Blood pressure; CO7, Large intestine.

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China and Taiwan, Two were from Iran, and the rest of two were from USA and Korea respectively. Five of them used AA as the sole intervention [9, 14, 18, 21], four of them involved AA and diet control as treatment [9, 15, 17, 20], and the rest adopted AA, diet and exercise [16]. None intervention [14, 18], sham AA [9, 21], sham AA + diet [15, 17, 19, 20], Sham AA + diet + exercise [16] as control intervention were designed in the corresponding literatures. The whole treatment period ranged from four to twelve weeks (Table 1).

Risk of bias in the included studies

In general, as Figure 2 shown, of nine studies, two studies performed the low risk of bias [9, 21], others were considered as high risk of bias.

The poor allocation concealment, blinding of participants, personnel and outcome assessment were the main problems in the relevant articles [14, 16-20, 22].

Auricular acupuncture versus none intervention or sham auricular acupuncture

The simple AA may not reduce the weight comparing with the control. Combing four studies [9, 14, 18, 21] (208 participants) that provided data on body weight (kg) using a fixed effects model produced a weighted MD in favor of AA compared to placebo, none intervention or sham AA (pooled MD = -0.40 kg, 95% CI = -0.95 to 0.15, P = 0.15) (Figure 3). Statistical heterogeneity was not found among studies ($I^2 = 0\%$). There was no perceptible asymmetry in funnel plots of these three studies (Figure 3).

Auricular acupuncture + diet versus diet

Surprisingly combining AA with diet can reduce the bodyweight comparing with the simple diet. Four studies [15, 17, 19, 20] were involved into the meta-analysis (383 participants). The combined result, based on a fixed effects model,

Moderate risk of bias : at least one validity criterion was only partly met; (3) High risk of bias: at least one validity criterion was completely not met.

Data analysis

Review Manager Software 5.3 was used for data analysis. A Chi-square test was performed to assess the heterogeneity of studies. The random-effect model was chosen because this model offers a wider, more conservative confidence interval (CI). The data were dichotomized and expressed as a relative ratio (RR) with a 95% CI.

Results

Description of the trials

As Table 1 shown, in this review, 129 potentially relevant studies were identified, of which 9 met the inclusion criteria (Figure 1). The key data from all included RCTs are listed in the Table 1 [9, 14-21]. Seven adopted a two-arm parallel group design [9, 14-19], and the rest adopted a three- arm parallel group design [20, 21]. Five trials were originated from mainland

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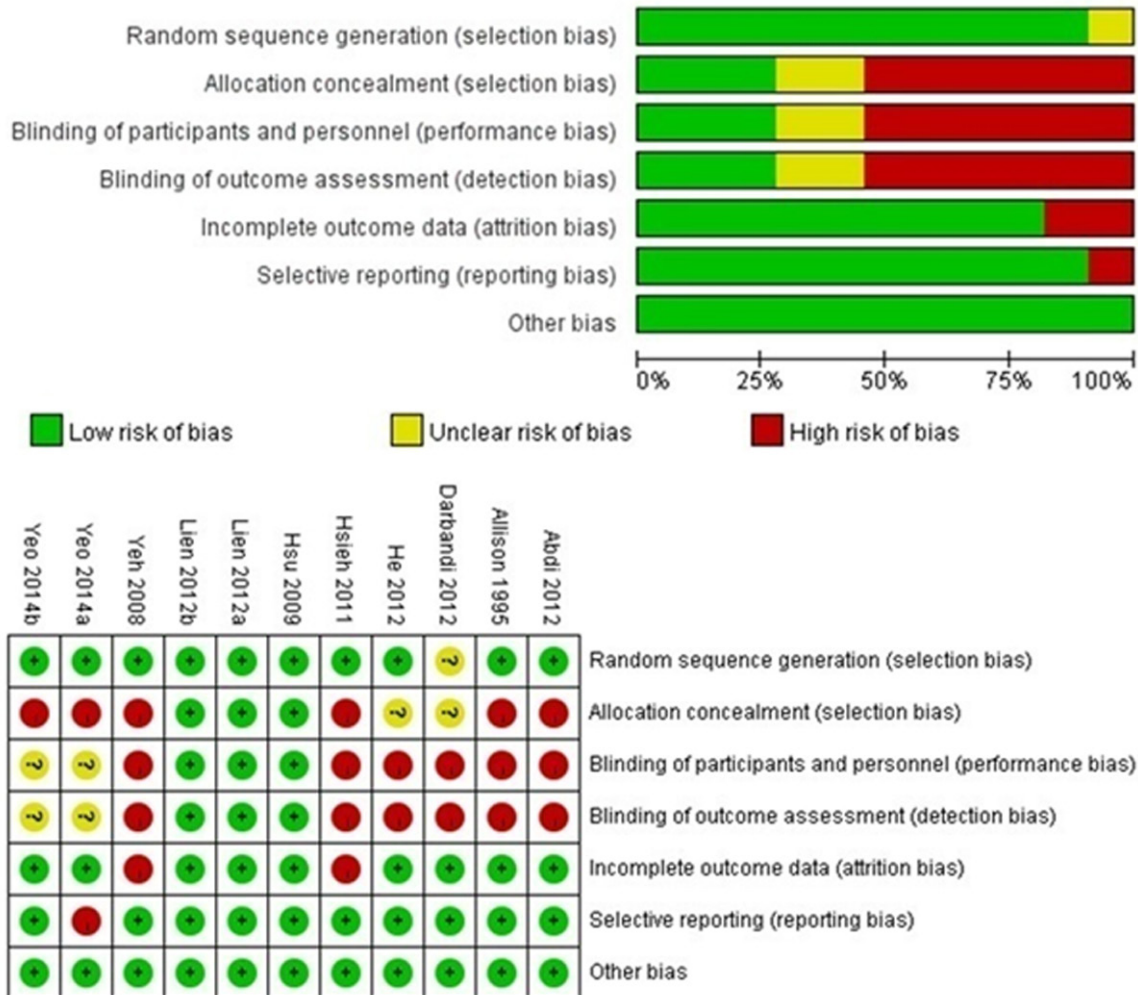


Figure 2. The graph of the risk of bias assessment.

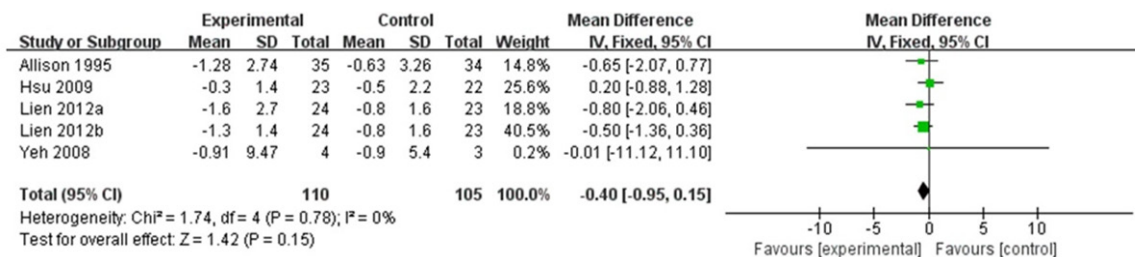


Figure 3. A Forest plot with a combined result of meta-analysis for mean difference of body weight changes between auricular acupuncture and no intervention or sham auricular acupuncture.

showed statistically significant reduction in severity of obesity (pooled MD = -1.39 kg, 95% CI = -1.47 to -1.32, P < 0.001) (Figure 4). No heterogeneity was found between the treatment and control (I² = 6%). There was no perceptible asymmetry in funnel plots of these five studies (Figure 4).

Auricular acupuncture plus diet plus exercise versus diet plus exercise

He and his co-workers [16] tested AA + diet + exercise comparing with diet + exercise (60 participants) for weight loss and found these three intervention combination can effectively

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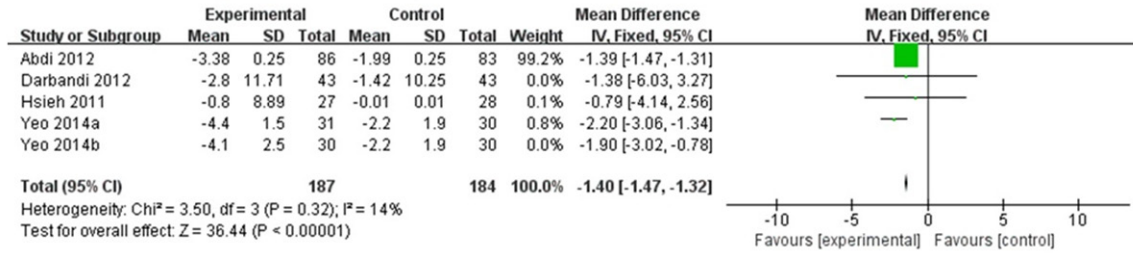


Figure 4. A Forest plot with a combined result of meta-analysis for mean difference of body weight changes between auricular acupuncture plus diet and diet.

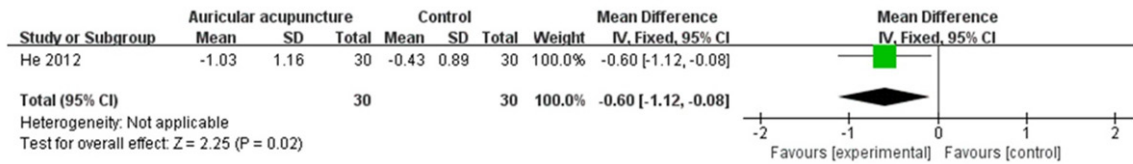


Figure 5. A Forest plot with a combined result of meta-analysis for mean difference of body weight changes between auricular acupuncture plus diet plus exercise and diet plus exercise.

reduce body weight (MD = -0.60, 95% CI = -1.12 to -0.08, P = 0.02) (**Figure 5**). No heterogeneity was found between the treatment and control ($I^2 = 0\%$). There was no perceptible asymmetry in funnel plots of these five studies (**Figure 5**).

Adverse events associated with auricular acupuncture

A total of five RCTs reported on adverse events associated with AA [9, 14, 17, 18]. Of these five trials, three studies reported that there were no adverse events [9, 14, 17]. Allison [18] reported mild redness, pain, discomfort or bleeding in ears. Lien [21] introduced a case of dizziness (**Table 1**).

Discussion

To the best of our knowledge, this is the first meta-analysis of AA for obesity treatment that did not restrict studies for analysis due to the language of publication. However few RCT shave tested the effects of AA for obesity. Based on our finding, the results of meta-analysis suggested that the simple AA treatment may not have specially effect on weight loss, furthermore, AA with others' interventions on weight loss such as diet control and exercise are contributed to weight loss management. This is an interesting finding.

Given the experience with risk of bias assessment, only two studies were considered as high quality, the others presented high risk of bias. This result affected this quality of this analysis to some extent. Scholars have to take more attention on the trials' design and improve the article's quality.

Analyses of the outcome of the trials that comparing simple AA with none intervention or sham AA queried the AA's effect on weight loss. This is a surprising result, from the sole AA studies, because of negative results were reported once more [9, 21]. It has been admitted that relevant literatures are found as much as possible. Therefore, AA intervention that has less benefit for weight loss.

More interesting, the analysis of the results of the studies that comparing AA plus diet to simple diet suggested that these two intervention combination took positive effect on weight loss. However, only one study reported the details of recipe during the clinical observing time [20]. Others studies shortly introduce the requests of controlling food intake or banning food intake at a certain period of the whole day. Just as our known, food intake control is very important for weight loss [23-25].

Although there are only one test on observing the AA plus diet plus exercise compared to diet

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plus exercise, the result suggest these three intervention combination reduce the body weight as well. However fewer reports have been found, thus such data are highly susceptible of bias. It has to be admitted that exercise is benefit to weight loss in clinic.

For explaining the results more visual, a special phenomenon in chemical field can be used to explain the meta-analysis results. AA may play a role as “catalyst” in the chemical reaction. Itself can't take any effect on weight loss, but if it combing with others effective intervention such as diet control or exercise, this action will be magnified.

Limitation of our systemic review pertains to the potential incompleteness of the evidence reviewed. It was aimed to identify all studies on the subject. The distorting effects of publication bias and location bias on systematic reviews and meta-analysis are well documented [26, 27]. In the present review, there were no restrictions on the review publication language, and a large number of different databases were searched. All relevant data on the subjects will be sure correctly. However it has to be admitted that a degree of uncertainty remains.

Future studies in obesity treatment with AA should emphasize adequate methods to permit RCTs and the use of pilot trials to help prepare appropriate RCTs. The sole AA intervention should be observed more, and more evidences should be reported the special effect of AA on obesity.

Disclosure of conflict of interest

None.

Address correspondence to: Zhizhong Ruan, Department of Acupuncture and Moxibustion, Nanjing Hospital of Traditional Chinese Medicine, The Third Affiliated Hospital of Nanjing University of Traditional Chinese Medicine, No. 1 Jinling Road, Nanjing 210001, Jiangsu, China. E-mail: ruan-zhizhong025@sina.com

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