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REVIEW

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Effects of traditional Chinese medicines on weight management among adults with overweight or obesity: A systematic review and network meta-analysis

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Abstract

Increasing evidence has reported the anti-obesity effects of traditional Chinese medicines (TCMs) and their potential advantages in weight loss, such as fewer side effects and lower costs compared to the current recommended treatments like Western medicines. Previous review studies have examined the effects of a few commonly used TCM therapies such as acupuncture and herbal medicines on weight loss. This network meta-analysis (NMA) study aims to review and rank the effects of currently available TCMs on weight loss and to compare the effects of TCMs with different intervention durations. Eligible Randomized controlled trials (RCTs) conducted among Chinese adults with overweight or obesity were searched on electronic databases (PubMed, Embase, CNKI, WanFang, VIP, and SinoMed) up to 1 March 2023. Pairwise meta-analysis was performed to examine the pooled effects of TCMs on weight loss, and NMA was conducted to rank different types of TCMs. Subgroup analysis stratified by intervention duration was performed. Forty-six RCTs were eligible for inclusion in the review. The results showed that TCMs, especially when the treatment duration was ≤6 months, were more effective in both body weight and Body Mass Index (BMI) reduction than non-pharmacological interventions and placebo/no treatment. Acupotomy was ranked as the most effective TCM treatment in reducing both body weight and BMI. Traditional Chinese medicines have promising potential for weight loss and could be included in future clinical guidance as a standalone or supplementary treatment for obesity. Future studies need to further investigate under-researched TCMs, examine the long-term effects and safety of TCMs in obesity treatment, and validate the findings from this study among other ethnic populations.

KEYWORDS
adults, obesity, traditional Chinese medicines, weight management

1 | INTRODUCTION

While the standard treatments for obesity largely through lifestyle, pharmacological, and surgical interventions are suggested in many national and international guidelines, increasing evidence has reported the anti-obesity effects of traditional medicines and their great potentials in weight loss.[1–8] Several previous studies have reviewed the effects of traditional Chinese medicines (TCMs) on weight control, finding that TCMs not only help individuals lose weight and improve metabolic parameters but also possess advantages such as fewer side effects and lower costs compared to the current recommended treatments like Western medicines.[7,9–11]

However, there are some significant limitations in the previous review studies. First, the majority of studies have only examined the pooled effects of a few commonly used TCM therapies such as acupuncture and herbal medicines on weight loss. For instance, Chen et al. (2020) compared acupuncture with non-acupuncture interventions, showing that acupuncture and related therapies had better performance in reducing body weight and improving serum lipid parameters.[12] This narrow focus has resulted in limited understanding of the currently available types of TCMs for treating obesity. Second, most review studies have adopted the methodology of pairwise meta-analysis, which only allows head-to-head direct comparison between the effectiveness of two particular interventions of interest. For instance, Wen et al. (2022) reviewed studies that compared the effectiveness and safety of herbal preparations against placebo/no treatment and reported the superiority of TCMs in treating overweight and obesity.[7] However, because there are many different kinds of TCMs for obesity treatment, more robust analytic methods like network meta-analysis (NMA) are needed to compare multiple treatments in a single analysis, allowing decision makers to select the best treatment from amongst the many potential options. Third, very few previous review studies have compared the effects of TCM treatments with different durations on weight control, resulting in a lack of evidence and guidance for precise treatment plan development.

The present review and NMA study thus aims to systematically evaluate and compare the efficacy of currently available TCM treatments for weight loss, as compared to regular care intervention (e.g., Western medicine, non-pharmacotherapy) or placebo/no treatment, among adults with overweight or obesity. Specifically, this study will (1) calculate and rank the effects of different TCMs in treating obesity, and (2) compare the effects of TCMs with different treatment durations on weight loss. The findings from this study will extend our understanding of TCM in weight management by providing a comprehensive picture of the available TCM therapies and their effects. This will have significant health implications for both clinicians and patients by providing a reference for comparing potential intervention plans and developing new approaches.

2 | METHODS

This study was conducted and reported following the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) Statement (2020) and the predetermined methods documented in a protocol, registered in the International Prospective Register of Systematic Reviews (PROSPERO; registration number: CRD42022275328).

2.1 | Literature search strategies

A search was conducted for studies published in English or Chinese prior to 1 March 2023, using the following databases: PubMed, Embase, CNKI, WanFang Data, VIP Chinese Science Journals Database, and SinoMed. Search terms included combination, truncations, and synonyms of the following: (1) TCMs/complementary treatment, (2) obesity, (3) Chinese adults, and (4) effectiveness. Chinese search terms included (1) 中医, (2) or, and (3) 功效. The complete search strategies are shown in Appendix A. Search results across databases were merged using the reference management software Endnote 20 (Camelot UK Bidco Limited, Clarivate Analytics), and duplicate records from the same study were removed. Study selection followed the process described in the Cochrane Handbook of Systematic Reviews and PRISMA statements. Two reviewers independently screened titles and abstracts to identify studies that met the inclusion criteria described below. Any disagreements were discussed and resolved by consensus.

2.2 | Inclusive/exclusive criteria

2.2.1 | Inclusive criteria

Type of studies

Randomized controlled trials (RCTs) that used TCM to treat obesity published in English or Chinese were eligible for review.

Participants

Chinese adults (aged ≥18 years old) were diagnosed to be overweight (Body Mass Index (BMI) ≥24 kg/m^2) or obese (BMI ≥28 kg/m^2), according to the diagnosis criteria recommended in the "Guidelines for the Prevention and Control of Overweight and Obesity in Chinese Adults (2021)" released by the National Health Commission's Bureau of Disease Control and Prevention.

Intervention group

The experimental group received single or combined TCM treatments (e.g., acupuncture, electroacupuncture, auricular acupressure, catgut embedding, etc.) for weight loss, regardless of treatment duration.

Control group

Participants in the control group received TCM therapies that were different from the intervention group, regular care intervention (e.g., Western medicine, non-pharmacotherapy), or placebo/no treatment.

Type of outcome measures

The eligible studies reported body weight (kg) and/or BMI (kg/m^2) as weight change outcomes.

2.2.2 | Exclusive criteria

Studies were excluded if they (1) were not RCTs; (2) did not examine the effects of TCMs; (3) were not conducted among the population of interest; (4) included participants who had other serious medical conditions or diseases that would affect their body weight and/or BMI (e.g., polycystic ovarian syndrome, heart disease, cancer, etc.); (5) compared the same TCM technique with variations in the intervention and control groups; or (6) did not have full text available.

Quality assessment

The risk of bias of the eligible studies was assessed using Version 2 of the Cochrane risk-of-bias tool for randomized trials (RoB2). Specifically, the five domains of randomization process, deviations from intended interventions, missing outcome data, measurement of the outcome, and selection of the reported result at the study level were assessed.[13] A judgment about the risk of bias in each domain was generated by an algorithm embedded in RoB2 based on responses to more detailed signaling questions. Judgments are designated as "low" risk of bias, "high" risk, or "some concerns" about the risk of bias. Review Manager (RevMan version 5.4) was used to record and visualize the risk of bias results.

To evaluate the presence of publication bias within our meta-analysis, Egger's test was employed using the metabias command in Stata. Comprehensive insights into asymmetry in our findings were further sought through the generation of funnel plots, executed in Review Manager (RevMan), thus providing a visual assessment of potential bias. Additionally, a Trim-and-Fill analysis was undertaken to estimate and correct for observed bias in the meta-analytic results. This was carried out using the metafor package in R, which allowed us to adjust our estimates by imputing hypothetical studies to yield a symmetrical funnel plot, thereby mitigating the impact of potential publication bias on our conclusions.

The Grading of Recommendations Assessment, Development, and Evaluation (GRADE) framework was used to assess the overall quality of evidence included in this review by evaluating the following factors: risk of bias, inconsistency, indirectness, imprecision, and other factors (including publication bias).[14] The levels of quality of evidence were "high", "moderate", "low", and "very low". The results were summarized using the GRADEpro Guideline Development Tool (GDT software; McMaster University and Evidence Prime, 2022, available from gradepro.org).

2.3 | Data extraction, analysis, and synthesis

Basic information about the reviewed studies, including author, year, sample size, participant demographics, intervention and control groups, and outcome measures, were extracted and summarized. Moreover, the intervention characteristics, including types of intervention, duration of intervention, and effects of the interventions were extracted and recorded.

A pairwise meta-analysis using Review Manager 5.4 was performed to calculate the pooled effects of TCM therapies compared to no intervention or regular care intervention (i.e., Western medicine, non-pharmacotherapy). The outcomes were reported as mean differences (MDs) in body weight and/or BMI after treatment and 95% confidence intervals (CIs), and presented using forest plots. For studies that did not directly report MDs in body weight and/or BMI, mean values and corresponding standard deviations (SDs) before and after the trial were extracted to calculate the MD and SD using the formula recommended by the Cochrane Handbook for Systematic Reviews of Interventions:

$$\overline{X}_{change} = \overline{X}_{final} - \overline{X}_{baseline}$$

$$SD_{change} = \sqrt{SD^2_{baseline} + SD^2_{final} - (2 \times Corr \times SD_{baseline} \times SD_{final})}$$

where Corr was set at 0.5.[15] For studies with multiple intervention groups, the control group was divided accordingly to be compared with each intervention group, following the Cochrane Handbook guidance.[15] Heterogeneity among studies was calculated using the I-square (I^2) test to determine the choice of effect model: when $I^2 < 50\%$, studies were considered homogeneous and a fixed-effects model was used; when $I^2 > 50\%$, studies were considered to have high heterogeneity and a random-effects model was used.

Network meta-analysis with a contrast-based model within a Bayesian framework—which allows for the consideration of heterogeneity between studies and inconsistency between designs—was performed using Stata software (version 18; StataCorp, College Station) for the between- and within-trial randomized treatment comparisons.[16] Clustering analysis of different treatments was performed by grouping the competing treatments into meaningful groups like TCM therapies, Western medicine, and non-pharmacotherapy. The rank probabilities of each treatment method were reported using the surface under the cumulative ranking curve (SUCRA). Rankograms were generated to visualize the distribution of rank probabilities regarding the different types of interventions. The amount of difference between direct and indirect evidence for each of the pairwise comparisons in the NMA loop was detected using the "loop-specific" approach, quantifying the degree of incoherence as an inconsistency factor. The inconsistency test was performed using the ifplot macro in Stata (version 18; StataCorp, College Station).[17]

To compare the effects of different TCMs on weight control, the pairwise meta-analysis and NMA were also conducted among five subgroups stratified by the durations of the intervention: 1) ≤ 1 month, 2) 1–2 months, 3) 2–3 months, 4) 3–6 months, and 5) > 6 months. If a study reported weight outcomes at baseline, during, and after the intervention and if the intervals fell within one of the five subgroup categories, multiple data points from the same study were extracted and used in the subgroup analysis. For instance, if a 6-month-long experimental study reported weight change results at the end of 2 and 6 months of the intervention, these two data points were used in the 1-2-month and 3-6-month subgroup analysis.

To ascertain the robustness of our findings, a sensitivity analysis was employed to scrutinize the effect of study heterogeneity in outcome reporting. Specifically, studies were excluded if they did not directly reporting changes in mean body weight and/or BMI, or in SDs. Subsequent modifications were made in the meta-analytic calculations. Forest plots for pairwise meta-analysis were adjusted in Review Manager (RevMan) by deselecting the noncompliant studies. For NMA, a revised dataset—omitting the studies in question— was prepared and re-imported into Stata to recalculate the results. Furthermore, an additional sensitivity analysis was conducted to assess the influence of different meta-analytical approaches on the observed effects of TCM interventions. This involved applying both random-effects and fixed-effect models to evaluate the extent to which our conclusions were contingent upon the choice of statistical framework.

3 | RESULTS

A total of 1584 studies were screened, of which 184 were excluded due to duplication. After examining the titles and abstracts of the remaining 1400 studies, 163 studies were kept for full-text review, of which 117 studies were further excluded for the following reasons: the full text was not available (n = 43), the study was not conducted among participants of interest (n = 36), it did not report body weight or BMI results (n = 26), it did not have comparators of interest (n = 8), or it was not an RCT (n = 4). Ultimately, 46 studies were included in the final review and meta-analysis (Figure 1).[18–63]

The basic information and characteristics of the reviewed studies are summarized in Table 1. The included studies were published between 2005 and 2022, including a total of 4397 patients with overweight or obesity in China. The age of the participants ranged from 18

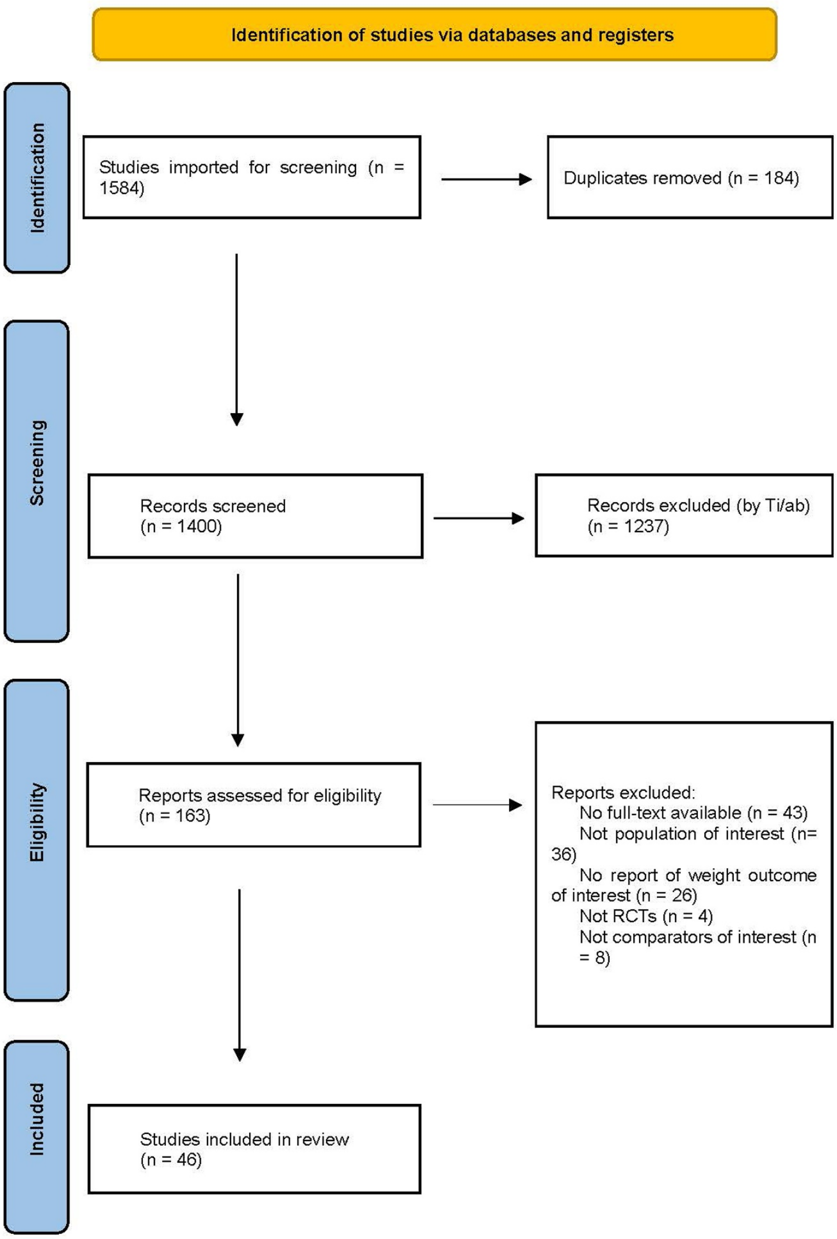

FIGURE 1 PRISMA flowchart for literature searching and screening.

TABLE 1 Summary of characteristics of the included studies.

Author, year	Location	Sample size (I/C)	Age: Mean (SD) or range (I/C)	Gender	Intervention(s)	Control	Type of comparison	Outcome variable(s)	Duration (month)	BW reduction effects: MD (SD) (kg) (I/C)	BMI reduction effects: MD (SD) (kg/m^2) (I/C)
Bu et al., 2007	Shijiazhuang	32/23	32.1 (1.1)/ 33.4 (1.3)	Both	AC + AA + CP	AC	Combined TCM versus Single TCM	BW, BMI	1	11.09 (14.8)/6.12 (9.12)	4.91 (9.5)/2.5 (10.82)
		32/25	32.1 (1.1)/ 32.7 (2.4)			AC + AA					
Chen et al., 2007	Wuhan	40/40	43.4 (13.6)/ 44.6 (10.3)	Both	CE	AC	Single TCM versus Single TCM	BW, BMI	1	5.21 (5.56)/4.91 (6.08)	6.2 (4.17)/7.3 (4.42)
Chen et al., 2018	Taiwan	40/40	39.9 (9.8)/ 43.7 (9.3)	Female	CE	Sham CE	Single TCM versus Placebo	BW, BMI	2	1.7 (12.15)/0.4 (12.65)	0.8 (3.9)/0.9 (5.58)
Chen et al., 2011	Nanjing	35/35	33.03 (1.43)/ 33.11 (1.80)	Both	AP	EA	Single TCM versus Single TCM	BW, BMI	1	11.07 (2.43)/8.15 (1.31)	4.11 (0.61)/3.12 (0.35)
		35/35	33.03 (1.43)/ 33.09 (1.65)			AC				11.07 (2.43)/5.1 (2.1)	4.11 (0.61)/1.95 (0.44)
Chen et al., 2022	Wuhan	108/108	31.66 (6.55)/ 30.75 (6.71)	Both	CE	Sham CE	Single TCM versus Placebo	BW, BMI	4	4.17 (0.54)/1.85 (0.63)	1.55 (0.2)/0.73 (0.2)
Dai et al., 2022	Shanghai	42/42	33.05 (6.60)/ 36.17 (9.71)	Both	CE + NPI	Sham CE + NPI	Single TCM + NPI versus NPI	BW, BMI	3	2.97 (2.98)/1.4 (2.95)	1.07 (1.1)/0.49 (1.04)
Deng et al., 2014	Foshan	30/10	33 (8)/32 (7)	Both	CE + NPI	NPI	Single TCM + NPI versus NPI	BW	3	2.64 (0.53)/1.45 (0.26)	NA
		30/10	33 (7)/32 (7)		AC + NPI					2.87 (0.44)/1.45 (0.26)	NA
		30/10	32 (7)/32 (7)		CE + AC + NPI		Combined TCM + NPI versus NPI			4.49 (0.59)/1.45 (0.26)	NA
Guo et al., 2014	Qingdao	32/32	38 (2.7)/36 (4.2)	Both	EA + NPI	NPI	Single TCM + NPI versus NPI	BW	2	5.2 (6.9)/3.3 (7.93)	NA
He et al., 2007	Shanghai	22/23	46.04 (5.76)/ 45.68 (6.39)	Male	CHM	Placebo	Single TCM versus Placebo	BMI	3	NA	0.8 (2.57)/0.02 (2.83)
He et al., 2014	Liuyang	28/28	NA	Female	AC + TN	AC	Combined TCM versus Single TCM	BW, BMI	1	2.41 (0.27)/2.91 (0.21)	0.99 (0.1)/1.2 (0.09)
		20/20								1.88 (0.25)/2.44 (0.21)	0.76 (0.1)/0.97 (0.09)
He et al., 2008	Shijiazhuang	40/40	18–50	Both	EA + AA	WP	Combined TCM versus Single WP	BW, BMI	2	6.56 (10.24)/4.21 (9.93)	1.91 (3.1)/1.43 (3.2)
He et al., 2012	Hubei	30/30	18–54	Female	AA + NPI	NPI	Single TCM + NPI versus NPI	BW, BMI	1	1.03 (1.16)/0.43 (0.89)	0.39 (0.43)/0.16 (0.39)

(Continues)

TABLE 1 (Continued)

Author, year	Location	Sample size (I/C)	Age: Mean (SD) or range (I/C)	Gender	Intervention(s)	Control	Type of comparison	Outcome variable(s)	Duration (month)	BW reduction effects: MD (SD) (kg) (I/C)	BMI reduction effects: MD (SD) (kg/m^2) (I/C)
Hsu et al. (b), 2005	Taiwan	11/20	40.0 (11.5)/ 41.3 (9.9)	Female	EA	NPI	Single TCM versus NPI	BW, BMI	2	1.7 (11.4)/0.4 (12.55)	0.7 (3.45)/0.2 (3.95)
		11/21	40.0 (11.5)/ 40.5 (9.9)			Placebo	Single TCM versus Placebo			1.7 (11.4)/0.1 (6.62)	0.7 (3.45)/0.1 (3.45)
Hsu et al. (a), 2005	Taiwan	46/46	41.26 (1.25)/ 41.26 (1.25)	Female	EA	NPI	Single TCM versus NPI	BW, BMI	2	1.46 (11.22)/0.3 (11)	0.79 (3.68)/0.14 (3.71)
Hsu et al., 2009	Taiwan	23/22	40.0 (10.5)/ 39.4 (13.6)	Female	AA	Placebo	Single TCM versus Placebo	BW, BMI	2	0.3 (1.4)/0.5 (2.2)	0.1 (5.6)/0.3 (0.9)
Huang & Pan, 2011	Guangzhou	30/30	33.4/34.6	Both	CE	EA	Single TCM versus Single TCM	BW, BMI	2	5.77 (9.37)/4.08 (7.49)	1.9 (3.54)/1.37 (2.34)
Lee et al., 2022	Taiwan	47/47	48.38 (8.02)/ 48.94 (9.35)	Both	CHM	Placebo	Single TCM versus Placebo	BMI	9	NA	1.78 (3.55)/0.99 (3.82)
Lin et al., 2010	Taiwan	20/21	54.05 (3.44)/ 56.05 (3.11)	Female	EA	Placebo	Single TCM versus Placebo	BW	3	1.17 (10.35)/0.06 (7.12)	NA
Li & Yin, 2010	Wulumuqi	36/38	38.1 (9.9)/ 36.1 (7.9)	Both	CE	WP	Single TCM versus Single WP	BW	2	5.7 (7.15)/0 (8.5)	NA
Ni et al., 2022	Changsha	28/26	30.79 (8.80)/ 30.50 (9.53)	Both	EA	NPI	Single TCM versus NPI	BW, BMI	3	8.3 (7.39)/3.65 (3.25)	2.98 (2.48)/1.3 (1.14)
Pan et al., 2005	Kunming	40/38	41.2 (8.3)/ 41.0 (7.9)	Both	CHM	Placebo	Single TCM versus Placebo	BW, BMI	2	1.1 (11.93)/0.2 (10.1)	0.6 (2.86)/0 (2.95)
Sheng et al., 2021	Hangzhou	37/36	49.90 (4.6)/ 51.50 (4.4)	Female	EA + NPI	NPI	Single TCM + NPI versus NPI	BW, BMI	2	1.92 (7.6)/0 (5.98)	0.75 (2.86)/0.24 (2.2)
Tang et al., 2009	Kunshan	33/32	37.82/36.41	Both	EA + CE	EA	Combined TCM versus Single TCM	BW, BMI	1	6.52 (8.26)/3.73 (9.16)	2.8 (1.68)/1.49 (1.79)
Tong et al., 2011	Guangzhou	76/42	35.08 (9.31)/ 34.60 (8.55)	Both	AC + NPI	Sham AC + NPI	Single TCM + NPI versus NPI	BMI	<1	NA	1.04 (2.93)/0.06 (3.19)
Wang et al., 2006	Hangzhou	31/29	50.97 (11.10)/ 49.24 (10.07)	Both	CHM + NPI	NPI	Single TCM + NPI versus NPI	BMI	2	NA	0.57 (2.08)/0.16 (2.37)
Wang et al., 2016	Nanjing	55/55	36 (11)/35 (11)	Both	WM + AA	WM	Combined TCM versus Single TCM	BW, BMI	3	7.55 (16.78)/7.22 (17.77)	2.8 (4.4)/2.73 (4.36)
Wang et al., 2005	Hongkong	19/20	36.16 (12.59)/ 35.30 (11.91)	Both	AC	AA	Single TCM versus Single TCM	BW, BMI	1	2.29 (0.53)/1.82 (0.35)	2.39 (0.54)/1.76 (0.36)
Wang, 2013	Nanjing	45/45	31 (10)/32 (12)	Female	EA	AC	Single TCM versus Single TCM	BW, BMI	2	3.43 (5.54)/3.34 (8.73)	2.96 (1.87)/2.63 (2.74)

TABLE 1 (Continued)

Author, year	Location	Sample size (I/C)	Age: Mean (SD) or range (I/C)	Gender	Intervention(s)	Control	Type of comparison	Outcome variable(s)	Duration (month)	BW reduction effects: MD (SD) (kg) (I/C)	BMI reduction effects: MD (SD) (kg/m^2) (I/C)
Wu, 2014	Nanjing	52/52	35 (9)/35 (9)	Female	AC + TP	AC	Combined TCM versus Single TCM	BW, BMI	3	6.8 (2.3)/6.9 (2.8)	2.6 (0.9)/2.8 (1.5)
Xia et al., 2022	Nanjing	53/53	37 (8)/37 (6)	Both	EA + CE	EA	Combined TCM versus Single TCM	BW, BMI	3	4.49 (2.02)/3.38 (2.65)	1.65 (0.71)/1.27 (0.99)
Xie et al., 2017	Beijing	30/30	33 (6)/34 (7)	Both	AC + NPI	Sham AC + NPI	Single TCM + NPI versus NPI	BW, BMI	2	7.23 (7.49)/1.44 (7.98)	2.14 (2.11)/0.32 (2.07)
Xu et al., 2013	Shanghai	30/15	48.8 (13.3)	Female	AC	No treatment	Single TCM versus Placebo	BMI	1	NA	2.37 (1.21)/0.36 (1.06)
Yan et al., 2014	Chengdu	28/26	30–55/25-53	Both	TN + NPI	NPI	Single TCM + NPI versus NPI	BW, BMI	2	7.1 (12.35)/3.4 (11.19)	4.62 (1.58)/2.17 (1.46)
Yang et al., 2010	Shijiazhuang	31/30	18–42/18-48	Both	EA + NPI	NPI	Single TCM + NPI versus NPI	BW	2	8.9 (6.92)/6.22 (7.95)	NA
Yu et al., 2018	Beijing	215/199	52.82 (9.01)/ 52.90 (8.52)	Both	CHM	WP	Single TCM versus Single WP	BW, BMI	3	2.47 (2.71)/2.03 (2.36)	0.9 (0.99)/0.74 (0.86)
Zhang & Yang, 2015	Beijing	32/28	41.2 (6.8)/ 43.1 (5.4)	Male	EA + NPI	NPI	Single TCM + NPI versus NPI	BMI	3	NA	1.1 (3.46)/1.1 (4.2)
Zhou et al., 2014	Beijing	70/64	39.91 (11.50)/ 40.02 (11.98)	Both	CHM	Low-dose CHM	Single TCM versus Placebo	BW, BMI	6	3.58 (0.48)/1.91 (0.38)	1.26 (0.17)/0.69 (0.14)
Wan et al., 2022	Zhengzhou	68/63	34 (4)/34 (4)	Both	CE	Sham CE	Single TCM versus Placebo	BMI	3	NA	6.1 (2.84)/2.71 (2.92)
Sun et al., 2013	Guangzhou	25/50	32 (8)/34 (9)	Both	CE + EA	EA	Combined TCM versus Single TCM	BW, BMI	2	10.56 (8.71)/5.17 (12.5)	3.79 (3.36)/1.93 (3.03)
		25/50	32 (8)/34 (10)			CE				10.56 (8.71)/5 (9.82)	3.79 (3.36)/2 (4.16)
Yin et al., 2007	Shijiazhuang	40/39	39.24 (9.04)/ 39.45 (8.56)	Both	CHM	WP	Single TCM versus Single WP	BW, BMI	2	6.33 (8.82)/7.92 (9.93)	1.91 (3.42)/1.73 (3.2)
Zhang et al., 2012	Chengdu	15/15	33.20 (5.60)/ 34.80 (3.10)	Both	EA	Sham EA	Single TCM versus Placebo	BMI	1	NA	3.2 (4.06)/1.1 (5.4)
Zhang et al., 2017	Tangshan	55/55	47.98 (6.43)/ 46.78 (5.97)	Both	NPI + CE + MB	NPI + WP	Combined TCM + NPI versus Single WP + NPI	BMI	3	NA	9.59 (5.61)/4 47 (5.8)
		55/55	47.98 (6.43)/ 48.08 (6.69)			NPI + CP				NA	9.59 (5.61)/3.38 (5.97)
Zhu & Luo, 2014	Suining	30/30	21–58	Both	CP + AC	AC	Combined TCM versus Single TCM	BW, BMI	3	7.07 (13.57)/6.57 (12.59)	2.62 (2.99)/2.49 (2.82)
Li et al., 2019	Ha'erbin	40/40	34.51 (6.25)/ 34.72 (6.45)	Both	MB + CE	AC	Combined TCM versus Single TCM	BMI	1	NA	2.6 (2.26)/1.3 (1.55)

(Continues)

TABLE 1 (Continued)

Author, year	Location	Sample size (I/C)	Age: Mean (SD) or range (I/C)	Gender	Intervention(s)	Control	Type of comparison	Outcome variable(s)	Duration (month)	BW reduction effects: MD (SD) (kg) (I/C)	BMI reduction effects: MD (SD) (kg/m^2) (I/C)
Wang & Cheng, 2006	Hangzhou	30/29	25–60	Both	EA + NPI	NPI	Single TCM + NPI versus NPI	BW, BMI	2	4.42 (9.46)/0.5 (6.35)	1.61 (1.61)/0.16 (2.37)
Wang & Jiang, 2021	Changsha	35/35	38.01 (7.94)/36.77 (8.24)	Both	SP + NPI	NPI	Single TCM + NPI versus NPI	BW, BMI	2	6.23 (3.04)/3.55 (2.65)	2.16 (1.33)/1.29 (1.23)

Abbreviations: AA, auricular acupressure; AC, acupuncture; AP, acupotomy; C, control; CE, catgut embedding; CHM, Chinese herbal medicine; CP, cupping; EA, electroacupuncture; I, intervention; NPI, non-pharmacological intervention; SP, scraping; TCM, traditional Chinese medicine; TN, tuina; TP, tapping; WM, warming needle acupuncture; WP, Western pharmacotherapy.

to 70 years old. Regarding gender distribution, 33 studies (72%) included both male and female participants, 11 (24%) included only female participants, and 2 (4%) included only male participants. The duration of the treatments ranged from <1 month to 9 months, with 11 studies (24%) lasting for 1 month or less, 19 (41%) for 2 months, 13 (28%) for 3 months, 2 (4%) for 3–6 months, and 1 (2%) for >6 months.

Among the reviewed studies, 10 types of TCM treatments (including acupuncture, electroacupuncture, auricular acupressure, catgut embedding, Chinese herbal medicine (CHM), tuina, tapping, cupping, moxibustion, and scraping) and their combinations were examined in the intervention groups. Six studies (13%) compared TCM therapies with Western medicine (e.g., Sibutramine, Metformin, etc.), 15 (33%) compared with non-pharmacological interventions (e.g., diet, exercise), 5 (11%) compared between single TCM therapies, 11 (24%) compared between combined TCM therapies and single TCM treatments, and 11 (24%) compared TCM therapies with placebo/no treatment. With regard to body weight and BMI, 31 studies (67%) reported on both body weight and BMI in the results, 5 (11%) on body weight changes only, and 10 (22%) on BMI reduction only. The network plots are summarized in Appendix B.

3.1 | Quality assessment

The RoB2 assessment results showed that 29 studies (63%) had some concerns of risk of bias (Figure 2). The risk of bias came from the randomization process, mainly because the nature of the interventions made it difficult to blind the participants and/or operators. One study by Guo et al. (2014) had a relatively high risk of bias because the study reported a significant difference in BMI between the intervention and control groups at baseline, which introduced differential measurement errors and could lead to bias in the BMI outcomes. The GRADE assessment showed high quality of evidence for studies that compared TCM therapies with placebo/no treatment, moderate quality for studies that compared TCMs with non-pharmacotherapies, and low quality for studies that compared TCMs with Western medicines (Appendix C).

Funnel plots were utilized to assess the possibility of publication bias in the pairwise comparison between TCM and non-pharmacological interventions, the only comparison incorporating over 10 studies. This decision was made based on the recommendation from the Cochrane Handbook, which cautions against the limited power of funnel plot analysis with fewer than 10 studies. The funnel plots of both the comparison in bodyweight reduction and BMI reduction showed asymmetry, favoring TCM (Appendix D1 & 2), suggesting publication bias or other possible explanations such as selective reporting of outcomes. Egger's Test was then performed to further assess the presence of small-study effects. In terms of bodyweight reduction outcomes, while there was a significant correlation between study precision and effect size, there was no evidence of small-study effects (Appendix D3). However, for BMI reduction outcomes, the presence of small-study effects was suggested (Appendix D4). Trim-and-fill analysis indicated 4 missing

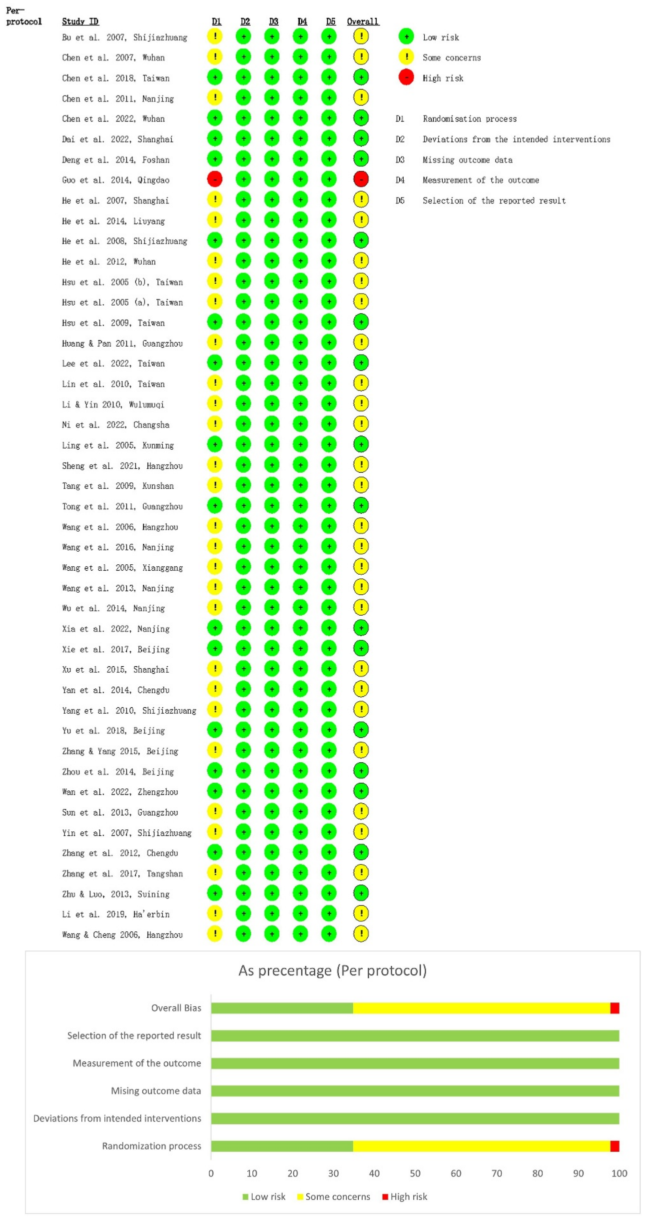

FIGURE 2 RoB2 assessment summary.

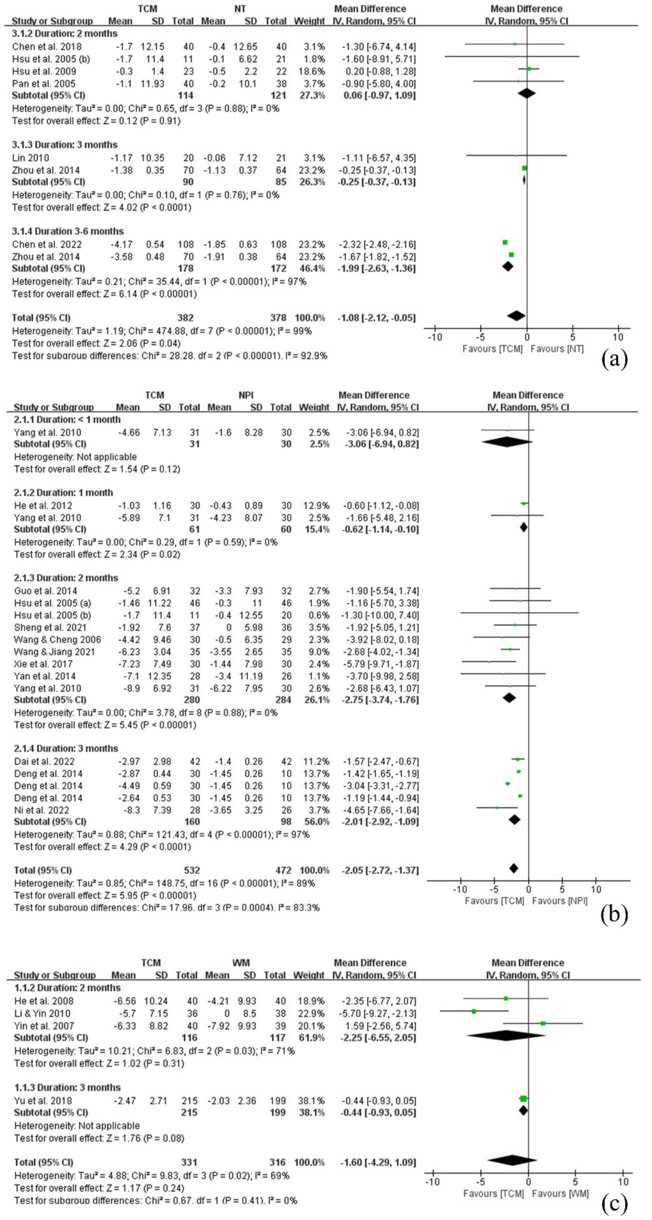

FIGURE 3 Overall and Subgroup Meta-analysis of the Effects of TCMs on Body Weight Reduction. (A) TCM versus Placebo/No Treatment; (B) TCM versus NPI; (C) TCM versus WM. Note: Random-effects model was used. TCM, traditional Chinese medicine; NPI, non-pharmacological intervention; WM: Western medicine.

studies on the right side for bodyweight reduction outcomes (SE = 2.7779) (Appendix D5). However, the estimated effect size was close to the initial pooled effects, thus suggesting minimal influence from missing studies. For BMI reduction outcomes, no missing studies were suggested (Appendix D6). Therefore, the detected small-study effects could be a result of reasons other than publication bias, such as true heterogeneity in effect sizes.

3.2 | Pairwise meta-analysis

3.2.1 | Body weight

Overall, TCM therapies were more effective in weight reduction compared to placebo/no treatment (MD: −1.08 kg; 95% CI: −2.12, −0.05) and non-pharmacological interventions (MD: −2.05 kg; 95% CI: −2.72, −1.37). However, TCM therapies were not more effective in reducing body weight compared with Western medicine (MD: −1.60 kg, 95% CI: −4.29, 1.09). In subgroup analysis by the duration of interventions, compared to placebo/no treatment, TCMs with 3-month and 3-to-6-month durations both yielded significantly more weight loss effects, with the latter showing the largest advantage (MD: −1.99 kg; 95% CI: −2.63, −1.36). Compared to non-pharmacological interventions, TCMs with 1-, 2-, and 3-month durations all performed significantly better, with TCMs with a 2-month duration resulting in the most body weight improvement (MD: −2.75 kg, 95% CI: −3.74, −1.76) (Figure 3).

3.2.2 | Body Mass Index

TCM therapies yielded better BMI reduction results compared to placebo/no treatment (MD: −0.90 kg/m^2; 95% CI: −1.25, −0.55) and non-pharmacological interventions (MD: −0.98 kg/m^2; 95% CI: −1.42, −0.54). Traditional Chinese medicine therapies were not more effective in reducing BMI compared to Western medicine (MD: −1.21 kg/m^2, 95% CI: −2.75, 0.32). The subgroup analysis showed that, compared to placebo/no treatment, TCMs with ≤ 1-month and 3-to-6-month durations resulted in significantly greater BMI reductions, with the former exhibiting more body weight improvement (MD: −2.01 kg/m^2; 95% CI: −2.69, −1.34). Compared to non-pharmacological interventions, TCMs with durations of 2 and 3 months yielded significantly greater BMI reduction (MD: −1.20 kg/m^2, 95% CI: −1.77, −0.63; MD: −0.86 kg/m^2, 95% CI: −1.70, −0.02, respectively) (Figure 4).

3.3 | Network Meta-analysis

3.3.1 | Body weight

The pooled result of NMA showed that catgut embedding, combined TCM treatments, and acupotomy were more effective in weight loss than placebo/no treatment (MD: −2.32 kg, 95% CI: −4.25, −0.39; MD: −3.08 kg, 95% CI: −5.48, −0.69; MD: −6.38 kg, 95% CI: −9.64, −3.12, respectively). Electroacupuncture, combined TCM treatments, and TCM treatments combined with non-pharmacological interventions were shown to be more effective than non-pharmacological interventions (MD: 3.07 kg, 95% CI: 0.16, 5.97; MD: 3.92 kg, 95% CI: 0.60, 7.24; MD: 2.17 kg, 95% CI: 1.00, 3.34, respectively). Combined TCM treatments were more effective than Western pharmacotherapy (MD: 3.13 kg, 95% CI: 0.15, 6.10). Acupotomy was significantly more effective than all other treatment groups except warming needle acupuncture (Table 2) (Table 3).

Acupotomy (98.1%) was found to have the highest effectiveness in reducing body weight, followed by combined TCM treatments (79.6%), catgut embedding (66.4%), electroacupuncture (65.6%), warming needle acupuncture (61.7%), acupuncture (54.5%), TCM treatments combined with non-pharmacological interventions (48.5%), CHM (36.7%), and auricular acupuncture (32.2%). Western pharmacotherapy (22.3%), placebo (21.2%), and non-pharmacological interventions (13.2%) were the three least effective interventions (Figure 5).

3.3.2 | Body Mass Index

Network meta-analysis showed that acupuncture, electro-acupuncture, catgut embedding, CHM, combined TCM treatments, and acupotomy were more effective than placebo (MD: −1.56 kg/m^2, 95% CI: −2.42, −0.70; MD: −1.52 kg/m^2, 95% CI: −2.43, −0.61; MD: −1.40 kg/m^2, 95% CI: −2.19, −0.62; MD: −0.81 kg/m^2, 95% CI: −1.59, −0.02; MD: −2.11 kg/m^2, 95% CI: −3.02, −1.21; MD: −3.11 kg/m^2, 95% CI: −4.49, −1.73, respectively). Acupuncture, electro-acupuncture, catgut embedding, combined TCM treatments, and TCM treatments combined with non-pharmacological interventions were more effective than non-pharmacological interventions (MD: 1.49 kg/m^2, 95% CI: 0.44, 2.53; MD: 1.45 kg/m^2, 95% CI: 0.51, 2.38; MD: 1.33 kg/m^2, 95% CI: 0.10, 2.56; MD: 2.04 kg/m^2, 95% CI: 1.07, 3.01; MD: 0.76 kg/m^2, 95% CI: 0.24, 1.29, respectively). Acupotomy

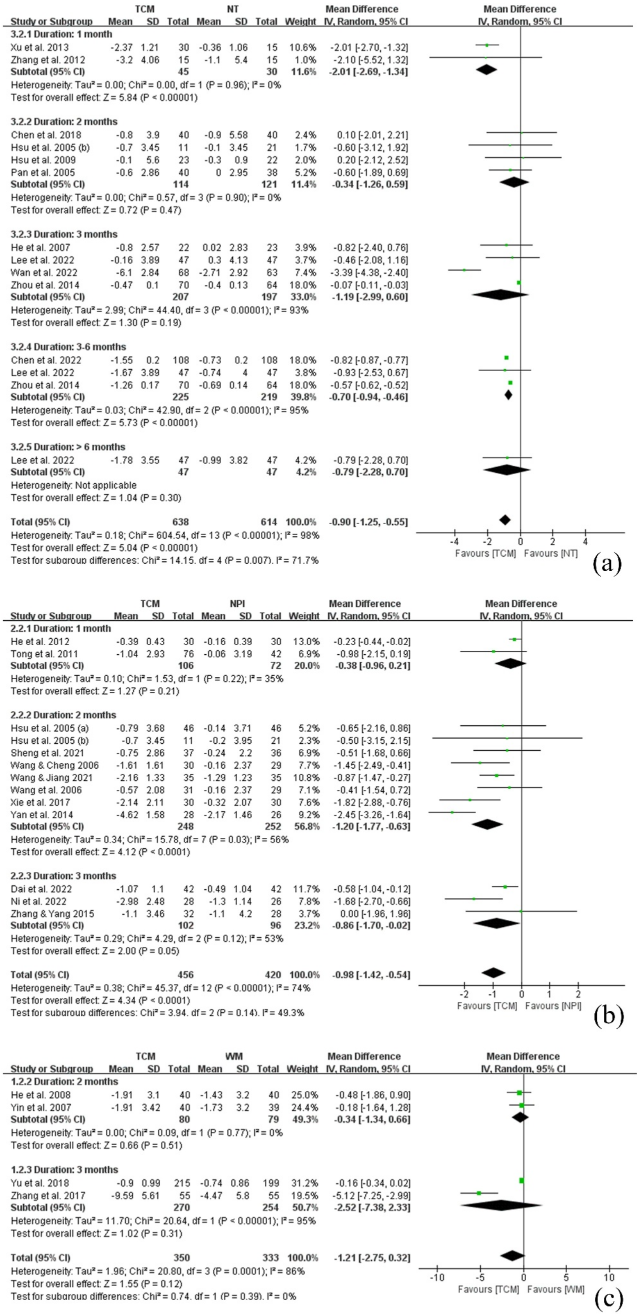

FIGURE 4 Overall and Subgroup Meta-analysis of the Effects of TCMs on BMI Reduction. (A) TCM versus Placebo/No Treatment; (B) TCM versus NPI; (C) TCM versus WM. Note: Random-effect model was used. TCM, traditional Chinese medicine; NPI, non-pharmacological intervention; WM: Western medicine.

TABLE 2 The Network Meta-analysis results of the effectiveness of TCMs in body weight reduction.

Body weight											
PLB											
−1.74 (−3.97, 0.48)	**AC**										
−2.23 (−4.52, 0.06)	−0.49 (−2.16, 1.18)	**EA**									
−0.59 (−2.89, 1.72)	1.15 (−1.08, 3.38)	1.64 (−0.92, 4.21)	**AA**								
−2.32 (−4.25, -0.39)	−0.58 (−2.69, 1.53)	−0.09 (−2.27, 2.10)	−1.73 (−4.33, 0.87)	**CE**							
−0.71 (−2.87, 1.44)	1.03 (−1.83, 3.88)	1.52 (−1.37, 4.40)	−0.13 (−3.15, 2.90)	1.60 (−1.01, 4.22)	**CHM**						
−2.75 (−10.14, 4.64)	−1.01 (−8.17, 6.15)	−0.52 (−7.74, 6.69)	−2.17 (−9.62, 5.28)	−0.44 (−7.78, 6.91)	−2.04 (−9.63, 5.55)	**WM**					
−3.08 (−5.48, -0.69)	−1.34 (−2.88, 0.19)	−0.85 (−2.63, 0.92)	−2.50 (−5.07, 0.08)	−0.77 (−3.02, 1.49)	−2.37 (−5.33, 0.59)	−0.33 (−7.32, 6.66)	**Combined**				
−1.34 (−5.00, 2.32)	0.40 (−3.06, 3.87)	0.89 (−2.25, 4.04)	−0.75 (−4.67, 3.17)	0.98 (−2.70, 4.66)	−0.62 (−4.74, 3.49)	1.42 (−6.40, 9.23)	1.75 (−1.75, 5.24)	**TCM + NPI**			
0.04 (−2.53, 2.61)	1.78 (−1.15, 4.72)	2.27 (−0.71, 5.25)	0.63 (−2.59, 3.84)	2.36 (−0.34, 5.05)	0.75 (−1.37, 2.88)	2.79 (−4.80, 10.39)	**3.13 (0.15, 6.10)**	1.38 (−2.82, 5.58)	**WP**		
0.84 (−2.63, 4.30)	2.58 (−0.69, 5.84)	**3.07 (0.16, 5.97)**	1.42 (−2.31, 5.16)	3.15 (−0.34, 6.64)	1.55 (−2.38, 5.48)	3.59 (−4.15, 11.33)	**3.92 (0.60, 7.24)**	**2.17 (1.00, 3.34)**	0.79 (−3.23, 4.82)	**NPI**	
−6.38 (−9.64, -3.12)	**−4.64 (−7.28, -2.01)**	**−4.15 (−6.77, -1.53)**	**−5.80 (−9.16, -2.43)**	**−4.07 (−7.25, -0.88)**	**−5.67 (−9.38, -1.96)**	−3.63 (−11.19, 3.93)	**−3.30 (−6.17, -0.42)**	**−5.05 (−9.10, -0.99)**	**−6.42 (−10.20, -2.64)**	**−7.22 (−11.10, -3.34)**	**AP**

Abbreviations: AA, auricular acupressure; AC, acupuncture; AP, acupotomy; CE, catgut embedding; CHM, Chinese herbal medicine; Combined, combined TCMs; EA, electroacupuncture; NPI, non-pharmacological intervention; PLB, placebo; TCM, traditional Chinese medicine; WM, warming needle acupuncture; WP, Western pharmacotherapy.

was more effective than all other treatment groups except warming acupuncture and combined TCM treatments. Combined TCM treatments were more effective in reducing BMI than CHM and TCM treatments combined with non-pharmacological interventions (MD: -1.31 kg/m^2, 95% CI: −2.41, −0.20; MD: 1.28 kg/m^2, 95% CI: 0.17, 2.38) (Table 3).

The pooled ranking results showed that acupotomy (97.6%) had the highest effectiveness, followed by combined TCM treatments (85.0%) and warming acupuncture (72.6%). Next was acupuncture (65.1%), closely followed by electroacupuncture (63.1%) and catgut embedding (57.3%). Next was WP (37.2%), closely followed by TCM treatments combined with non-pharmacological interventions (36.6%), CHM (34.5%), and auricular acupuncture (33.3%). Non-pharmacological interventions (10.4%) and placebo (7.2%) had the lowest effectiveness (Figure 6).

3.3.3 | Subgroup analysis

For subgroup analysis, only RCTs with 1-, 2-, and 3-month durations were available for analysis, and they examined the effects of acupuncture, electroacupuncture, and combined TCM treatments. The pooled ranking results showed that combined TCM treatments had the highest effectiveness (body weight[64]: 69.5%; BMI: 80.1%), followed by electroacupuncture (BW: 57.7%; BMI: 48.7%), while acupuncture was the least effective (BW: 22.7%; BMI: 21.2%). The

TABLE 3 The Network Meta-analysis results of the effectiveness of TCMs in BMI reduction.

BMI											
PLB											
−1.56 (−2.42, -0.70)	**AC**										
−1.52 (−2.43, -0.61)	0.04 (−0.64, 0.72)	**EA**									
−0.71 (−2.07, 0.64)	0.85 (−0.33, 2.02)	0.81 (−0.52, 2.13)	**AA**								
−1.40 (−2.19, -0.62)	0.16 (−0.77, 1.09)	0.12 (−0.81, 1.05)	−0.69 (−2.12, 0.74)	**CE**							
−0.81 (−1.59, −0.02)	0.75 (−0.34, 1.85)	0.71 (−0.42, 1.85)	−0.09 (−1.62, 1.43)	0.60 (−0.48, 1.67)	**CHM**						
−2.04 (−4.30, 0.21)	−0.48 (−2.63, 1.67)	−0.52 (−2.69, 1.64)	−1.33 (−3.77, 1.11)	−0.64 (−2.91, 1.63)	−1.24 (−3.58, 1.11)	**WM**					
−2.11 (−3.02, -1.21)	−0.55 (−1.15, 0.05)	−0.59 (−1.24, 0.06)	−1.40 (−2.70, −0.10)	−0.71 (−1.66, 0.25)	**−1.31 (−2.41, -0.20)**	−0.07 (−2.13, 1.99)	**Combined**				
−0.84 (−2.13, 0.46)	0.73 (−0.44, 1.89)	0.68 (−0.39, 1.76)	−0.12 (−1.76, 1.51)	0.57 (−0.77, 1.90)	−0.03 (−1.48, 1.43)	1.21 (−1.13, 3.55)	**1.28 (0.17, 2.38)**	**TCM + NPI**			
−0.88 (−2.02, 0.26)	0.68 (−0.60, 1.95)	0.64 (−0.67, 1.95)	−0.17 (−1.85, 1.51)	0.52 (−0.80, 1.84)	−0.08 (−1.04, 0.89)	1.16 (−1.25, 3.57)	1.23 (−0.02, 2.48)	−0.05 (−1.64, 1.54)	**WP**		
−0.07 (−1.25, 1.11)	**1.49 (0.44, 2.53)**	**1.45 (0.51, 2.38)**	0.64 (−0.91, 2.19)	**1.33 (0.10, 2.56)**	0.73 (−0.62, 2.09)	1.97 (−0.31, 4.25)	**2.04 (1.07, 3.01)**	**0.76 (0.24, 1.29)**	0.81 (−0.69, 2.31)	**NPI**	
−3.11 (−4.49, −1.73)	**−1.55 (−2.71, −0.39)**	**−1.59 (−2.75, −0.43)**	**−2.40 (−4.04, −0.76)**	**−1.71 (−3.12, −0.30)**	**−2.31 (−3.84, −0.77)**	−1.07 (−3.47, 1.33)	−1.00 (−2.23, 0.23)	**−2.28 (−3.82, −0.73)n**	**−2.23 (−3.90, −0.56)**	**−3.04 (−4.49, −1.59)**	**AP**

Abbreviations: AA, auricular acupressure; AC, acupuncture; AP, acupotomy; CE, catgut embedding; CHM, Chinese herbal medicine; Combined, combined TCMs; EA, electroacupuncture; NPI, non-pharmacological intervention; PLB, placebo; TCM, traditional Chinese medicine; WM, warming needle acupuncture; WP, Western pharmacotherapy.

ranking of these three treatments was the same in the subgroups of 1-month and 2-month intervention durations. However, acupuncture became the most effective treatment when the interventions lasted 3 months (BW: 76.9%; BMI: 87.6%), followed by combined TCM treatments (BW: 71.1%; BMI: 60.6%) and electroacupuncture (BW: 1.9%; BMI: 1.6%) (Figures 5 and 6).

3.3.4 | Inconsistency test

Body weight

Regarding body weight, 11 loops were found in the network of studies without restrictions of intervention duration (Appendix E). Three of the loops had 95% CI crossing zero, indicating no presence of inconsistency. Three loops that showed inconsistency were the acupuncture-catgut embedding-combined TCM treatments loop, the placebo-catgut embedding-Chinese herbal medicine-Western pharmacotherapy loop, and the acupuncture-electroacupuncture-combined TCM treatments loop. The inconsistency of the remaining five loops could not be estimated due to insufficient observations.

Body Mass Index

Regarding BMI, 13 loops were found in the network of studies with no restrictions on intervention duration. Eight loops had 95% CI crossings zero, indicating no evidence of inconsistency. One loop—the acupuncture-electroacupuncture-combined TCM treatments loop—showed inconsistency. The inconsistency could not be estimated for the remaining four loops due to insufficient observations.

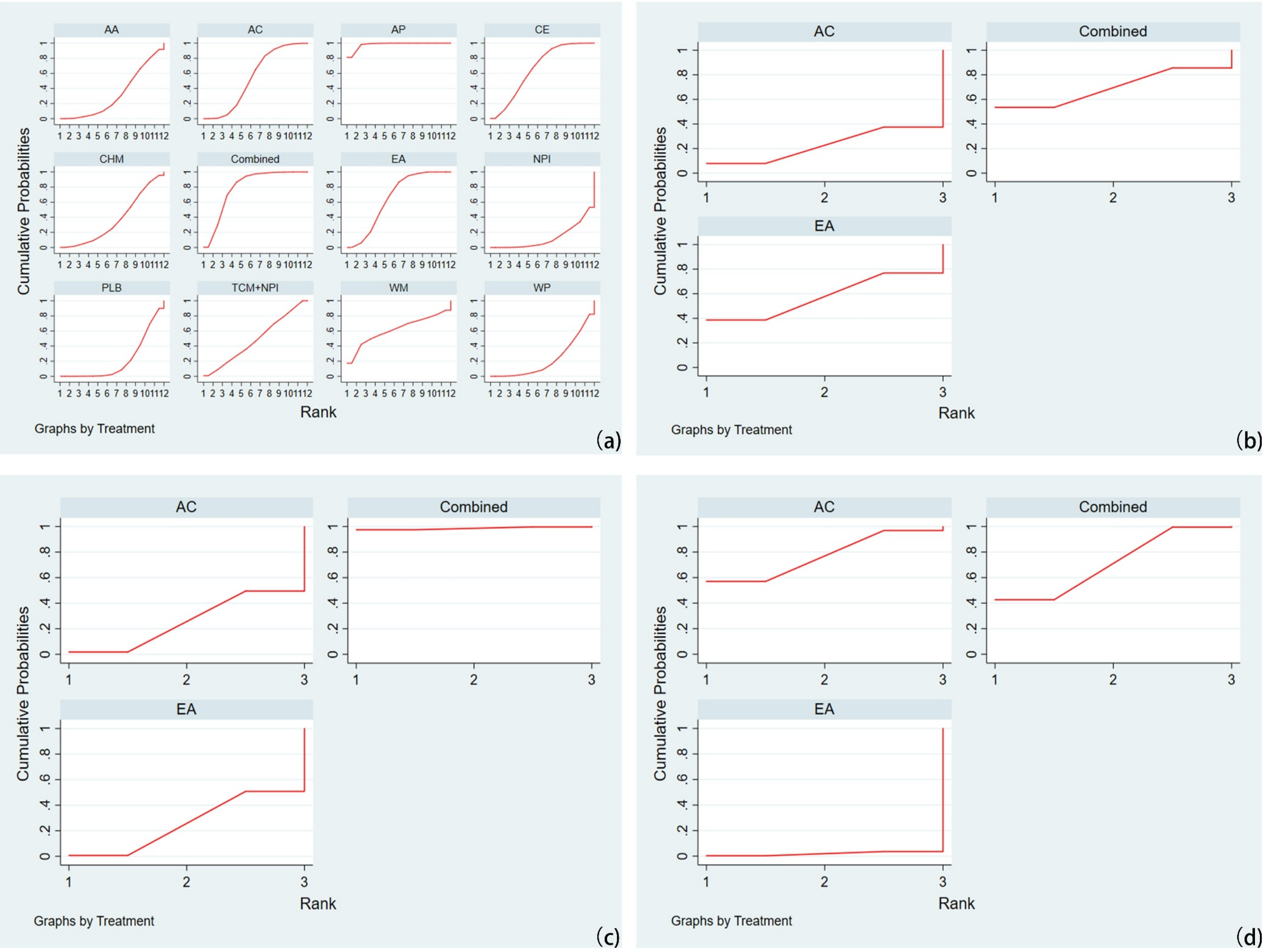

FIGURE 5 Rankograms of the Effectiveness of Reviewed Treatments on Body Weight Reduction. (A) Overall ranking regardless of intervention duration; (B) one-month duration; (C) two-month duration; (D) three-month duration. AA, auricular acupressure; AC, acupuncture; AP, acupotomy; CE, catgut embedding; CHM, Chinese herbal medicine; EA, electroacupuncture; NPI, non-pharmacological intervention; TCM, traditional Chinese medicine; WM, warming needle acupuncture; WP, Western pharmacotherapy. For subgroup analysis, only RCTs with 1-, 2- and 3-month durations were available for analysis among the reviewed studies.

Three loops were found for studies reporting interventions with a 1-month duration. One loop had 95% CI crossings zero, indicating consistency, while the other two loops had insufficient observations to estimate inconsistency.

3.4 | Sensitivity analysis results

For pairwise meta-analysis, the exclusion of studies that did not direct measures of mean body weight or BMI differences did not significantly alter the pooled effect estimates for comparison between TCM treatments with Western medicine or non-pharmcological interventions (Appendix F1, 2, 3 & 4). However, the same set of studies was excluded for comparisons with placebo/no treatment, the statistical significance of the TCM treatment benefits disappeared, suggesting that these studies influenced the previously noted effect (Appendix F5 & 6).

Sensitivity analysis was then performed on NMA. In terms of body weight reduction, the removal of specific studies due to sensitivity criteria led to the removal of two TCM methods (acupotomy and warming acupuncture) from the analysis. Consistent with initial findings, combined TCM treatments remained the most effective (88.7%), while placebo (26.7%) and non-pharmacological interventions (7.8%) ranked as the least effective (Appendix F7). Acupuncture and CHM ascended significantly (from initial 9th and 8th positions to the 2nd and 3rd positions, respectively) after the sensitivity analysis. In the subgroup with an intervention duration of three months, the removal of one study did not significantly change the ranking of the treatment methods (Appendix F8). Sensitivity analysis could not be conducted on the other two subgroups due to an insufficient number of studies for NMA, following the application of sensitivity analysis criteria.

In terms of sensitivity analysis of NMA on BMI reduction, acupotomy and warming acupuncture were also not reported after

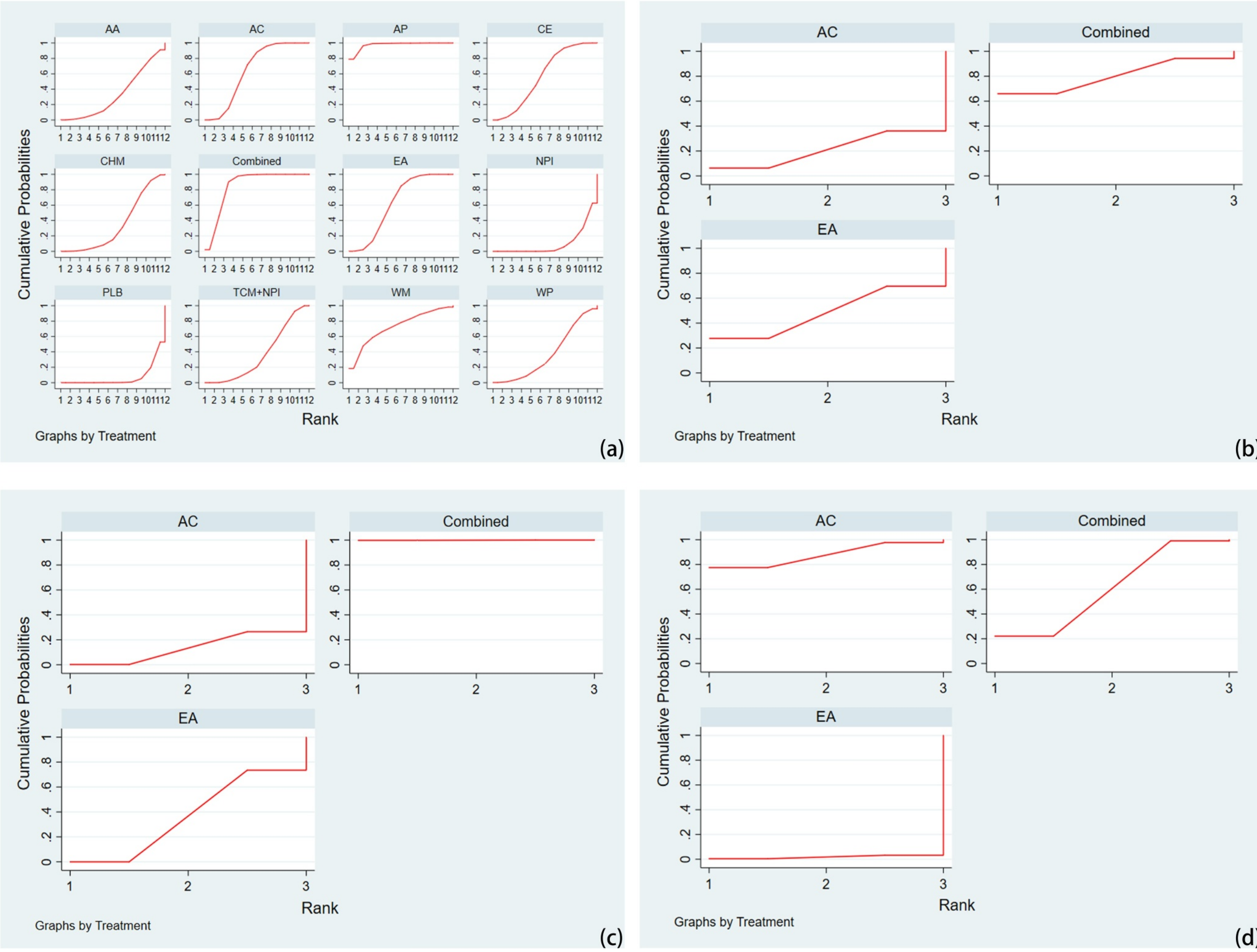

FIGURE 6 Rankograms of the Effectiveness of Reviewed Treatments BMI Reduction. (A) Overall ranking regardless of intervention duration; (B) one-month duration; (C) two-month duration; (D) three-month duration. AA, auricular acupressure; AC, acupuncture; AP, acupotomy; CE, catgut embedding; CHM, Chinese herbal medicine; Combined: Combined TCMs; EA, electroacupuncture; NPI, non-pharmacological intervention; PLB, placebo; TCM, traditional Chinese medicine; WM, warming needle acupuncture; WP, Western pharmacotherapy. For subgroup analysis, only RCTs with 1-, 2- and 3-month durations were available for analysis among the reviewed studies.

exclusion of the studies (Appendix F9). Among the remaining treatment methods, the ranking of catgut embedding and CHM ascended, while TCM combined with non-pharmacological interventions was ranked after placebo, as opposed to being ranked 8th in the initial result. When it comes to the subgroup with an intervention duration of 3 months, the ranking was consistent with the initial results after removing one study following the sensitivity analysis criteria (Appendix F10).

Another sensitivity analysis was performed to examine whether the choice of effect model had an influence on the pooled effect estimates. The result showed that when comparing TCM and non-pharmacological interventions and no treatment, changing the effect model from random to did not affect the outcome (Appendix F11-18**)**. However, for comparisons between TCM and Western medicine, the choice of effect model did influence the results, with fixed effect model appearing to have superior effects on reducing body weight and BMI. Conversely, with the random-effects model, the differences were not statistically significant (Appendix F19-22).

4 | DISCUSSION

This study aimed to provide a comprehensive picture of different kinds of TCM therapies for obesity treatment. Both pairwise analysis and NMA were conducted to examine and rank the effects of 10 different TCM therapies and their combinations by analyzing the combination of direct and indirect evidence from 46 RCTs including 4397 Chinese patients with overweight or obesity. Additionally, subgroup analysis was conducted to evaluate the effects of different TCMs with different intervention durations.

The overall and subgroup pairwise meta-analysis results showed that TCMs, particularly those with intervention duration of 6 months or less, were more effective in reducing weight loss and BMI than non-pharmacological interventions and placebo/no treatment. These findings align with those of previous reviews. Cho (2009), Fang (2017) and Zhang (2018) studies reported that acupuncture led to more significant reduction in body weight and BMI compared to non-pharmacological interventions like lifestyle modification and placebo/no treatment.[65–67] Wen et al. study (2022) found traditional Chinese herbal preparations to be more effective than placebo/no treatment for decreasing both BMI and body weight.[7]

However, our review did not find TCMs to outperform WP in treating overweight or obesity. This is consistent with several previous meta-analysis studies, which have reported that while TCMs like acupuncture and herbal medicines may be superior to lifestyle modifications or no intervention, they did not exceed the efficacy of Western medications in the management of overweight and obesity.[7,65,68–70] Considering these insights, it is suggested that both TCMs and WP could be considered preferential over non-pharmacological interventions such as simple lifestyle modifications or placebo/no treatment in treating simple obesity.

According to our comprehensive NMA findings, acupotomy - a specialized form of acupuncture featuring a flat-bladed needle that incorporates a scalpel's cutting function - emerged as the most effective TCM technique for reducing both body weight and BMI, with combined TCM approach following behind. Despite its promising efficacy in weight management, the precise mechanisms by which acupotomy affects simple obesity have not been be fully elucidated. However, several plausible mechanisms have been proposed. First, acuotomy may share some mechanisms with traditional acupuncture, such as modifying hypothalamic pathways. For instance, it could possibly increases the expression of pro-opiomelanocortin (POMC) and α-melanocyte-stimulating hormone (α-MSH) in the arcuate nucleus (ARC), reduces the expression of neuropeptide Y (NPY) and agouti-related peptide. Additionally, it might excite neurons in the ventromedial hypothalamus (VMH) and inhibit those in the lateral hypothalamic area. These changes could result in reduced expression and increased sensitivity to leptin and insulin, along with an increase in cholecystokinin (CCK), collectively contributing to decreased food intake and increased energy expenditure, ultimately leading to weight loss.[71] Second, acupotomy may promote local fat loss by cutting the fibrous connective tissue of local fat tissue, which may enhance blood circulation and facilitate the elimination of fat cells.[72,73] There is a need for future studies to delve deeper into the mechanisms by which acupotomy influences overall body weight reduction and local fat decrease. Such studies should aim to verify the effects of acupotomy on weight loss within larger and more diverse populations, to ensure the generalizability and applicability of these findings. Our study reveals that when compared to placebo/no treatment, catgut embedding, combined TCM treatments, and acupotomy are more effective for weight loss, while acupuncture, electroacupuncture, catgut embedding, CHM, combined TCM treatments, and acupotomy lead to more significant reduction inBMI. When compared to non-pharmacological interventions, electro-acupuncture, combined TCM treatments, and TCM treatments combined with non-pharmacological interventions were more effective in losing body weight, with acupuncture, electro-acupuncture, catgut embedding, combined TCM treatments, and TCM treatments combined with non-pharmacological interventions proving more beneficial for BMI reduction. Assessing the impact compared to WP, combined TCM treatments alone show superior performance in facilitating weight loss. Subgroup analysis further highlight the preeminence of combined TCM treatments for intervention periods ranging from one to three months, suggesting a particular efficacy for short-term treatment. Overall, these findings suggest that combined TCM treatments—for example, acupuncture with auricular acupressure and cupping, or catgut embedding with acupuncture - holds considerable potential for treating obesity, outpacingWestern medicines, non-pharmacological interventions, and placebo/no treatment, especially for short-duration therapies. The majority of the existing studies have focused on the immediate effects of TCMs on weight loss. To ensure the inclusion of TCM as a principal option for obesity treatment, future studies with longer durations (beyond three months) are needed to investigate the lasting effects and safety profile of the TCMs.

This study is among the first to use both pairwise and NMA to compare and rank the effects of an extensive array of TCM therapies for obesity treatment among the Chinese population and to conduct subgroup analysis according to intervention durations. Despite these strengths, the findings from this review must be interpreted with caution, and a number of limitations should be borne in mind. First, as the quality assessment results indicated, due to the nature of the treatment, the participants in most of the reviewed studies were not blinded, which could potentially lead to bias in the reported TCM effects. Second, substantial heterogeneity in most of the overall and subgroup pairwise meta-analysis limits the robustness of the results; This is attributable to broad inclusion criteria that introduce significant variations in intervention types, sample sizes, durations, and study qualities. Third, an inconsistency issue was detected in the NMA, likely stemming from the inclusion of less commonly practiced TCM treatments - such as cupping, tuina, tapping, and scraping—based on a limited number of studies. Fourth, the preponderance of RCTs with a two-month intervention duration, skewing the distribution of reviewed RCTs in the subgroups. This uneven representation hampers a comprehensive evaluation of the TCMs' long-term effects, potentially undermining the validity of the findings from this review. Lastly, although the detected publication bias does not seem to significantly compromise the synthesized findings from this study, its presence cannot be disregarded. Future research would benefit from larger sample sizes to mitigate this bias. Moreover, future studies need to validate the findings from this study.

5 | CONCLUSION

This comprehensive review of currently available TCM therapies revealed that, compared to non-pharmacological interventions and placebo/no treatment, TCM therapies are effective in weight loss, especially when the treatment duration is ≤ 6 months. Acupotomy and combined TCMs were found to be the two most effective TCM therapies. These findings suggest that TCMs could be recommended as a standalone or supplementary therapy for obesity treatment, at least for adults with overweight or obesity. Future studies are needed to investigate under-researched TCM therapies (like acupotomy), examine the long-term effects and safety of TCMs for obesity treatment, and validate the findings from this study among other ethnic populations.

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CONFLICT OF INTEREST STATEMENT

The authors declare no conflicts of interest.

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SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

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