

## The Effectiveness of Electroacupuncture in Reducing Body Weight in Obese Patients: A Meta-Analysis

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### ABSTRACT

**Background:** Obesity is a problem that is starting to be found, not only in urban areas with high socioeconomic status, but also in children living in rural areas, even from middle to lower socioeconomic groups. This study aims to examine the effectiveness of electroacupuncture in obesity cases.

**Subjects and Method:** Meta-analysis was carried out with PICO as follows: The population in this study were obese patients aged 16-65. The intervention was in the form of electroacupuncture therapy. Comparison in the form of sham / placebo acupuncture. The outcome is weight loss. A meta-analysis study was applied to this study with electronic data sources: Clinical Key, Google Scholar, MEDLINE/PubMed, Science Direct, Scopus. The article used is a full-text article with a Randomized Control Trial (RCT) study design. There were 10 articles used in this study with a sample size of 818 people who were divided into two groups (455 people in the acupuncture group and 363 people in the sham/placebo acupuncture group). Articles were analyzed using the Review Manager 5.4 application. The results of this study aim to determine the Standardized Mean difference (SMD) and the heterogeneity of the research sample.

**Results:** There is a high heterogeneity between one experiment and another ( $I^2=86\%$ ;  $p<0.001$ ) so the Random Effect Model (REM) was used. Electroacupuncture therapy was effective in reducing body weight with a Standardized Mean Different (SMD) of 0.50 compared to false acupuncture (SMD -0.50; 95% CI = -0.92 to -0.08;  $p=0.020$ ).

**Conclusion:** Giving acupuncture therapy was able to lose weight in obesity cases with a Standardized Mean Different (SMD) of 0.50 compared to fake acupuncture.

**Keywords:** Acupuncture, Obesity

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### BACKGROUND

Obesity is a problem that is often found, not only in urban areas with high socioeconomic status, but also in children living in rural areas and even from the lower middle socioeconomic groups. Handling obesity requires a comprehensive management approach, including promotive, preventive,

curative, and rehabilitative. Handling obesity can vary greatly, due to many factors that influence it, from genetic, environmental and wrong habits (Sjarif et al., 2014).

Weight gain in overweight and obesity conditions correlates with more deaths than underweight, this condition occurs in every region except parts of sub-Saharan

Africa and Asia (WHO, 2020). The increase in Body Mass Index (BMI) obesity increases the risk factors for cardiovascular disease (heart and stroke), which is the main cause of death in 2012, diabetes, musculoskeletal disorders (osteoarthritis and degenerative joint disease), some cancers (endometrial, breast, ovarian, prostate), liver, bile, kidney, and large intestine). Obesity in childhood is associated with early death, and higher disability in adulthood. In addition, obese children have difficulty breathing, increased risk of fractures, hypertension, early markers of cardiovascular disease, insulin resistance and other psychological effects (WHO, 2020).

The worldwide prevalence of obesity nearly tripled between 1975 and 2016. 38 million children under 5 years of age were overweight or obese in 2019 and more than 340 million children and adolescents aged 5-19 years were overweight or obese. Obesity in 2016 (WHO, 2020). Based on the results of the 2018 Riskesdas, the Research and Development Agency of the Ministry of Health, the prevalence of obesity has increased since the three Riskesdas periods, namely in 2007 as much as 10.5%, in 2013 as much as 14.8%, and in 2018 as much as 21.8%. The indicator of obesity in adults is in people with a body mass index (BMI) above 27, where the normal BMI is 18.5 to 22.9.

There are several ways to treat obesity, some of which are by adjusting diet, activity patterns, exercise, psychotherapy, surgery or with acupuncture. As for pharmaceutical treatments for obesity, such as: Fenfluramine and Meridia (Sibutramine), and Xenical (Orlistat), however, there are various limitations to their use because they reduce liver and kidney function. Acupuncture is an alternative intervention for obesity that is relatively easy, inexpensive, safe and has been widely used in clinical

practice in China and other countries (Kepei et al., 2018). Acupuncture therapy can have a positive regulatory effect on the body, namely regulating endocrine balance which can significantly remove excess water from the body, controlling appetite, relieving constipation and maintaining central reflexes to relieve anxiety so that patients feel comfortable (Yanji et al., 2018). Electroacupuncture is a special therapeutic method in which needles are inserted into specific points in the body by applying a small electric charge. Electroacupuncture provides the advantages of acupuncture and electrical stimulation and has the same indications as filiform acupuncture in general, so it can be used for a variety of conditions. Micro-acupuncture theory is widely used in electroacupuncture (Yajuan, 2009).

The role of electroacupuncture in weight loss is to unblock meridians, regulate endocrine regulation and body fat metabolism. In addition, electroacupuncture can improve blood and lymph circulation, to remove fat that is not useful from the body through sweat glands, respiration, urine and feces. Electroacupuncture is also useful for improving therapeutic outcomes, such as controlling diet (during the treatment process, the capacity to eat is reduced by 1/3 compared to the previous capacity) (Fu-zhen, 2003).

There are several previous systematic review articles that have been published discussing the effectiveness of acupuncture in overcoming the problem of obesity. The author is interested in using a meta-analysis technique in this study to make it easier to obtain evidence-based research results with a large sample size to determine the effectiveness of electroacupuncture against obese patients compared to fake acupuncture (sham/placebo acupuncture).

## SUBJECTS AND METHOD

### A. Study Design

This was a systematic review and meta-analysis involving various appropriate electronic journal databases including: Clinical Key, Google Scholar, MEDLINE/PubMed, Science Direct, Scopus. With keywords including: “acupuncture”, “obesity”, “obese”, “overweight”, “randomized controlled trial”, “acupuncture for obesity”, “obesity randomized controlled trial”, “acupuncture randomized controlled trial”, “Weight Reduction”, “acupuncture and sham electroacupuncture”, “obesity and placebo”, “sham electroacupuncture”).

### B. Inclusion Criteria

- 1) The article used is a full paper article
- 2) The article has an appropriate title and is related to the effectiveness of acupuncture against obesity
- 3) Articles published in English and/or Indonesian
- 4) The article uses a Randomized Controlled Trial (RCT) study design
- 5) Include the results of the study in the form of the number of respondents, the mean value and the standard deviation (SD) value
- 6) The research subjects are adults with a range of 16 – 65 years old
- 7) Intervention on research subjects in the form of electroacupuncture
- 8) Intervention in the control group in the form of sham/placebo electroacupuncture

### C. Exclusion Criteria

- 1) Not a full paper article
- 2) Articles using a quasi-experimental study design, protocol study, pilot study, cohort, case control and cross-sectional.
- 3) Articles use languages other than English and Indonesian
- 4) Research subjects are animals

### D. Operational Definition of Variable ElectroAcupuncture

ElectroAcupuncture is an intervention by inserting acupuncture needles and using an electrostimulator with electricity.

### Sham/Placebo Electro Acupuncture

Interventions by inserting the original acupuncture needle but inserted shallowly so that it does not hit the acupuncture point, using different acupuncture points, where these points have very different functions and uses, or the use of an electrostimulator in the absence of electricity.

**Insomnia** is an increase in body fat mass, with conditions associated with higher morbidity and mortality

### E. Instrument

Published articles obtained from various databases of appropriate electronic journals include: Clinical Key, Google Scholar, MEDLINE/PubMed, Science Direct, Scopus. This research was conducted for 10 months (14 January 2021 - 14 November 2020) by searching for and selecting research results from various races, ethnicities and locations in the world.

### F. Data Analysis

This research was conducted using secondary data in the form of data from previous research results and data processing was carried out using the Review Manager (RevMan 5.4).

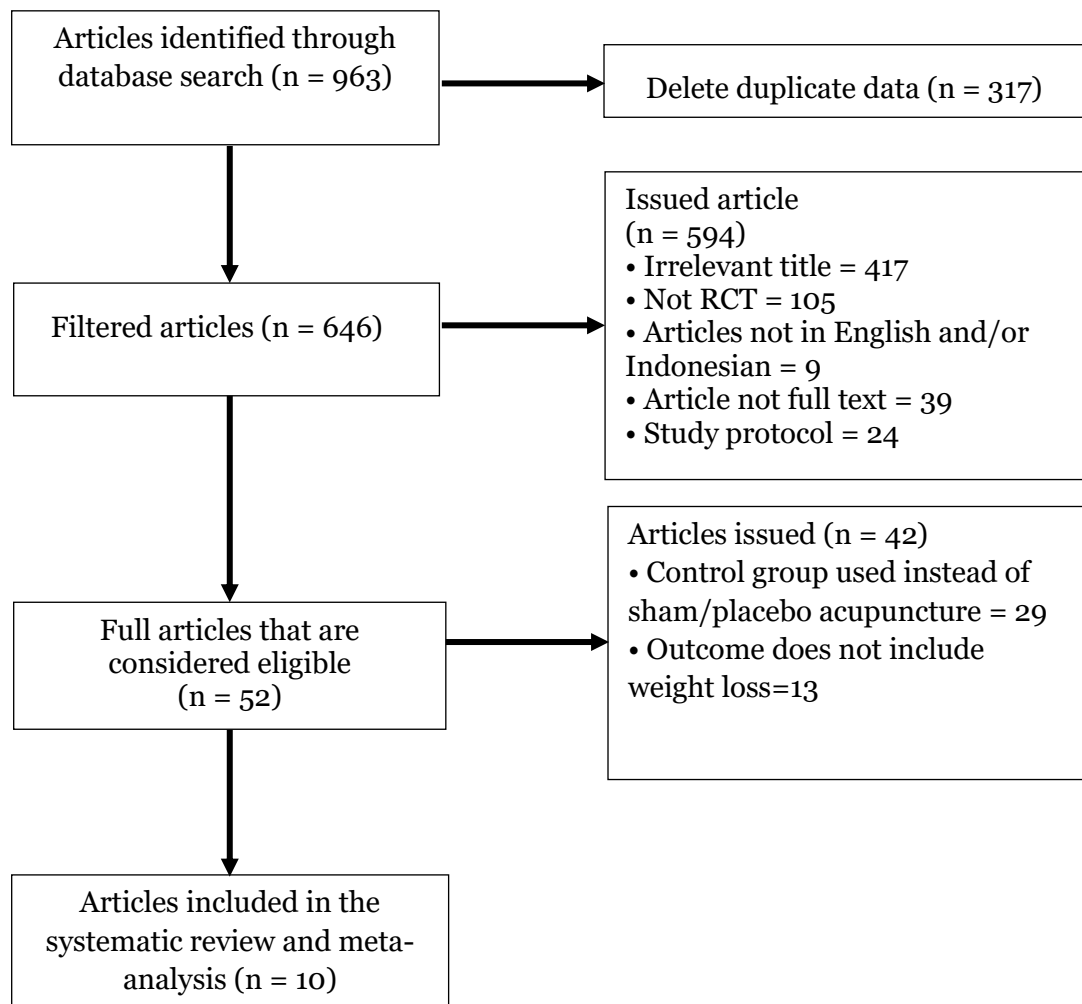
## RESULTS

The article selection process is carried out using the Mendeley desktop application. In the initial process of searching for articles, a number of 963 . were obtained

After the checking process, the same 317 articles were found, so that the duplicate articles were deleted. so that a total of 646 articles have been filtered. Of the 646 articles, 594 articles were excluded because they did not meet the inclusion criteria. Again, the 52 articles were screened, there

were 42 articles that were not suitable because they did not meet the inclusion criteria.

There are 10 articles which are the final results of article selection which were included in the process of systematic review and meta-analysis.



**Figure 1. Flowchart of the article review process**

**Table 1. PICO (Population, Intervention, Comparison and Outcome) for each study**

No	Author	P (Population)	I (Intervention)	C (Comparison)	O (Outcome)
1.	Cabioglu et al (2006)	Female subjects aged 35 to 50 years with a body mass index (BMI) between 30 and 40 (n=55)	Body electroacupuncture: LI 4, LI 11, St 36 and St 44	Ear acupuncture: hungry point and Shen Men	Body weight, Insulin Serum, C-Peptide Blood sugar
2.	Cabioglu et al (2007)	Female study subjects aged 35 to 50 years with a body mass index (BMI) between 30 and 40 (n=60)	Electroacupuncture body: Hegu (Fact Sheet 4), Quchi (Fact Sheet 11), Zusanli (St 36), Neiting (St 44), and Ren 6	Ear acupuncture: hungry point and Shen Men	Body weight and serum levels of IgG, IgA, IgM and IgE
3.	Ergene et al (2007)	Female study subjects aged 35 to 50 years with a body mass index (BMI) between 30 and 40 (n=165)	Electroacupuncture body: Hegu (Fact Sheet 4), Quchi (Fact Sheet 11), Zusanli (St 36), Neiting (St 44), and Taichong (Liv 3)	Ear acupuncture: hunger point, Shen Men, and stomach	Weight and Psychological Symptoms
4.	Cabioglu et al (2008)	The study subjects were women aged 35 to 50 years with a body mass index (BMI) between 30 and 40 (n=58).	Body electroacupuncture: Hegu (Fact Sheet 4), Quchi (Fact Sheet 11), Tianshu (St 25), Zusanli (St 36), Neiting (St 44) and Liv 3	Ear acupuncture: hunger point, Shen Men, and stomach	Body weight, Plasma Lipoprotein A, Apolipoprotein A and Apolipoprotein B
5.	Chung et al (2010)	Research subjects aged between 16 - 65 years with waist circumference 90cm (men), ≥85cm (women), BMI more than 25(kg/m <sup>2</sup> ) (n=39)	Electroacupuncture at points: CV12, CV6, ST25, SP15, SP14, LI4, LI11, ST36, ST44	Acupuncture placebo	Waistline, Body Weight, BMI, WHR, BFR, VFA, scores of BULIT-R, KoQoL, and BSQ
6.	Abdi et al (2012)	Study subjects were overweight and obese BMI from 25 to 45 with ages between 18 - 55 years (n=161)	Electroacupuncture on the point:	Acupuncture placebo	Waist circumference, body weight, BMI, HC, FBS, TC, HDL-C, LDL-C, DBP, SBP.
7.	Darbandi et al (2013)	Study subjects were aged 18 to 65 years, with a BMI between 25 and 45 kg/m <sup>2</sup> (n= 94)	ST25, GB28, REN12, REN9, REN4, SP6, LI11, ST40, REN6, and SP9)	Sham body acupuncture	BMI, body weight, BFM = body fat mass.
8.	Wang et al (2013)	Study subjects with a BMI between 25 and 35kg/m <sup>2</sup> (n=90)	Electroacupuncture at points: ST25, LI11, RN12, GB28, RN9, RN4, SP6, ST40, RN6, SP9.	Acupuncture placebo	Value of BMI, body weight and BFM (Body Fat Mass).
9.	Darbandi et al (2014)	Male study subjects, aged 18-50 years with BMI between 30–40 kg/m <sup>2</sup> at the Nutrition Clinic at Ghaem Hospital	Electroacupuncture at points ST 44, ST 39, ST 40, ST 36, SP 9, LI 11	Acupuncture placebo	Body weight, BMI, Waist circumference, TFM (Trunk fat mass), HC (hip

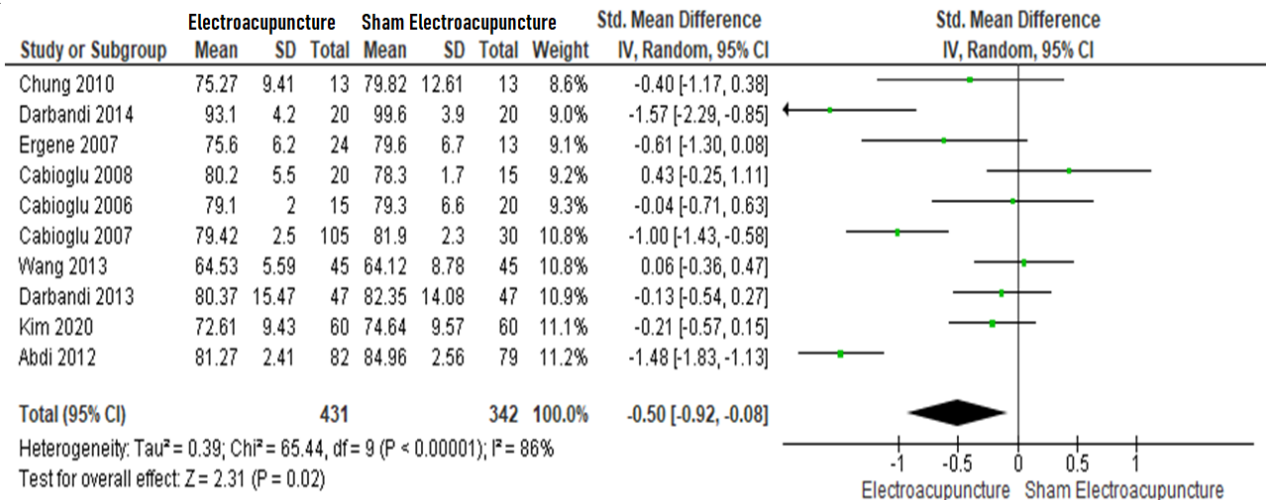
10.	Kim et al (2020)	(Mashhad, Iran) (n=120) Study subjects were premenopausal women (aged 19 years) with a clinical diagnosis of excess obesity (BMI 25 kg/m <sup>2</sup> ) (n=120)	Electroacupuncture at points: ST25, GB28, RN12, RN9, RN4, SP6, LI11, ST40, RN6, SP9.	Acupuncture placebo	circumference). BMI, Body weight, lipid levels: triglycerides (TG), (TC), (HDL), (LDL).
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**Table 2. Research Quality Assessment (Critical Appraisal)**

Items	Publication									
	Cabioglu et al (2006)	Cabioglu et al (2007)	Ergene et al (2007)	Cabioglu et al (2008)	Chung et al (2010)	Abdi et al (2012)	Darbandi et al (2013)	Wang et al (2013)	Darbandi et al (2014)	Kim et al (2020)
Relevance of goals and problems	1	1	1	1	1	1	1	1	1	1
Relevance of methods and problems	1	1	1	1	1	1	1	1	1	1
Sufficient sample	1	1	1	1	1	1	1	1	1	1
Sample validity	1	1	1	1	1	1	1	1	1	1
Comparable cases and controls	1	1	1	1	1	1	1	1	1	1
No bias	0	1	1	1	1	1	1	1	1	1
Information data search	1	1	1	1	1	1	1	1	1	1
Analysis of relevant and valid data	1	1	1	1	1	1	1	1	1	1
Relevance Effect Size	1	1	1	1	1	1	1	1	1	1
95% CI reporting	1	1	1	1	1	1	1	1	1	1
Confounding factors reported	1	1	1	1	1	1	1	1	1	1
Results can be applied	1	1	1	1	1	1	1	1	1	1
Total	11	12	12	12	12	12	12	12	12	12

There are 10 randomized controlled trial (RCT) studies as a source of research, a systematic review and meta-analysis of the effectiveness of acupuncture in obesity cases in this study. An overview of the PICO

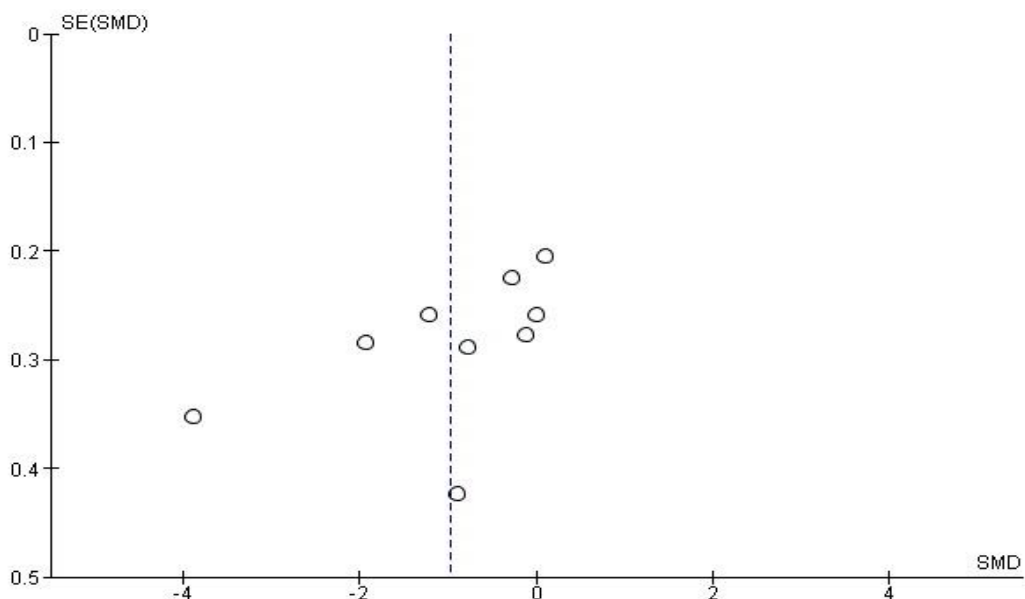
(Population, Intervention, Comparison, Outcome) of the 10 articles used in the systematic review and meta-analysis of this study can be seen in table 1.



**Figure 2. Forest plot**

The interpretation of the results of the meta-analysis of 10 primary research articles in this study can be seen in the forest plot image (Figure 2). Based on the results of the analysis using RevMan 5.4 software, it is known that there is a high heterogeneity between one experiment and another

(I<sup>2</sup>=86%; p<0.001) so the Random Effect Model (REM) was used. Electroacupuncture therapy was effective in reducing body weight with a Standardized Mean Difference (SMD) of 0.50 compared to sham acupuncture (SMD -0.50; 95% CI= -0.92 to -0.08; p=0.020).



**Figure 3. Funnel plot**

A funnel plot is a plot that depicts the size of the effect of each study on the estimate of its accuracy, usually the standard error. The interpretation of the funnel plot results showed that there was no publication bias as indicated by: 1. The plot shape was symmetrical on the right and left sides, 2. The distance between plots was balanced, 3. SE value  $<0.2$ . The description of the funnel plot in this study can be seen in the funnel plot image (Figure 3). The funnel plot image in this study shows that there is no publication bias. This is indicated by the symmetry of the right and left sides of the plot. On the right side there are 6 circles and on the left side there are 4 circles. However, the left side of the funnel plot in this study has a Standard Error ( $SE > 0.2$ ) and the right side of the funnel plot in this study has a Standard Error ( $SE < 0.2$ ).

## DISCUSSION

Acupuncture is a medical therapy by inserting a special needle (filiform needle) at acupuncture points that have been mapped on the human body. There are 361 acupuncture points that have been included in the international nomenclature, these 361 points are divided into 14 meridians (acupuncture channels) (Godson and Wardle, 2019).

According to the World Health Organization (2020), overweight and obesity are defined as abnormal or excessive fat accumulation that can interfere with health. The increase in Body Mass Index (BMI) in overweight and obesity increases the risk factors for non-communicable diseases such as cardiovascular disease (especially heart disease and stroke), which were the main causes of death in 2012, diabetes, musculoskeletal disorders (especially osteoarthritis and degenerative joint disease), some cancers (including endometrial, breast,

ovarian, prostate, liver, biliary, kidney and colon) (WHO, 2020).

Acupuncture is an alternative intervention for obesity that is relatively easy, inexpensive, safe and has been widely used in clinical practice in China and other countries (Kepei et al., 2018). Acupuncture therapy can have a positive regulatory effect on the body, namely regulating endocrine balance which can significantly remove excess water from the body, controlling appetite, relieving constipation and maintaining central reflexes to relieve anxiety so that patients feel comfortable (Yanji et al., 2018).

In this meta-analysis, the topic of the effectiveness of electroacupuncture in cases of obesity is taken up, where the independent variable in this study is electroacupuncture and the dependent variable in this study is obesity.

Confounding factors are things that cannot be avoided in a study, but can be controlled. Confounding factors affect the relationship or effect of exposure to disease events estimated (estimated) by the study that are not the same as the relationship or effect that actually occurs in the target population, aka the study results are invalid (incorrect) (Murthi, 2018).

In this systematic study and meta-analysis using research that controls confounding factors, this can be seen from the inclusion and exclusion requirements required in this study, so that they can control confounding factors that can make this study invalid. There are 10 articles that have passed the inclusion and exclusion requirements of a number of primary studies that were included in this systematic review and meta-analysis. Then the number of respondents, the mean and standard deviation (SD) values were combined and processed using the RevMan 5.4 application. The mean and standard deviation



(SD) values were obtained from body weight measurements.

The mean and standard deviation (SD) values were obtained from body weight measurements. Body Mass Index (BMI) is a simple index of weight to height used to classify overweight and obesity in adults. BMI is defined as a person's weight in kilograms divided by the square of height in meters ( $\text{kg}/\text{m}^2$ ) (Ministry of Health, 2018). Measurement of BMI is one way to determine nutritional status by comparing weight and height. BMI can estimate body fat but cannot be interpreted as an exact percentage of body fat. Women are more likely to have a higher percentage of body fat than men with the same BMI. The limitation of using BMI is that it cannot be used in growing children, pregnant women, and very muscular people such as athletes. For children, age needs to be considered when defining overweight and obesity (Hutagalung, 2014).

The results of data processing using the RevMan 5.4 application in this study with 10 articles from Iran, China, and Korea showed that electroacupuncture therapy was able to reduce body weight with a Standardized Mean Difference (SMD) of 0.50 compared to fake acupuncture (sham/placebo acupuncture), and this was stated to be statistically significant with a significance value (SMD -0.50; 95% CI = -0.92 to -0.08;  $p=0.020$ ).

This is in line with a previous meta-analysis by Yao et al., (2019) which showed that acupuncture was effective in overweight/ obesity interventions in Asia, compared to the control group, the acupuncture group showed a significant reduction in body mass index (BMI). greater (WMD -1.23  $\text{kg}/\text{m}^2$ ; 95% CI 1.94-0.51) and waist circumference (WMD -2.56 cm; 95% CI -4.43-0.69). The results of this systematic review and meta-analysis show that

acupuncture can be an alternative therapy for overweight and obesity conditions.

Based on a meta-analysis study conducted by Yanji et al., (2018) showed that electroacupuncture (SMD: 0.60; 95% CrI, 0.03-1.22) was superior to lifestyle modification in lowering BMI. The combination of acupuncture and related therapies is the optimal method for weight loss and BMI.

In addition, another systematic review and meta-analysis conducted by Gao et al., (2020) showed that the total effective rate (RR= 1.29, 95% CI [1.13 to 1.48];  $p=0.0002$ ), BMI (MD= -1.82, 95% CI [-2.21 to -1.43];  $p<0.001$ ), waist circumference (MD= -2.39, 95% CI [-3.95 to -0.84];  $p=0.003$ ), hip circumference (MD = 0.31, 95% CI [-2.37, 2.99];  $P=0.82$ ), waist-to-hip ratio (MD = -0.05, 95% CI [-0.07, -0.03];  $p<0.00$ ), and body fat content (MD= -1.56, 95% CI [-2.35, -0.78];  $p=0.0001$ ) in the electroacupuncture group was superior to the control group.

#### **AUTHOR CONTRIBUTION**

Nurmila Mutiah as the main researcher is the executor of the research, collecting research data, formulating research articles, and processing data. Bhisma Murti plays a role in formulating the framework of thinking and analyzing research data. Hanung Prasetya plays a role in the background and discussion of the research.

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This study is self-funded.

#### **CONFLICT OF INTEREST**

There is no conflict of interest in this study.

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