

Effect of Acupressure on Blood Glucose Level in Diabetes Mellitus Patients: Meta-Analysis

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ABSTRACT

Background: Diabetes Mellitus (DM) is a group of metabolic diseases characterized by hyperglycemia resulting from abnormalities in insulin secretion that affect blood sugar levels. Chronic hyperglycemia in DM is associated with long-term damage to several organs of the body. One of the interventions that can be given to lower blood sugar levels is acupressure therapy. The purpose of this study was to determine the effect of acupressure therapy on blood sugar levels in patients with diabetes mellitus.

Subjects and Method: This study is a systematic review and meta-analysis with PICO, P: Diabetes mellitus patients, I: Acupressure, C: No acupressure, O: Blood sugar levels. The process of searching for articles is done through a database of journals including: Pubmed, Google Scholar, Science Direct, Scopus, Spinger Link, CNKI and Hindawi. The keywords used in the literature search were: “acupressure” AND “diabetes” AND “blood sugar” AND “blood glucose” AND “standard controlled trial”, “acupressure for diabetes”, “diabetes standardized controlled trial”, “acupressure randomized controlled trial”. trial”, diabetes acupoint, “diabetes and placebo”, “acupressure” AND “diabetes”. The articles included in the study were full text articles with a randomized controlled trial study design and the results were reported with the effect size, mean standard deviations (SMD). Articles were collected using PRISMA flow diagrams and analyzed using the Review Manager 5.3 application.

Results: A meta-analysis of 9 articles reviewed in this study came from Taiwan, China, Indonesia, Egypt and Iran with a sample size of 451. The study results showed that acupressure therapy was able to reduce blood sugar levels in diabetes mellitus patients with SMD blood sugar values. acupressure was 0.56 units lower than no acupressure and was statistically significant with a significance value of (SMD=-0.56; 95% CI= -0.76 to -0.37; p<0.001).

Conclusion: Acupressure therapy has the effect of lowering blood sugar levels in diabetes mellitus patients.

Keywords: acupressure, blood sugar, diabetes mellitus.

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BACKGROUND

Diabetes Mellitus (DM) is a serious problem all over the world. The number of people with DM has increased since the beginning

of the 21st century. The increasing prevalence of DM in several countries must be anticipated by policy makers in an effort to determine long-term health service policy plans

(Decroli, 2019). The prevalence of DM will continue to increase up to 3-fold in 2030, this increase has been predicted by the World Health Organization (WHO) that in 2030 it will reach 21.3 million and according to the International Diabetes Federation (IDF) report in 2021 places Indonesia as the the country ranks 9th in the number of DM sufferers in the world. Predictions from the IDF state that there will be an increase in the number of DM patients from 10.7 million to 13.7 million in 2030 (PERKENI, 2021).

DM is a group of metabolic diseases characterized by hyperglycemia resulting from defects in insulin secretion, insulin action or both. Chronic hyperglycemia in DM is associated with long-term damage, dysfunction or failure of several organs, especially the eyes, kidneys, nerves, heart and blood vessels (Purnamasari, 2014). Insulin deficiency, if left long-term, can cause damage to multiple organs of the body, leading to disabling and life-threatening health complications. However, if proper DM management is achieved, these serious complications can be delayed or prevented altogether (IDF, 2021).

Management of DM, the short-term goal is to eliminate DM symptoms and maintain patient comfort and health while the long-term goal is to prevent complications, such as macroangiopathy, microangiopathy, and neuropathy, and ultimately reduce morbidity and mortality associated with DM (Ministry of Health, 2020). Management of DM includes education, nutrition, pharmacological interventions, non-pharmacological interventions, and physical exercise with the long-term goal of preventing complications through controlling blood glucose levels. Alternative treatments are an option in non-pharmacological treatment, one of which is acupuncture. Several studies have shown that acupuncture is useful for

lowering blood glucose levels in DM sufferers (Feng et al., 2018).

Acupuncture is a complementary therapy that is easy to find, safe, effective, inexpensive and efficient for improving blood glucose levels (Dunning, 2014). Acupuncture has the potential to lower blood glucose levels and normalize endocrine function, especially in patients with type 2 DM (Simadibrata et al, 2017). Acupuncture has a philosophy based on the natural "Self-Healing Potential" (the body's ability to heal itself). Acupuncture stimulates the body's homeostatic forces to achieve a normal balance (Nurwati et al., 2020). Acupuncture therapy is basically carried out by providing stimulation to points on the surface of the body or what are known as meridian points as an effort to maintain the balance of organ functions.

Acupuncture is better known as a therapy that uses needle media, at acupuncture points on the surface of the body it is proven to be a receptor that can be stimulated in various ways as long as it is in the form of energy (Tang et al., 2014). In modern medicine, stimulation of acupuncture points is believed to activate peripheral afferent nerve fibers and receptors, resulting in sensory interactions at various levels of the central nervous system and the release of various transmitters and modulators, resulting in anti-inflammatory, neuroendocrine and neuro-immune signals (Koya, 2010).

Several studies have concluded that acupuncture can improve insulin sensitivity. Patients with DM who were treated with acupuncture showed improvement in clinical manifestations as well as decreased fasting blood glucose and improved oral glucose tolerance tests. Another study showed that acupuncture improves both hyperglycemia and insulin resistance. The underlying mechanism appears to be related to endogenous opioids and insulin secretion.

Puncture at the CV 12 point (Zhongwan) stimulates the adrenal glands to induce endorphins, which increase insulin secretion, resulting in a decrease in plasma glucose levels. The hypoglycemic effect of stabbing at the ST 36 point (Zusanli) is also mediated by serotonin and endogenous opioid peptides through insulin secretion (Liang and Koya, 2010).

Many primary studies have proven that acupuncture therapy can have an effect in reducing blood sugar levels in DM patients. Therefore, researchers are interested in further research by conducting a meta-analysis of the effect of acupuncture therapy on reducing blood sugar levels in patients with diabetes mellitus to see how much influence acupuncture therapy has. There are several previous systematic review articles that have been published which discuss the effect of acupuncture in overcoming DM problems. The author is interested in using the meta-analysis technique in this study to make it easier to obtain evidence-based research results with a large sample size to determine the effect of acupuncture intervention on DM cases. Meta-analysis is an epidemiological study by combining statistical data from the results of primary research which discusses the same hypothesis so that quantitative summary results are obtained (Murti B, 2018). The results of the meta-analysis may include estimates of the effect of the intervention. By conducting this meta-analysis research it is hoped that it will be useful to identify how much influence acupuncture therapy has on reducing blood sugar levels in DM patients.

SUBJECTS AND METHOD

1. Study Design

This research is a systematic review and meta-analysis. Data collection was obtained from databases, namely: Clinical Key, Google Scholar, PubMed, Hindawi, BMC, Euro-

pe PMC, Science Direct, Scopus, CNKI and Spinger Link. A literature search was performed using the following keywords: “acupressure” AND “diabetes” AND “blood sugar” AND “blood glucose” AND “randomized controlled trial”, “acupressure for diabetes”, “diabetes randomized controlled trial”, “acupressure rdanomized controlled trial”, acupoint diabetes, “diabetes and placebo”, “acupressure” AND “diabetes”.

2. Steps of Meta-Analysis

Meta analysis was carried out in 5 steps as follows:

- 1) Formulate research questions in PICO format (Population, Intervention, Control/Comparisons, Outcomes)
- 2) Looking for primary study articles from various electronic and non-electronic data based such as PubMed, Google Scholar, Science Direct, SCOPUS and so on
- 3) Perform screening to determine inclusion and exclusion criteria and carry out critical assessments
- 4) Extract the data from the primary study and synthesize the effect estimates using the Revman 5.3 application
- 5) Interpret the results and draw conclusions

3. Inclusion Criteria

The inclusion criteria in this study were articles using a randomized control trial study design, the measure of influence used was the Mean SD. The research subjects were diabetes mellitus patients, the intervention was given by acupressure, the comparison was not acupressure with the outcome of blood sugar levels.

4. Exclusion Criteria

Exclusion criteria in this study were articles published in languages other than English and Indonesian, not full-text, articles with quasi-experimental study designs, protocol studies, pilot studies, cohorts, case control and cross-sectional.

5. Operational Definition of Variables

The articles included in this study were adjusted according to the PICO. The article search was carried out taking into account the eligibility criteria using PICO as follows: the population is diabetes mellitus patients, the intervention is given acupressure, comparison or comparison is not acupressure with the outcome of blood sugar levels.

Fasting blood sugar level is an examination of blood sugar levels after not consuming calories for at least 8 hours before the test. The instrument used is a glucometer with a continuous scale.

Acupressure therapy is an intervention at acupuncture points by pressing for a few minutes. Observation sheet instrument, categorical scale.

6. Study Instruments

The instrument used in assessing the quality of this research is the Critical Appraisal Checklist for Randomized Controlled Study published by CEBM University of Oxford.

7. Data Analysis

The articles in this study were collected according to the PRISMA and Critical App-

raisal flowcharts. The data analysis process used RevMan 5.3 to determine the effect size and heterogeneity of the study.

RESULTS

Based on search results of relevant research articles 7 databases. The initial search process for articles returned 912 articles. After the checking process was carried out, 784 articles were found to be the same, so that duplicate articles were removed and a total of 833 articles were obtained that had been filtered. Of the 833 articles, 784 of them were excluded because they did not meet the inclusion criteria. Further screening was carried out on the 49 articles that had been obtained, and a number of 40 articles that did not meet the inclusion criteria were obtained. The final result of the article review process, there are 9 articles that meet the quantitative requirements for a meta-analysis on the effect of acupressure therapy on reducing blood sugar levels in patients with diabetes mellitus.

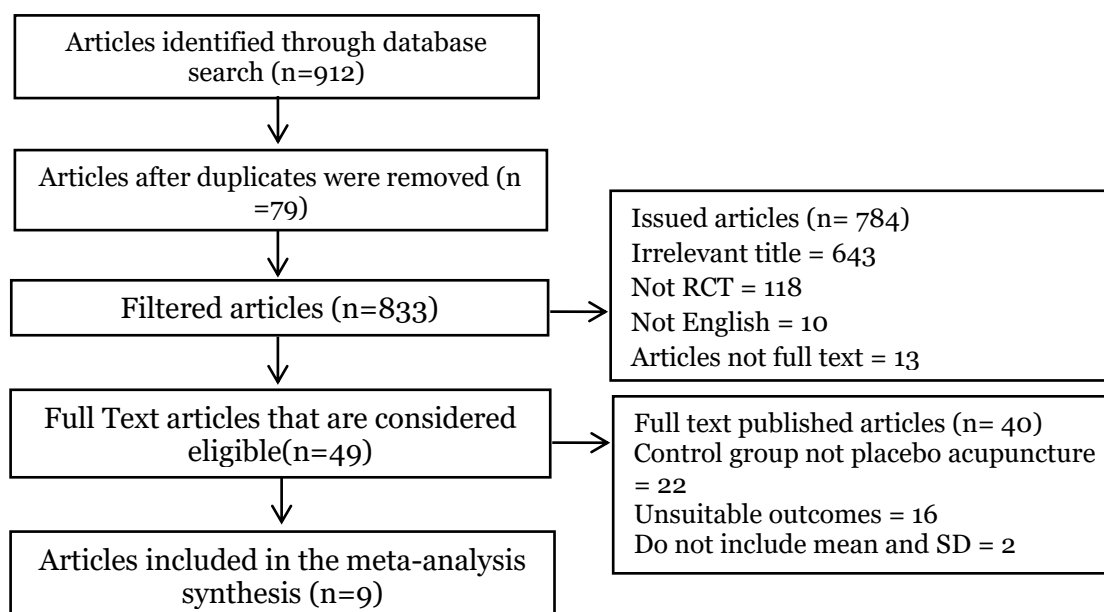


Figure 1. PRISMA flowchart diagram of therapy article search acupressure on blood sugar levels in diabetes mellitus patients



Figure 2. Map of the distribution of research article locations on the effect of acupressure therapy on blood sugar levels in patients with diabetes mellitus

Figure 2 is a map of the distribution of research article locations. The articles contained in the review process are articles ori-

ginating from 2 continents. The search results obtained 9 articles with search locations around the world.

Table 1. Assessment of the quality of randomized controlled trial studies on the effect of acupuncture therapy on reducing migraine recurrence

Authors (Year)	Criteria of Questions												Total
	1	2	3	4	5	6	7	8	9	10	11	12	
Zarvasi et al., 2018	1	1	1	1	1	1	1	1	1	1	1	1	12
Mood <i>et al.</i> , 2021	1	1	1	1	1	1	1	1	1	1	1	1	12
Najafi <i>et al.</i> , 2020	1	1	1	1	1	1	1	1	1	1	1	1	12
Jin <i>et al.</i> , 2009	1	1	1	1	1	1	1	1	1	0	1	1	11
Wei et al., 2019	1	1	1	1	1	1	1	1	1	0	1	1	11
Shamy <i>et al.</i> , 2018	1	1	1	1	1	1	1	1	1	1	0	1	11
Chuang et al., 2019	1	1	1	1	1	1	0	1	1	1	1	1	11
Purwanto et al., 2013	1	1	1	1	1	1	1	1	1	1	1	1	12
Xie <i>et al.</i> , 2022	1	1	1	1	1	1	0	1	1	1	1	1	11

Description of the question criteria:

- 1 = Does the research address a clearly focused statement/problem?
- 2 = Is the randomized controlled trial research method appropriate to answer the research question?
- 3 = Are there enough subjects in the study to establish that the findings did not occur by chance?

- 4 = Were subjects randomly allocated to the experimental and control groups? If not, could this introduce bias?
- 5 = Were inclusion/exclusion criteria used?
- 6 = Were the two groups comparable at study entry?
- 7 = Were objective, unbiased outcome criteria used?
- 8 = Are objective and validated measurement methods used to measure the results? If not, were the results assessed by someone who was not aware of the group assignment (i.e. was the assessment blinded)?
- 9 = Is the effect size practically relevant?
- 10 = How precise is the estimated effect? Are there confidence intervals?
- 11 = Could there be confounding factors that haven't been taken into account?
- 12 = Can the results be applied to your research?

Description of the answer score:

- 0 = No
- 1 = Yes

Table 2. Summary of randomized controlled trial (RCT) primary study articles with each PICO (N=451)

Author (Year)	Country	Sample Size	P	I	C	O
Zarvasi et al., 2018	Iran	60	DM Patients	Acupressure therapy	Without acupressure	GDP decline
Mood et al., 2021	Iran	66	DM Patients	Acupressure therapy	Without acupressure	GDP decline
Najafi et al., 2020	Iran	63	DM Patients	Acupressure therapy	Without acupressure	GDP decline
Jin et al., 2009	China	64	DM Patients	Acupressure therapy	Without acupressure	GDP decline
Shamy et al., 2018	Egypt	30	DM Patients	Acupressure therapy	Without acupressure	GDP decline
Chuang et al., 2019	Taiwan	26	DM Patients	Acupressure therapy	Without acupressure	GDP decline
Purwanto et al., 2013	Indonesia	40	DM Patients	Acupressure therapy	Without acupressure	GDP decline
Xie et al., 2022	China	36	DM Patients	Acupressure therapy	Without acupressure	GDP decline
Wei et al., 2019	China	66	DM Patients	Acupressure therapy	Without acupressure	GDP decline

The forest plot in Figure 3 shows that there is an effect of acupressure therapy on reducing blood sugar levels in patients with diabetes mellitus. Diabetes Mellitus patients who received acupressure therapy had an average GDP score of -0.56 units lower than those without acupressure (SMD=-0.56;

95% CI= -0.76 to -0.37; $p < 0.001$). The forest plot also showed heterogeneity of effect estimates which were highly heterogeneous between primary studies ($I^2 = 89\%$; $p < 0.001$). Thus the calculation of the average effect estimate is carried out using the random effect model approach.

Table 3. Effect estimates (Mean SD) of all primary studies performed in the meta-analysis (N=429)

Author (Year)	Acupressure		Non- Acupressure	
	Mean	SD	Mean	SD
Jin <i>et al.</i> (2009)	5.72	0.97	5.75	0.85
Purwanto <i>et al.</i> (2013)	2.74	23.44	27.45	26.22
Zarvasi <i>et al.</i> (2018)	122.23	30.93	142.53	38.26
Sharmy <i>et al.</i> (2018)	129.2	1.1	128.9	0.1
Wei <i>et al.</i> (2019)	7.7	1.27	8.43	1.2
Chuang <i>et al.</i> (2019)	131.6	29.6	128.2	32.2
Najafi <i>et al.</i> (2020)	143.34	49.75	165	80.96
Mood <i>et al.</i> (2021)	40.63	29.52	156.53	31.39
Xie <i>et al.</i> (2022)	7.08	0.92	7.7	0.88

1. Forest Plot

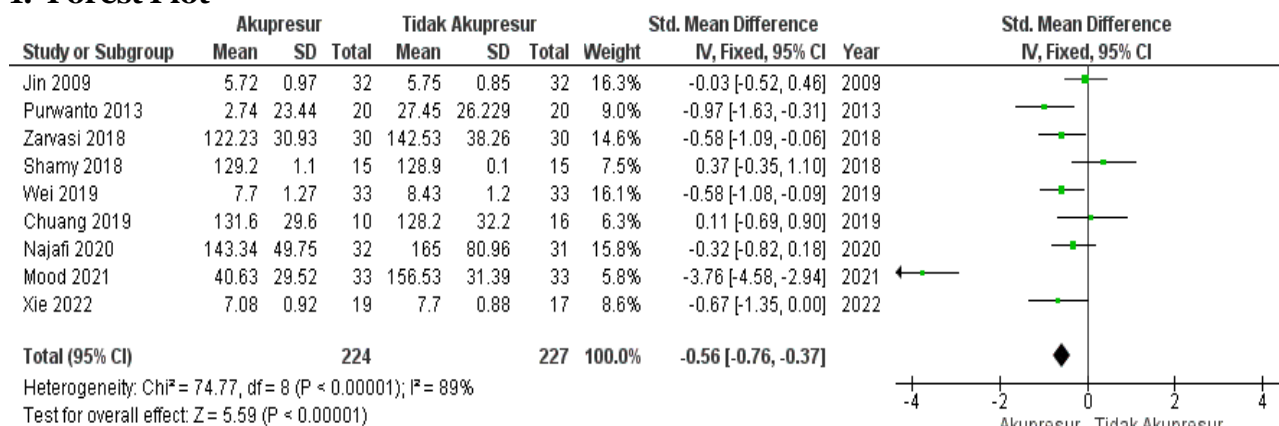


Figure 3 Forest plot of the effect of acupressure therapy on reducing blood sugar levels in patients with diabetes mellitus.

2. Funnel Plot

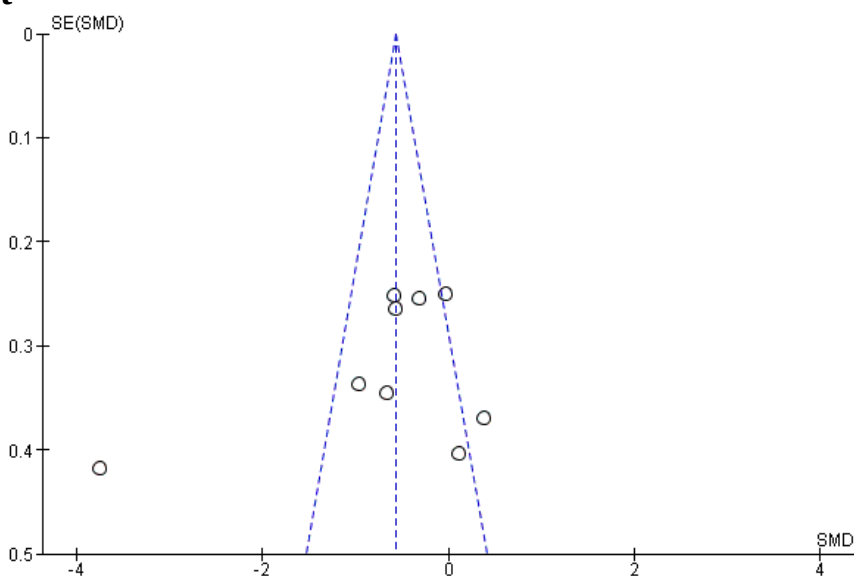


Figure 4. Funnel plot of the effect of acupressure therapy on reducing blood sugar levels in patients with diabetes mellitus.

The funnel plot in Figure 4 shows the distribution of effect estimates that are not symmetrical between the right and left of the vertical line of the average effect estimates. This indicates that there is publication bias because the distribution of effect estimates is more to the right than to the left of the vertical line and opposite the direction of the average effect estimate which is to the left of the vertical line of hypothesis 0. So that publication bias reduces the acupuncture effect that actually (underestimated).

DISCUSSION

Acupressure is the stimulation of pressure using the fingers on acupressure points to restore balance in the body's systems. Can function as a diagnostic tool such as there are points of tenderness, the presence of muscle hypertonicity (Kiswojo, 2013). Acupressure utilizes stimulation at acupuncture points on the patient's body to affect the flow of bioenergy (Setyowati, 2018).

DM is a syndrome with impaired carbohydrate, fat and protein metabolism caused by reduced insulin secretion or decreased tissue sensitivity to insulin (Guyton and Hall, 2014). DM includes a group of metabolic diseases characterized by hyperglycemia that occurs due to defects in insulin secretion, insulin action or both. Chronic hyperglycemia in diabetes is associated with long-term damage, dysfunction or failure of several organs, especially the eyes, kidneys, nerves, heart and blood vessels (Purnamasari, 2014).

This study takes the topic of the effect of acupressure therapy on blood sugar levels in patients with diabetes mellitus, where the independent variable in this study is acupressure and the dependent variable in this study is not acupressure. Confounding factors in a study cannot be avoided but can be controlled. Confounding factors affect the effect of exposure or relationship to disease incid-

ence that is estimated (estimated) in a study that is not the same as the actual relationship or effect that occurs in the target population or it can be said that the study is invalid (Murti B, 2018).

In this study, confounding factors were controlled using inclusion and exclusion criteria according to the requirements of the researchers. There were 9 articles that met the inclusion and exclusion requirements from a number of primary studies that were included in this systematic review and meta-analysis. Then the number of research subjects, the mean and standard deviation values were combined and processed using the RevMan 5.3 application. The mean and standard deviation values are obtained from the measurement results of GDP.

The results of data processing using the Revman 5.3 application on 9 articles originating from Taiwan, China, Indonesia, Egypt and Iran show that acupressure therapy can reduce blood sugar levels in patients with diabetes mellitus with a standard mean difference (SMD) GDP value of acupressure of 0.56 units or more. lower than no acupressure and statistically significant with a significance value of (SMD=-0.56; 95% CI= -0.76 to -0.37; $p < 0.001$). This is in line with a study conducted by Simadibrata et al, (2017) Acupressure has the potential to reduce blood glucose levels and normalize endocrine function, especially in patients with type 2 DM.

Acupressure therapy lowers blood sugar levels in patients with diabetes mellitus, these results are in accordance with the hypothesis. In addition, research (Liang and Koya, 2010) has concluded that acupressure can increase insulin sensitivity. Patients with DM who were treated with acupressure showed improvement in clinical manifestations as well as decreased fasting blood sugar and improved oral glucose tolerance tests. Another study showed that acupressure im-

proves both hyperglycemia and insulin resistance. The underlying mechanism appears to be related to endogenous opioids and insulin secretion. Puncture at the CV 12 point (Zhongwan) stimulates the adrenal glands to induce endorphins, which increase insulin secretion, resulting in a decrease in plasma glucose levels. The hypoglycemic effect of stabbing at point ST 36 (Zusanli) is also mediated by serotonin and endogenous opioid peptides via insulin secretion.

The results of the forest plot with research articles with a randomized controlled trial design show that there is an effect of acupressure therapy on reducing blood sugar levels in patients with diabetes mellitus. Diabetes Mellitus patients who received acupressure therapy had an average GDP score of -0.56 units lower than those without acupressure (SMD=-0.56; 95% CI= -0.76 to -0.37; $p < 0.001$). The forest plot also showed heterogeneity in effect estimates which were highly heterogeneous between primary studies ($I^2 = 89\%$; $p < 0.001$). Thus the calculation of the average effect estimate is carried out using the random effect model approach. The strength of this study is that it can ensure that acupressure can lower blood sugar levels in diabetic patients so that it can be used as a reference and can be used as a reference in making health promotion strategies with promotive and preventive efforts related to diabetes mellitus. In accordance with (Nurwati et al., 2020) Acupressure has a philosophy based on "Self-Healing Potential" (the body's ability to heal itself) which is natural. Acupressure stimulates the body's homeostatic forces to achieve normal balance, so that it can be used to create health promotion strategies with promotive and preventive efforts related to diabetes mellitus.

The limitation of this study is the existence of publication bias shown in the funnel plot and language bias because in this study

only articles published in English and Indonesian were used, thus ignoring articles published in other languages. In this study there are limitations in the search for articles. Not many articles have been analyzed for acupressure variables, because there is still little research on acupressure on diabetes mellitus.

AUTHORS CONTRIBUTION

Muslihatin Khuril Rosyida is the main researcher who selects topics, searches for, and collects research data. Didik Tamtomo and Hanung Prasetya, analyzed and reviewed research documents.

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CONFLICT OF INTEREST

There is no conflict of interest in this study.

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