



THE EFFECT OF ELECTROACUPUNCTUR ON BLOOD PRESSURE, MEAN ARTERIAL PRESSURE AND PULSE PRESSURE IN HYPERTENSIVE PATIENTS: LITERATURE REVIEW

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ABSTRACT

A person who has uncontrolled hypertension has seven times greater risk to have a stroke and three times greater risk to have a heart attack. Electroacupuncture therapy is one of the non-pharmacological therapies that can be used as a solution to control blood pressure values in hypertensive patients. This research was conducted to analyze the effect of electroacupuncture therapy on the values of blood pressure, Mean Arterial Pressure, and Pulse Pressure in hypertensive patients. This research used a Literature Review design with journal searches using Science Direct, PubMed, and Google Scholar published in 2009-2020. Among the 17944 articles obtained, 15 articles were taken for analysis. Furthermore, the Journal Reviews was done by employing the Duffy 2005 Research Appraisal Critical Format. The results of this study found that 9 journals of electroacupuncture and 6 journals of acupuncture showed positive results in which there was an effect of electroacupuncture therapy on the value of blood pressure, mean artery pressure and pulse pressure in hypertensive patients. The researchers concluded that Electroacupuncture therapy affects the value of blood pressure, mean artery pressure, and pulse pressure in hypertensive patients.

Keywords: blood pressure; electroacupuncture; hypertensive patients; mean arterial pressure; pulse pressure

First Received

08 March 2021

Revised

18 April 2021

Accepted

25 April 2021

Final Proof Received

10 May 2021

Published

29 May 2021

How to cite (in APA style)

Septiawan, T., Kamil, M., Hamsih, H., & Framaisella, D. (2021). The Effect of Electroacupunctur on Blood Pressure, Mean Arterial Pressure and Pulse Pressure in Hypertensive Patients: Literature Review. *Indonesian Journal of Global Health Research*, 3(2), 193-208. <https://doi.org/10.37287/ijghr.v3i2.427>

INTRODUCTION

WHO (World Health Organization) states that cardiovascular disease is the most common cause of passing in Southeast Asia, including Indonesia. This has caused Indonesia to face a twofold burden of malady in which, in addition to dealing with the problem of communicable diseases, we must also focus on handling non-communicable diseases. Among non-communicable diseases are heart disease, Diabetes Mellitus (DM), Chronic Obstructive Pulmonary Disease (COPD), cancer, stroke, and hypertension. (Direktorat Jenderal Pengendalian dan Penyehatan Lingkungan., 2015).

One of the non-communicable diseases is hypertension. Hypertension is a disease that can cause various complications and attacks the organs in the body like cardiac attack, kidney failure, and blindness. Therefore Hypertension is known as the "silent killer". Patients with uncontrolled hypertension have a seven times greater risk of having a stroke and a three times greater risk of having a heart attack (Sari, 2015 (Hasnah & Ekawati, 2016)). Hypertension can not be cured, and the patient will be diagnosed with hypertension for life, even though hypertension cannot be cured but its incidence can be controlled with good hypertension

management. Uncontrolled high blood pressure can cause various complications that can lead to death. In general, hypertension management is divided into pharmacological and nonpharmacological treatments. The use of drugs in the long term has side effects on the body and nonpharmacological therapy is safer and usually has minimal side effects, and both of them can be combined (Muttaqin., 2009; Udjianti., 2010).

Acupuncture is non-pharmacological therapies on of option that can be used to control the value of blood pressure in hypertensive patients . Acupuncture is a traditional method of medicine from China. This method uses needles inserted into certain points called acupoints as a treatment procedure. Together with technological developments that are increasingly advanced, this method of treatment is also advancing. By combining modern technology by providing an electrical stimulation called electroacupuncture with low intensity in its application (Dias et al., 2017).

Electroacupuncture consists of two types, namely Percutaneous Electrical Nerve Stimulation (PENS) and Transcutaneous Electrical Nerve Stimulation (TENS). Percutaneous electrical nerve stimulation (PENS), which is the insertion of a needle that is inserted into the body tissue through the skin or muscle and then connected to a device that can deliver electricity to the body's tissues. Transcutaneous electrical nerve stimulation (TENS) to provide stimulation in the form of an electric current through an electrode placed on the surface of the skin (Mayor, 2007).

Transcutaneous Electrical Nerve Stimulation (TENS) is a simple technique that is a widely used invasive procedure for health care that can be performed by both physiotherapists, nurses, and midwives. TENS is a type of treatment that involves the application of electrical energy to make the nervous system more active through the surface of the skin. During TENS therapy, a pulsed electric current is generated from a portable generator which is delivered to the skin surface through pads called electrodes (Johnson, 2014).

Percutaneous Electrical Nerve Stimulation (PENS) is a type of electroacupuncture that involves applying electrical stimulation to acupoints via a small needle that penetrates the skin. The tools and methods of using PENS are not much different from TENS, PENS also uses a battery-powered electric stimulator. The difference is that PENS uses a small needle as an electrode which provides a closer current to the nerves and muscles under the skin, thereby minimizing the sensitivity of nerves to pain (Revord, 2017). To prevent complications, it is important to control the value of blood pressure in hypertensive patients and electroacupuncture therapy is a non-pharmacological treatment option could be a solution. To prove this, it is important to research to prove the effectiveness of electroacupuncture therapy in controlling blood pressure in hypertensive patients. Although research has been carried out on the effectiveness of electroacupuncture against hypertension, to assess the efficacy quality of these therapies, it is necessary to evaluate these studies utilizing of systematic assessment or SLR (systematic literature review). SLR itself is a method that refers to a particular study so that the development and evaluation of a study with a particular topic can be carried out. The aim of this research was to determine whether there was an effect of electroacupuncture on BP, MAP and PP in hypertensive patients.

METHOD

The research design used a literature review. The literature used is a original and full text article. Journal Searches were conducted using the MEDLINE (PubMed) database search, Scient Direct, and Google Scholar. The articles on jurnal chosen were published from 2009

to 2020. The articles on jurnal were searched using keywords electric acupuncture, electroacupuncture, Transcutaneous Electrical nerve stimulation, percutaneous electrical nerve stimulation, acupuncture, blood pressure, pulse pressure, Mean Arterial Pressure, and hypertension with human subjects in their research.

After selecting data based on inclusion and exclusion criteria, a RAC (Research Appraisal Checklist) was carried out in the journal. RAC was created to assess the writing of quantitative research carefully and systematically. In the RAC assessment, there are 53 criteria which include the assessment of titles, abstracts, problems, literature, methodology, data analysis, discussion, and systematic journal writing where each criterion has its score. Each criterion has a score range of 1 to 6. Score 1 means that the criteria are not found in the article, while score 6 means that the criteria are found completely and clearly in the article. After assessing the 53 criteria, the scores are added and entered into the total score. There are 3 categories based on the total score, superior (205-306 Points), Average (103-204 Points), Below Average (0-102 points) (Duffy, 2005). The analysis uses an exposition approach by describing existing data and facts so that correlations can be found, besides that an analytical approach is also carried out, namely through the process of data analysis and supporting arguments so that a conclusion can be drawn.

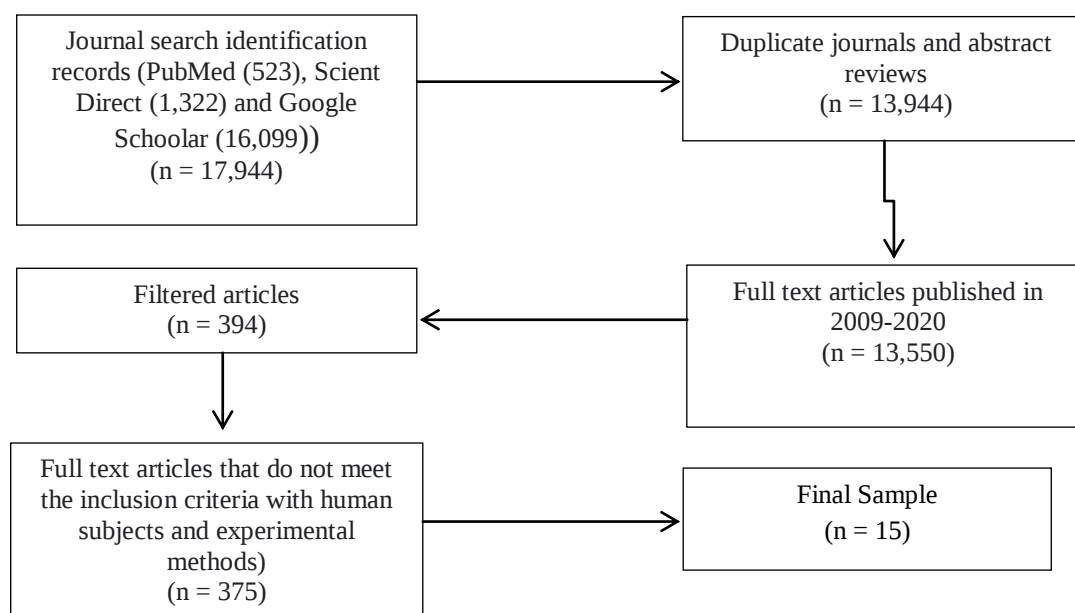


Figure 1. Flow Diagram

RESULTS

Table 1.
Table of Analysis

No	Author/ Year	Title	Objective	Sample	Design	Key Finding
1	(P. Li et al., 2015)	<i>Long-Lasting Reducing of Blood Pressure by Electroacupuncture in Patients with Hypertension: Randomized Controlled Trial</i>	To assess the efficacy of electric acupuncture at specific acupoints in lowering SBP and DBP in patients with hypertension.	65 people without a history of cardiovascular disease except for high blood pressure and did not take anti-hypertensive drugs for 72 hours before the study were split into two groups at random	<i>Two-arm parallel study</i>	After 8 weeks, 33 patients who received electroacupuncture therapy on PC 5-6 + ST 36-37 had lower peak & average SBP and SDP, than 32 patients who received therapy on LI 6-7 + GB 37-39. as acupoints control. After treatment, the concentration of norepinephrine, had decreased by 41%, renin 67% and aldosterone 22%. EA at select acupoints reduced blood pressure, Sympathetic and renin-aldosterone the long-term EA actions were most likely tied to systems.
2	Abdi, H et al/2017	<i>Abdominal and Auricular Acupuncture Reduces Blood Pressure Hypertensive Patients</i>	To evaluate and contrast the effectiveness of abdominal acupuncture and auricular acupuncture on blood pressure in 440 subjects with or without obesity.	440 samples with overweight (BMI: 25 to <30) and obesity (BMI: ≥ 30). Has no history of medication and drug consumption for 3 months prior to the study	<i>True-experimental with Solomon four group design</i>	Abdominal electroacupuncture has an effect on decreasing SBP and DBP in hypertensive patients in the case and control groups. Meanwhile, auricular acupuncture has no effect on blood pressure values in hypertensive patients.
3	Silverda l, J et al./2012	<i>Antihypertensive effect of low-frequency Transcutaneous Electrical Nerve Stimulation (TENS) in comparison with drug treatment</i>	To evaluate the antihypertensive effect of low-frequency TENS compared to the calcium-channel blocker felodipine, with the secondary aim of evaluating the tolerability of stimulation therapy	32 patients with the inclusion criteria were over 18 years of age with a history of hypertension. TD 140/90 mmHg - 170/105 mmHg	<i>prospective, randomized, crossover study</i>	The results showed that TENS reduced SBP by 5 mmHg but not DBP. Meanwhile, felodipine decreased BP by 10/6 mmHg.
4	Sartori, S. et al/2018	<i>Effects of Transcutaneous Electrical Nerve Stimulation in Autonomic Nervous System of Hypertensive Patients : A Randomized Controlled Trial</i>	to verify the effect of TENS by evaluation of heart rate variability (HRV) in patients with essential hypertension to assess the acute effect of TENS application at high, low frequency and placebo on the cardiovascular sympathetic nervous system	28 hypertensive patients with BP > 140/90 mmHg, aged 18-80 years	<i>A Randomized Controlled Trial</i>	The results showed that the LF group did not show a significant reduction in SBP (p <0.490), but HF and placebo showed an increase in SBP (p <0.121 and p <0.800). The DBP LF and placebo did not show any significant changes (p <0.824 and p <0.715). Meanwhile, in the HF group, the DBP increased (p <0.018). Researchers say further research is needed on the therapeutic effects of TENS.

No	Author/ Year	Title	Objective	Sample	Design	Key Finding
			and parasympathetic modulation in patients with hypertension.			
5	(Hanna et al., 2019)	<i>Effect of Cryotherapy versus Transcutaneous Electrical Nerve Stimulation on Patients with Hypertension</i>	To investigate the effect of cryotherapy versus transcutaneous electrical nerve stimulations (TENS) in hypertensive patients	40 male patients with essential hypertension with an age range of 40-50 years and a BMI value of 25- 29.9 kg / m2 were taken at Disuq General Hospital	<i>Two-arm parallel study</i>	As an acute effect: in group A there was a significant difference in systolic pressure except in sessions 3, 4, and 6 and a significant difference in diastolic pressure except in session 7. As a chronic effect: in group A there was no significant change in systolic pressure, but there was a significant change in diastolic pressure, while in group B there was a significant change in systolic and diastolic pressures
6	(Jiandan i & Sant, 2018)	<i>Burst TENS : An Immediate Alternative Therapy to Reduce Systolic Blood Pressure Temporarily in Hypertensives</i>	to evaluate the direct effect of TENS on resting blood pressure and exercise blood pressure in people with hypertension	60 patients aged 30-65 years diagnosed with Essential Hypertension (EH)	<i>Prospective randomized controlled intervention trial</i>	Blood pressure before and after the intervention was recorded and compared. The results of blood pressure after being given walking exercise intervention for 6 minutes with or without Burst TENS were (p: <0.05). There was a decrease in SBP, DBP, and arterial pressure in the experimental group. Whereas in the control group there was no significant change. Thus the TENS burst can be used to lower blood pressure in hypertensive patients.
7	Hamed H, et al/2010	<i>Effectiveness of Laser Acupoint Therapy and Exercise Program on Oxidative Stress and Antioxidant Response in Mild Hypertensive Patients</i>	To measure serum levels of Malondialdehyde (MDA) and Glutathione Proxidase (GPX) in conjunction with laser acupuncture practice and exercise programs in patients with mild essential hypertension	45 male patients with inclusion criteria had mild essential hypertension with blood pressure values of 140/90 mmHg - 160/100 mmHg, aged 40- 60 years, did not smoke, and did not take anti- hypertension during the procedure.	<i>Randimozed controlled trial</i>	The results showed the values of SBP, DBP, MDA and GPX in the laser group respectively (17.66 mmHg, 9.11 mmHg, 5.55 nmol / ml). p <0.01 SBP, DBP, MDA and GPX in the exercise group respectively (11.0 mmHg, 10.34 mmHg, 7.67 nmol / ml) P <0.01 SBP, DBP, MDA and GPX in the control group respectively (0.92 mmHg, 1.23 mmHg, 11.35 nmol / ml) p <0.01
8	(Pereira et al., 2018)	<i>Laser Acupuncture Protocol for Essential Systemic Arterial Hypertension: Randomized Clinical Trial</i>	To evaluate the efficacy of a laser acupuncture protocol developed and implemented by nurses in hypertensive patients	102 samples, aged between 30 and 70 years, were on drug therapy for one year or more with difficulty controlling blood pressure. Measurement results> 140/90 mmHg	<i>Randomized , multicenter, triple-blind and two- armed clinical trial</i>	Significant reduction in systolic (p <0.001) and diastolic (p <0.001) blood pressure. The results show the efficacy of the protocol. Blood pressure reduction and control is demonstrated, enabling the use of this technology for the treatment of patients with essential systemic arterial

No	Author/ Year	Title	Objective	Sample	Design	Key Finding
						hypertension.
9	(Lazuardi et al., 2018)	Effects of Needle Pens on Acupoints PC6, MA-IC 7, and MA-TF 1 on Blood Pressure and Quality of Life in Essential Hypertensive Patients	To find out the effect of the needle pens applied to the PC6 points. MA-IC 7, and MA-TF 1 on blood pressure and QoL questionnaire scores for essential hypertension patients	52 patients with essential hypertension who were treated at the Acupuncture Division of the Polyclinic and Internal Hypertension Medicine, Cipto Mangunkusumo Hospital	<i>True eksperiment pretest-posttest control group design</i>	The treatment group showed a decrease in systolic blood pressure at 30 minutes and at 3 days ($p < 0.05$), a decrease in diastolic blood pressure at 30 minutes and at 3 days ($p > 0.05$). PN therapy with antihypertensive drugs reduced blood pressure and improved quality of life in patients with essential hypertension compared with those in the control group.
10.	So'ema h/2017	The Effectiveness of Acupuncture Therapy on Changes in Blood Pressure in Patients with Hypertension	To prove the effectiveness of acupuncture therapy on changes in blood pressure in hypertensive patients at the Zona Mojokerto Therapy Foundation	18 respondents with stage I prehypertension and stage II hypertension were cooperative	<i>Pre-eksperiment al design pretest and post test</i>	The paired T-test shows that p (0.000) α (0.05), so that H_0 is rejected, which indicates that acupuncture therapy is effective in treating hypertensive patients.
11.	(Liu et al., 2015)	<i>Acupuncture Lowers Blood Pressure in Mild Hypertension Patients: A Randomized, Controlled, Assessor-blinded Pilot Trial</i>	To assess the effect of acupuncture on prehypertension and stage 1 hypertension and provide data for further research	Study participants had systolic blood pressure values 120-159 mmHg and diastolic blood pressures 80-90 mmHg	<i>Randomized preliminary study, controlled, assessor-blinded study with an 8-week intervention period and a 4-week follow-up</i>	DBP (-5.7 mmHg; $P = 0.025$), but not SBP (-6.0 mmHg; $P = 0.123$), differed significantly between the post-treatment groups. DBP (-7.8 mmHg; $P = 0.004$) and SBP (-8.6 mmHg; $P = 0.031$) were significantly different at follow-up. Among the HRV indices, only high-frequency power was significantly different between the groups at week 4 and 8 ($P = 0.047$ and $P = 0.030$, respectively). There were no differences between groups in EQ-5D, BMI or lipid profiles.
12.	(Hariyanto & Rajin, 2018)	<i>The Effect of Acupuncture Therapy on Blood Pressure Decrease Toward Elderly with Hypertension Diagnosed in Panti Werdha Mojopahit, Mojokerto, East Java, Indonesia</i>	To determine the effect of acupuncture therapy on blood pressure in the elderly with a diagnosis of hypertension at the Mojopahit Nursing Home, Mojokerto, East Java, Indonesia.	18 elderly patients with hypertension at Panti Werdha Mojopahit, Mojokerto	<i>Quasi Ekspeiment al pretest-posttest control group design</i>	The results showed that between the two groups produced hypertension in the elderly, after acupuncture therapy in 4 times (within 4 days) there was a significant decrease in blood pressure. Control group, both systolic and diastolic pressures in Paired T-Test.
13.	(L. Zhang, Lai, Li, Song,	<i>Effects of Acupuncture Manipulation at</i>	To investigate the manipulation parameters of the frequency of	120 patients with hypertension were randomly divided into 4 groups	<i>Randomized controlled trial</i>	120 revolutions / minute at the ST9 point gives changes to blood pressure (diastolic pressure/24 hours (24hDBP),

No	Author/ Year	Title	Objective	Sample	Design	Key Finding
	Wang, Fan, et al., 2019)	<i>Different Frequencies for Patients with Hypertension : Result of a 24-week Clinical Observation</i>	acupuncture in lowering blood pressure when acupuncture is applied to ST9 and LR3 acupuncture points in the human body			morning systolic pressure (mSBP), morning diastolic pressure (mDBP), daytime diastolic pressure (dDBP), nighttime diastolic pressure (nDBP) and night systolic pressure (nSBP)). 60 rev / minute at point ST9 gives changes to 24hDBP, dSBP, dDBP, and mDBP. 120 revolutions per minute at the LR3 point did not show any anti-hypertensive effect while 60 cycles / minute at LR3 had an effect on dSBP and dDBP. The results of this study indicate that the effect on blood pressure, anti-hypertensive effect, and the duration of acupuncture effect depends on the frequency of needle manipulation at the same acupuncture point.
14.	(Hasnah & Ekawati, 2016)	Effect of Acupuncture Therapy on Hypertension Patients at the Makassar Community Traditional Health Center	To prove the effect of acupuncture therapy on hypertensive patients at the Makassar Community Traditional Health Center	10 respondent by <i>accidental sampling</i>	<i>Pre-eksperiment al one group pretest-posttest</i>	The systolic and diastolic blood pressure data before and after being given acupuncture therapy showed the results of the paired t-test p value = 0.000. This shows the effect of acupuncture therapy on hypertensive patients. Giving therapy 3 times a week decreased systolic pressure by 10.59% and diastole by 19.9%.
15.	(Zhang et al, 2009)	Effects of electrical stimulation of acupuncture points on blood pressure	To see the effect of the Hans Accupoint Nerve Stimulator therapy model LH 202H on systolic and diastolic blood pressure values in men with normal blood pressure or with moderate hypertension	17 respondents who were divided into 2 groups, namely 1 intervention group and 1 control group, divided into groups using random sampling techniques	<i>Randomly assigned into control and experimental group</i>	In this study, the analysis used one way repeated measurement with a significant level of 0.05 which was determined with $P \leq 0.05$ using 3.5 statistical software, in this study it was found that the international group experienced a significant decrease in systolic blood pressure values with a value of $P < 0.05$ where The average systole value before treatment was 117.8 ± 4.2 mmHg and after the treatment decreased to 110.8 ± 5.5 mmHg at week 3 and 110.1 ± 5.8 mmHg at week 5, while the diastolic value before treatment was an average of 78.1 ± 5.0 mmHg and after being given the action it decreased to 77.4 ± 4.3 mmHg at week 3 and 74.8 ± 4.3 mmHg at week 5, where there was no significant decrease in diastolic pressure, whereas in the control group there was no significant decrease.

Research in the first article was conducted by Peng Li, et al (2015) at the Institute of Clinical Translational Sciences (ICTS), to be precise at the UCI campus and medical center (University of California, Irvine). This study used a two-arm parallel study design. The number of samples in this study was 65 patients who were randomly divided into two groups. 33 samples in the first group received electroacupuncture therapy at acupoint PC 5-6 + ST 36-37 while 32 samples in the second group received electroacupuncture at acupoint LI 6-7 + GB 37-39. The inclusion in this study was patients who did not have cardiovascular disease other than high blood pressure, was not pregnant, and did not take antihypertensive drugs for 72 hours before the study procedure. Blood pressure values in the samples were between 123/71 mmHg - 169/112 mmHg with ages between 38-75 years. The results of the study after 8 weeks of treatment showed a significant reduction in SBP (Systolic Blood Pressure) and DBP (Diastolic Blood Pressure) in the first group (PC 5-6 + ST 36-37) compared to the second group (LI 6-7 + GB 37-39). EA has more influence on the SBP value with a reduction of 7-13 mmHg and 4 mmHg in DBP.

The 2nd article was conducted by Abdi H, et al (2017) in Iran. The design of this study was a true experiment with Solomon four-group design with 400 respondents who were randomly divided into 4 groups. 2 case and control groups for Auricular acupuncture where each group consisted of 102 respondents, and 2 cases and control groups for abdominal electroacupuncture where each group consisted of 98 respondents. The results showed that abdominal electroacupuncture can reduce SBP and DBP in hypertensive patients.

The 3rd article takes a study conducted by Silverdal et al (2012) in Sweden. The study design was a prospective, randomized, crossover study. The study sample was 41 patients with inclusion criteria > 18 years with a history of HT with a blood pressure value of 140/90 mmHg - 170/105 mmHg. The sample was randomly divided into 2 groups. TENS and felodipine groups. The points used in TENS therapy are LI 4 and LI10. Each used bilateral stimulation. Performed for 8 weeks, 4 weeks of treatment, and 4 weeks of follow-up. 30 minutes in the morning and 30 minutes at night. Whereas in the felodipine group, the group received felodipine (2.5 mg) every morning during treatment. The results showed that TENS reduced SBP by 5 mmHg and there was no change in DBP, while felodipine reduced BP by 10/6 mmHg. ABPM measurement results show that both treatments can reduce BP. This means that TENS affects the BP value in hypertensive patients.

The 4th article is taken from a study conducted by Sartori et al (2018) in Brazil. The design of this study was a randomized controlled trial. The sample in the study amounted to 28 with inclusion criteria having hypertension with a BP value > 140/90 mmHg, with an age range of 18-80 years. Patients were divided into 3 groups. 8 patients received Low Frequency (LF) TENS, 10 patients received High Frequency (HF) TENS and 10 received a TENS placebo. total strength and normalization (n.u) of low frequency (LF- 0.04 to 0.15 Hz) and high frequency (HF-0.15 to 0.40 Hz). Therapy was performed at points TI to L2. Patients are prohibited from consuming caffeine 12 hours before therapy and are advised to eat beforehand. The results showed that the LF group did not show a significant reduction in SBP ($p < 0.490$), but HF and placebo showed an increase in SBP ($p < 0.121$ and $p < 0.800$). The DBP LF and placebo did not show any significant changes ($p < 0.824$ and $p < 0.715$). Meanwhile, in the HF group, the DBP increased ($p < 0.018$). From the results of this study, it can be concluded that TENS at the TI and L2 points cannot reduce blood pressure in hypertensive patients. TENS only lowers systolic blood pressure and increases diastolic blood pressure significantly. Researchers say further research is needed on the therapeutic effects of TENS.

The 5th article was conducted by Hanna et al (2019) at Dishuq General Hospital from September - October 2018. The sample of this study was 40 outpatients with a diagnosis of grade 1 essential hypertension (140/90-159/99 mmHg) aged 40-50 years and male. The sample was randomly divided into 2 groups. Group A received 30 minutes of paravertebral ice pack application of C7-L2 3 times a week for 4 weeks. Group B received paravertebral TENS application of C7-L2 with a frequency (10 HZ) for 30 minutes, 3 times a week for 4 weeks. The results of the study in group B who used the TENS application showed a significant reduction in SBP and DBP as a chronic effect.

The 6th article focuses on a study conducted in mumbai, india by Jiandani and Sant (2018). The study design was a prospective randomized controlled intervention trial. The study sample was 60 patients aged 30-65 years with essential hypertension. The sample was divided into two groups. The experimental group received the TENS burst and the control group received a TENS sham. Therapy was given at the acupuncture points LI 4 and LI 11. The results showed that blood pressure after being given walking exercise intervention for 6 minutes with or without Burst TENS was ($P < 0.05$). There was a decrease in SBP, DBP, and arterial pressure in the experimental group. Whereas in the control group, there was no significant change. Thus the TENS burst can be used to lower blood pressure in hypertensive patients.

The 7th uses a randomized controlled trial design to examine a study conducted in egypt by Hamed et al (2010). The study sample consisted of 45 male patients who were taken from outpatients with the National Heart Institute with inclusion criteria, diagnosed with mild essential hypertension, blood pressure between 140/90 mmHg - 160/100 mmHg, who did not smoke. The sample was divided into 3 groups. Each group consisted of 15 samples. The Low-Level Laser Therapy (LLLT) group, using a BTL-5110 device with a frequency of 5000 Hz, is applied for 2 minutes 3 times a week. Group exercise (treadmill), done for 20 minutes 3 times a week. The control group did not change physical activity and diet. The study was conducted for 4 weeks. The results showed the values of SBP, DBP, MDA and GPX in the laser group respectively (17.66 mmHg, 9.11 mmHg, 5.55 nmol / ml). $p < 0.01$. SBP, DBP, MDA and GPX in the exercise group respectively (11.0 mmHg, 10.34 mmHg, 7.67 nmol /ml) $P < 0.01$. SBP, DBP, MDA and GPX in the control group respectively (0.92 mmHg, 1.23 mmHg, 11.35 nmol/ml) $p < 0.01$. The results show laser therapy is more efficient at lowering blood pressure than a treadmill exercise program. This means that there is an effect of therapy on BP in hypertensive patients.

The 8th article was conducted by Pereira et al (2018) in Brazil. The study sample consisted of 102 respondents with systemic essential hypertension with inclusion of 30-75 years, doing SAH treatment for at least 1 year, having difficulty controlling blood pressure, blood pressure examination results above 140/90 mmHg. The sample was divided randomly into the intervention group and the control group. The intervention group received stimulation of antihypertensive drugs. The results showed a decrease in systolic ($p < 0.001$) and diastolic ($p < 0.001$) pressures in the intervention group, which means the protocol is effective in reducing blood pressure in patients with essential systemic hypertension.

The 9th article is a study carried out by Lazuardi et al (2018) in Jakarta. The study sample was 52 respondents who were patients at Cipto Mangunkusumo Hospital. The sample was split into two groups.. The treatment group was given therapy in the form of acupuncture press needles and the control group on the other hand received a placebo. The results of

intervention group experienced a reduction in systolic and diastolic blood pressure 30 minutes and 3 days after treatment ($p = 0.05$) compared to the control group.

The 10th article was conducted by So'emah (2017) at the Mojokerto Zone Therapy Foundation. The findings of this research 18 patients aged 17-55 years with stage I and stage II hypertension. The therapy given to patients is acupuncture. Blood pressure was calculated before and after acupuncture therapy. The results showed acupuncture's effect therapy on blood pressure values in hypertensive patients.

The 11th article is a study carried out by Liu Yan et al (2015) in Korea. The design of this research is Randomized Preliminary design. The study sample was 30 respondents with inclusion criteria of 20-65 years with a blood pressure value of 120/80 mmHg-159/99 mmHg. The study was conducted for 3 months, 8 weeks of therapy and 4 weeks of follow-up. The sample was divided into two groups, the intervention group and the control group. The intervention group received acupuncture therapy at points ST 36, PC 6, LR 3, SP 4, LI 11. Meanwhile, the control group was asked to maintain their usual lifestyle without the provision of antihypertensive drugs. The results showed that there were significant differences in the SBP and DBP values in the intervention group and the control group. In the intervention group, the SBP value decreased by 8.6 mmHg and DBP 7.8 mmHg. Whereas in the control group, there was no significant change.

The 12th is based on research conducted in Mojokerto, East Java, by Hariyanto and Rajin (2018), East Java. This research design is a quasi experimental with pretest-posttest control group design. The sample was 18 patients at the Mojopahit Nursing Home, Mojokerto with inclusion criteria of SBP > 140 mmHg and DBP > 90 mmHg. The sample was divided into 2 groups where the intervention group received acupuncture therapy while the control group did not. The results of the independent test after acupuncture were $P < 0.05$, indicating that acupuncture has an effect on blood pressure values.

The 13th article was conducted by Zhang L, et al (2019) in China. The study design was a randomized controlled trial. The study sample of 120 patients with inclusion were patients with essential hypertension, blood pressure values between 140/90 mmHg - 159/99 mmHg, duration of hypertension under 15 years, did not take antihypertensives or underwent any cardiovascular medication, did not have diabetes, were not pregnant. and have signed an informed consent. The sample was divided into 4 groups, namely the ST9 high frequency group, ST9 low frequency group, LR3 high frequency group, and LR3 low frequency group. The patient received 5 treatments per week for 12 weeks and a follow-up for 12 weeks. The results showed that 120 revolutions / minute at the ST9 point gave changes to blood pressure (diastolic pressure / 24 hours (24 hDBP), morning systolic pressure (mSBP), morning diastolic pressure (mDBP), daytime diastolic pressure (dDBP), night diastolic pressure (nDBP) and night systolic pressure (nSBP)). 60 revolutions / minute at point ST9 gives changes to 24 hDBP, dSBP, dDBP, and mDBP. 120 revolutions per minute at the LR3 point showed no antihypertensive effect, while 60 cycles / minute at LR3 had no effect on dSBP and dDBP. The results of this study indicate that the effect on blood pressure, the antihypertensive effect, and the duration of the acupuncture effect depends on the frequency of needle manipulation at the same acupuncture point.

The 14th article conducted by Hasnah and Ekawati (2016) in Makassar, Indonesia. The research design was a pre-experimental one group pretest-posttest. The research was conducted for 1 month with a sample of 10 people. Therapy is carried out at the acupuncture

points LI 4, LI 11, ST 36, and LR 3 3 times a week for 30 minutes / session. The results showed the value of the paired t-test $p = 0.000$, which means that there is an effect of acupuncture therapy on reducing blood pressure in patients with hypertension.

The 15th article conducted by Zhang J et al (2008). This study was conducted for 5 weeks with a total sample of 17 men with normal blood pressure or moderate hypertension. The design used is randomly assigned to control and experimental groups. The intervention group received Hans electrical stimulation therapy at two acupoint locations, points L1 and L11, for 30 minutes twice a week. The results of the one way repeated test were obtained if there was a significant decrease in the systole value in the intervention group with a P value < 0.05 . The conclusion of this study is that Hans electrical stimulation therapy at acupuncture points can reduce systolic blood pressure but not diastolic blood pressure in a population with normal blood pressure or moderate hypertension.

DISCUSSION

Electroacupuncture (EA) is divided into several methods, namely Transcutaneous Electrical Nerve Stimulation (TENS), and Percutaneous Electrical Nerve Stimulation (PENS). EA is thought to have been shown to be effective in reducing sympathetic nervous system activity in healthy subjects and individuals with cardiovascular disease. The results of the therapy carried out on a healthy person showed reduced sympathetic nerve activity. Low frequency TENS can reduce blood pressure in hypertensive patients (Sartori, et al (2018) & Pereira et al (2018). Not a few of those who have hypertension prefer non-pharmacological treatment. Most of them are not satisfied with the results of conventional treatment, so they turn to alternative medicine (Ervin & Ayubi, 2018). In addition, non-pharmacological treatments are cheaper in terms of costs and fewer side effects. Unfortunately, alternative medicine can only be applied to patients with mild hypertension (Chobanian et al., 2003).

According to research by Peng Li et al (2014), it was found that electroacupuncture therapy (EA) can reduce blood pressure in hypertensive patients with an average SBP (Systolic Blood Pressure) of 12-8 mmHg and DBP (Diastolic Blood Pressure) of 6-5 mmHg. PC 5-6 and ST 36-37 were the acupoint points used in this study. The results showed that long-term electroacupuncture at a specific acupoint could lower blood pressure, as well as decrease plasma concentrations of norepinephrine by 41%, renin by 67%, and aldosterone by 22%. The renin enzyme itself functions to increase blood pressure and this enzyme is produced in the kidneys. In addition, its function is to assess whether kidney function is problematic or not (Leeman et al, 2018). To regulate blood pressure itself, the renin enzyme works together with the hormone aldosterone and then forms a system called the renin-angiotensin-aldosterone-system (RAAS). The work of RAAS involves several organs, like the brain, kidneys and lungs. If renin-aldosterone decreases, blood pressure also decreases (Mutaqqin, 2010) which states that an increase in RAAS can lead to an increase in blood pressure, so that by decreasing RAAS activity, blood pressure will also decrease.

According to D. Li et al (2014), the mechanism of acupuncture therapy affects several systems, including the central nervous system, neuroendocrine, neurohumoral, and autonomic reflex nerves. Acupuncture affects the sympathetic nerves and endocrine system and can cause a decrease in plasma renin, angiotensin II, aldosterone, serotonin and norepinephrine. Vasodilation of blood vessels through the mediator inflammation results in the flow of blood to the kidneys becoming stable because the adrenal cortex does not strengthen vasoconstriction. As a result, no renin is produced, and no renin converts angiotensinogen to angiotensin I, which becomes angiotensin II, so the adrenal cortex does not secrete aldosterone, and the

renal tubules do not retain sodium and water, resulting in a stable intravascular volume in hypertensive patients.

Acupuncture needle insertion represents stimulation of afferent nerves, which will be passed to the cornu posterior spinalis, then to the cornu intermediolateral, and finally to the duct of autonomic nerves, which inhibits sympathetic stimulation, resulting in vasodilation (Hasnah & Ekawati, 2017). Inserting the needle into the acupuncture point will stimulate parasympathetic nerve impulses and suppress sympathetic nerves. The dominant parasympathetic nervous system will release acetylcholine bonds to endothelial cells, causing local nitric oxide formation, which then diffuses through vascular smooth muscle, affecting blood flow and local circulation, resulting in smooth muscle vascular relaxation (Nompo, 2020). This is in line as stated by Darmawan (2019), if the needle puncture method in acupuncture will stimulate the release and activation of active substances such as Nitrite Oxide which is a vasodilator produced by blood vessel endothelium which triggers vasodilation. Research conducted by Sartori (2018) on low frequency TENS decreases sympathetic nerve activity and increases parasympathetic nerve activity in hypertensive patients. Research conducted by Zhang et al (2019) obtained if the location of the ST 9 acupuncture point is close to the carotid sinus, the carotid sinus itself is a sensor to regulate blood pressure, the results of the study show that continuous stimulation of the carotid sinus, especially in unilateral baroreflex activities such as using electrical stimulation, can reduce high blood pressure in people with resistant hypertension.

Tabel 2.
Evaluate the Values Of Blood Pressure, Mean Arterial Pressure and Pulse Pressure

Title	No.	Blood Pressure		Pulse Pressure PP = SBP – DBP		Mean Arterial Pressure	
		Before	After	Before	After	Before	After
The Effectiveness of Acupuncture Therapy on Changes in Blood Pressure in Patients with Hypertension	1.	140/110 mmHg	130/110 mmHg	30 mmHg	20 mmHg	120 mmHg	116.6 mmHg
	2.	140/100 mmHg	130/110 mmHg	40 mmHg	20 mmHg	113.3 mmHg	116.6 mmHg
	3.	140/110 mmHg	140/100 mmHg	30 mmHg	40 mmHg	120 mmHg	113.3 mmHg
	4.	150/100 mmHg	140/100 mmHg	50 mmHg	40 mmHg	166.6 mmHg	113.3 mmHg
	5.	130/100 mmHg	120/90 mmHg	30 mmHg	30 mmHg	110 mmHg	100 mmHg
	6.	150/110 mmHg	140/110 mmHg	40 mmHg	30 mmHg	123.3 mmHg	120 mmHg
	7.	140/110 mmHg	130/100 mmHg	30 mmHg	30 mmHg	120 mmHg	110 mmHg
	8.	130/100 mmHg	130/100 mmHg	30 mmHg	30 mmHg	110 mmHg	110 mmHg
	9.	130/100 mmHg	120/90 mmHg	30 mmHg	30 mmHg	110 mmHg	100 mmHg
	10.	140/110 mmHg	140/100 mmHg	30 mmHg	40 mmHg	120 mmHg	113.3 mmHg
	11.	140/110 mmHg	130/100 mmHg	30 mmHg	30 mmHg	120 mmHg	110 mmHg
	12.	140/110 mmHg	140/100 mmHg	30 mmHg	40 mmHg	120 mmHg	113.3 mmHg
	13.	150/100 mmHg	120/90 mmHg	50 mmHg	30 mmHg	123.3 mmHg	100 mmHg
	14.	130/100 mmHg	120/90 mmHg	30 mmHg	30 mmHg	110 mmHg	100 mmHg
	15.	140/110 mmHg	130/100 mmHg	30 mmHg	30 mmHg	120 mmHg	110 mmHg
	16.	160/110 mmHg	150/110 mmHg	50 mmHg	40 mmHg	126.6 mmHg	123.3 mmHg
	17.	150/110 mmHg	140/110 mmHg	40 mmHg	30 mmHg	123.3 mmHg	120 mmHg
	18.	140/110 mmHg	140/100 mmHg	30 mmHg	40 mmHg	120 mmHg	113.3 mmHg

Table 2 shows the outcome of the research conducted by So'emah (2017) where there were differences in blood pressure values before and after acupuncture therapy was given. In this study, researchers provided an additional evaluation of PP calculations using the formula $PP = SBP - DBP$ (Homan et al, 2020). Evaluation of the PP calculation is carried out to strengthen the assumption that blood pressure can have an inverse relationship to the PP value. According to the results of the evaluation of PP calculations using data from So'emah (2017) research, acupuncture therapy can reduce the value of systole and diastole in most respondents, in addition to the value of Pulse Pressure. Samples number 4 and 13 even show PP values from abnormal (50 mmHg) to normal (30-40 mmHg). Similarly, the outcome of the MAP calculation were obtained using the formula $MAP = SBP + (2 \times DBP) / 3$ (Hopkins, 2011) to see if acupuncture therapy could reduce the Mean Artery Pressure value for the majority of respondents, with samples 5, 9, and 13 experiencing a reduce in MAP to Normal value from 110 mmHg to 100 mmHg.

The finding from So'emah (2017) is similar with study by John Zhang et al (2009) where the average blood pressure value in normal adults and high blood pressure patients at the time of initial electroacupuncture therapy was 117.8 mmHg for systole and 78.1 mmHg for diastole, then in the 3rd week it becomes 110.8 mmHg for systole and 77.4 mmHg for diastole and then at 5th week becomes 110.1 mmHg for systole and 74.8 mmHg for diastole. Evaluation of the average MAP was 91.3 mmHg at the time of electroacupuncture administration and at week 3 it decreased to 88.3 mmHg and at week 5 it decreased to 86.8 mmHg. Another study regarding the effects of electroacupuncture on hypertension was carried out by Yan Guo et al (2015). The research was conducted using animal subjects, rats. EA was administered to 27 subjects for 15 days. The results showed that EA reduced blood pressure in rats with pre hypertension that were given stress stimulation on day 5,7,9,11,13, and 15 of the interventions.

Electroacupuncture is used to bring yin and yang into harmony energy in order to maintain body hemodynamics. The EA of the TENS method is able to block the primary efferent pathway using low frequency electrical energy through electrodes that are attached to the skin's surface to inhibit pain. Apart from being an analgesic effect, TENS has been proved to increase the local vasodilator effect which contributes to lowering blood pressure and preventing ischemia (Vilela-Martin et al, 2016). The results of research from 9 articles show that Electroacupuncture by Percutaneous Electrical Nerve Stimulation (PENS), Transcutaneous Electrical Nerve Stimulation (TENS), Laser Electric Acupuncture (LA) and 6 articles about traditional acupuncture both have an influence on the SBP and DBP values in hypertensive patients

CONCLUSION

Electroacupuncture (EA) has a positive effect on BP, MAP, and PP in hypertensive patients. One of the effects of Electroacupuncture therapy is to reduce the secretion of the enzymes renin, aldosterone and norepinephrine plasma concentrations in order to prevent and control the increase of blood pressure, where EA is divided into TENS and PENS therapy, For patients who are afraid of acupuncture needles by Traditional Acupuncture or Percutaneous Electrical Nerve Stimulation (PENS), they can still feel the benefits of electroacupuncture by using the TENS method by placing special electrodes from the outside of the skin at the acupoint.

ACKNOWLEDGEMENTS

This research received funding by LPPM UMKT, thanks to Mr. Husni Thamrin, Ph.D and Mrs. Marjan Wahyuni, SKM, M.SI as the Head of LPPM UMKT who supported the research team.

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