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The Effectiveness of Acupressure and Foot Exercises on the Ankle Brachial Index (ABI) Value in Diabetes Mellitus Type 2 Patients

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ABSTRACT
Diabetes is still a problem and continues to increase. If not treated immediately, it will result in various complications such as diabetic ulcers, amputations, and even death. Most patients with type 2 diabetes still have difficulty controlling blood glucose levels so that it affects the ankle-brachial index values. Acupressure is useful in increasing ankle brachial index (ABI) values by increasing the circulation of qi (vital energy) in the body, but few studies examined the effect of acupressure to increasing ankle brachial index values in patients with type 2 diabetes mellitus. The aim of the study to determine the effectiveness of acupressure and foot exercises on the Ankle Brachial Index (ABI) value in patients with type 2 diabetes mellitus.This research used a quasi-experimental design with a pre-post test design approach on 60 respondents sample selection using purposive sampling. They were divided into 3 intervention groups, namely the acupressure group (n = 20), the DM exercises group (n = 20), and the combination of acupressure and the DM exercises group (n = 20). Thus, the testing difference in the average value of ABI in each group using the *Wilcoxon Signed-Ranks Test*. The results showed a significant difference in ABI values between the acupressure group (p = 0.000), foot exercises (p = 0.001) and a combination of acupressure and foot exercises (p = 0.000). Acupressure and DM exercises are effective interventions to increase the ABI values in patients with type 2 diabetes mellitus. Acupressure can be recommended as an independent complementary therapy in nursing care services for patients with type 2 diabetes mellitus.
Keywords: *acupressure, DM foot exercises, ankle-brachial index (ABI), type 2 diabetes mellitus*

1. INTRODUCTION

Over the past decade, the prevalence of diabetes has increased more rapidly in low and middle-income countries than in high-income countries[1]. Globally, the total adult population aged 20-79 years was 4.84 billion in 2017, and around 425 million people worldwide, or 8.8% are estimated to have diabetes. About 79% live in low and middle-income countries. If this continues, in 2045 we estimate it that 9.9% or 629 million people aged 20-79 years will suffer from diabetes. Meanwhile, the deaths for diabetes aged (20-79) years old reached 4 million people in 2017 [2].

Basic Health Research showed a significant increase in the prevalence rate of Diabetes, from 6.9% in 2013 to 8.5% in 2018, so that the estimated number of sufferers in Indonesia reaches over 16 million people are also at risk for developing other diseases, such as heart attack, stroke, blindness and kidney failure which can even cause paralysis and death[3]. A higher BGL in diabetic patients is one of the risk factors for macrovascular disorders. According to International Diabetes Federation (2017), there is a triad of macrovascular disorders in people with diabetes mellitus: coronary heart disease, cerebrovascular disease, and peripheral vascular disease (PVD), including peripheral artery disease (PAD)[2].

Peripheral artery disease is very prevalent in the population significantly associated with a higher average of patients' age, longer diabetes duration, higher systolic blood pressure, and smoking [4]. Other studies have shown that it closely relates uncontrolled blood glucose levels to complications experienced by patients such as macrovascular complications [5]. The ineffective management in dealing with DM will cause acute and even chronic complications. Complications from DM comprise acute complications, namely changes in glucose levels, and chronic complications such as changes in the cardiovascular system, changes in the peripheral nervous system, changes in mood, and increased susceptibility to infection. Besides, vascular changes in the lower extremities in people with diabetes can cause arteriosclerosis resulting in complications that affect the legs which lead to a high incidence of amputation in DM patients (4,5). The severity of Type II DM plays an important role in the occurrence of Peripheral Artery Disease (PAP). Around, 75% of people with Type II DM eventually die caused by vascular disease. Based on these data, the

prevention efforts that can be done to prevent further disability even though the disease has occurred is tertiary prevention, for example in the form of diabetes exercises [6].

It also uses diabetic foot exercises as a leg exercise. Exercises or movements performed by both legs alternately or together are useful for strengthening or flexing the muscles in the lower leg area, especially in the ankles and toes. In principle, foot exercises are carried out by moving all joints of the foot and adjusted to the patient's ability. In doing this foot exercises, one of the expected goals is to improve blood circulation in the leg area [7].

Ankle-Brachial Index (ABI) is a non-invasive examination of blood vessels that functions to detect the clinical signs and symptoms of ischemia, decreased peripheral perfusion which can lead to angiopathy and diabetic neuropathy. ABI is a simple method of measuring blood pressure in the ankle (foot) and brachial (hand) area by using a Doppler probe. The result of the ABI measurement showed the state of blood circulation in the lower limbs with a value range of 0.90-1.2, showing that the circulation to the leg area is normal. It gets this value from the comparison of systolic pressure in the feet and hands [8].

Peripheral arterial disease (PAD) is associated with higher cardiovascular morbidity and mortality, regardless of sex or form of clinical presentation (symptomatic or asymptomatic). PAD was considered as an independent predictor of cardiovascular mortality, more important for survival than a clinical history of coronary artery disease. *Ankle-brachial index* (ABI) is a sensitive and cost-effective filtering tool for PAD. ABI is useful for screening the peripheral artery disease in patients at risk and for diagnosing the disease in patients with lower limb symptoms [9]. The interprofessional approach (doctors, nurses, and foot care specialists) is often needed to support the needs of patients [10].

Various attempts have been made to provide complementary therapies to diabetics patients to avoid continuing complications. Acupuncture is effective to treat numbness in the lower extremities, spontaneous pain in the lower extremities, stiffness in the upper extremities, and changes in temperature perception in the lower extremities after therapy. Our pilot study, therefore, provides evidence that acupuncture may be one of clinical use for the radical treatment of diabetic peripheral neuropathy, this study aimed to investigate the effects of acupuncture on diabetic peripheral neuropathy [11].

2. RESEARCH METHODS

Design

This research was a comparative analytic study using a quasi-experimental design, where one group was intervened according to the desired method [12]. With the three groups of the pretest-posttest design approach, there were three groups, namely the acupressure group, the exercises DM group, and the acupressure and exercises DM group combination. The first intervention group was given the acupressure treatment, and the second intervention group was given exercises in DM treatment, while the third group was given a combination of treatments, namely acupressure and DM exercises. This research was conducted to determine whether there was an effect of a causal relationship after treatment in the intervention group. Then after the treatment was given, an assessment of the ankle-brachial index was carried out in the three groups and compared to see which one was more effective against the ABI value [13]. This research was conducted at the DR. Mintohardjo Central Jakarta Hospital.

Participant

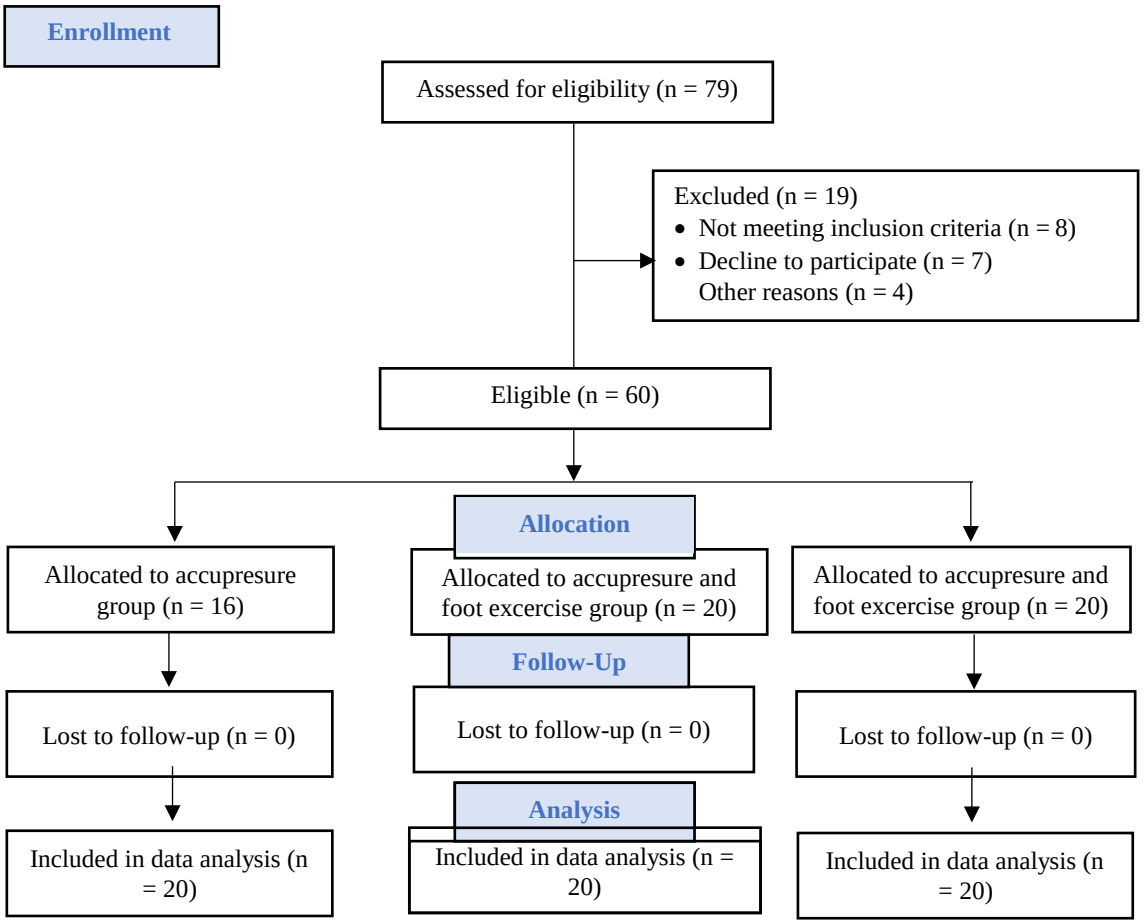
The population in this research was type 2 DM patients. Patients in this research were patients with type 2 diabetes mellitus, had an ABI value below <0.91. Their age was over 35 years old. With the exclusion criteria of unstable vital signs, acupressure contraindications: skin injury, swelling, fractures, and myalgia and respondents withdrew during the study process. The determination of the sample size was used using the Federer formula [14] so that the total sample was 60 people. The sampling technique used in this research was non-probability sampling in purposive sampling, It was a technique by selecting samples from the population according to what the researcher wanted (objectives/problems in the research) so that the sample could represent the characteristics of the population [12], [13].

Ethical Consideration

This research was conducted after obtaining approval from the ethics review board or passed the ethical review of *Sekolah Tinggi Ilmu Kesehatan Indonesia Maju* with number 1099/Sket/Ka.Dept/RE/ STIKIM/ VI/ 2020. The researchers have explained to the potential respondents including the objectives, methods, benefits, and risks. The researcher guarantees the confidentiality of the participants and gives the respondent the right that they can withdraw from the study without implication for further treatment.

Procedure (*figure* 1)

Figure 1



A total of 79 subjects were studied, and it was found the eligibility only for 60 subjects which agreed to participate. The average respondent was 75.9%. Participants who have agreed to become respondents signed the informed consent. The measuring of blood glucose levels was conducted twice. First, it was conducted in the first week before the intervention which a pretest. Then, after 3 weeks of therapy, the researcher returned to measure the blood glucose levels as a post-test. During the process, the researchers conducted home visits to provide therapy.

Intervention group

Acupressure Group

Researchers examined Individual training program (intervention) and implemented in the intervention group. Acupressure was performed by the researcher to the respondents because he has been certified as an acupressure therapist. The program consisted of the therapists and respondents' hygiene, applying oil massage to the acupressure area, giving acupressure at point LR 3 (*Taichong*), KI 3 (*Tai Xi*), SP 6 (*San Yin Jiao*), SP 10 (*Xue Hai*) and ST 36 (*Zusanli*) for 10 minutes on the left and right of the respondent. Therapy was given in 7 sessions (1 time in 2 days for 2 weeks). Researchers measured the ABI value of patients before acupressure was performed in the first week, this data was used as a pretest. Then the measurement of the ABI value of the respondent was carried out after 2 weeks of giving acupressure therapy, this data was used as a posttest.

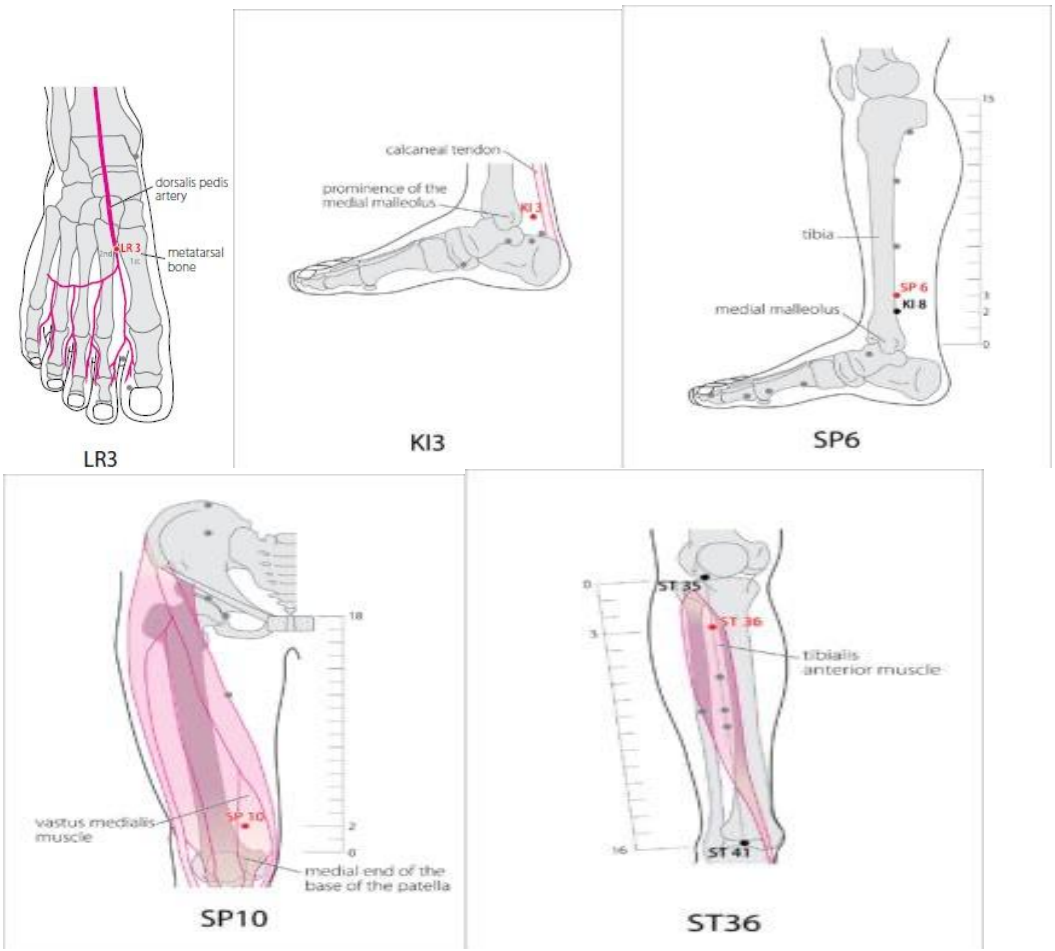


Fig.1; LR 3 (Taichong), KI 3 (Tai Xi), SP 6 (San Yin Jiao), SP 10 (Xue Hai), ST 36 (Zusanli)

Source: (Fitrullah & Rousdy, 2017; Focks 2008; Mashitoh et al., 2015; Surya et al., 2018; Zick et al., 2011)

Foot Excercise Group

In this group, 3 sessions of DM exercises were given with a duration of 30 minutes each session. It was conducted once a day for 3 days using newspapers. Researchers measure the ABI value of respondents before doing DM exercises. It uses this data as data pretest. After 3 days, the ABI value was measured again, and it used this data as the post-test.

Acupressure and Foot Exercise

This group was given acupressure combination therapy at LR 3 (*Taichong*), KI 3 (*Tai Xi*), SP 6 (*San Yin Jiao*), SP 10 (*Xue hai*), and ST 36 (*Zusanli*) for 10 minutes on the left and right of the respondent with DM exercises in 7 sessions (1 time in 2 days for 2 weeks) and 3 sessions of DM exercises with a duration of 30 minutes for each session. It was conducted once a day for 3 days in a row using the newspaper.

Statistical analysis

We performed descriptive statistics to describe the characteristics of the sample and blood glucose levels baseline. A paired t-test was conducted to see the difference in blood glucose levels before and after acupressure administration in the intervention and control groups and to prove the research hypothesis. The data that has been collected is processed using the SPSS version 19 program. Before the bivariate test, data normality tests had been carried out using the *Shapiro-Wilk* test. It carried the normality test out on the blood glucose levels of each intervention group from both measurement times. Thus, the p value> 0.05 was obtained, which means the data is normally distributed. The homogeneity test with Levene's test has also been carried out first to get p value> 0.05.

Research Limitations

The limitation of this research is that it did not include many variables such as the sensitivity of the foot, blood sugar levels, and capillary refill time. Even though there were limitations to this research, it suffices to explain the ABI value manually where the ABI value is at least an indicator so that DM patients can perform foot care to prevent diabetic foot wounds and avoid the amputation incidence rates.

3. RESEARCH RESULTS

Characteristics of Respondents

Table 1
Results of Respondent Analysis by Age at Mintohardjo Hospital, Jakarta August-September 2020 (n = 60)

Variable	Group	n = 0	Mean	SD	Min - Max	95% CI
Age	Acupressure	20	53,95	7.930	40-74	50.24-57.66
	Foot exercises	20	57,05	7.990	45-74	53.31-60.79
	Acupressure and Foot Exercises	20	55.85	6.167	48-74	52.96-58.74

Table 2
Results of Respondent Analysis by Gender, Age, Occupation, History of Smoking, and History of Hypertension at RSAL Mintohardjo Jakarta August-September 2020 (n = 60)

Variable	Category	Acupressure	DM exercises	Acupressure and DM Exercises	Total
		n = 0	n = 0	n = 0	n = 0
Type Gender	Male	5 (25)	6 (30)	7 (35)	18 (30)
	Female	15 (75)	14 (70)	13 (65)	42 (70)
Occupation	Housewives	16 (80)	13 (65)	12 (60)	41 (68.3)
	Entrepreneur	3 (15)	5 (25)	7 (35)	15 (25)
	Private	0 (0)	2 (10)	1 (5)	3 (5)
	Civil servants	1 (5)	0 (0)	0 (0)	1 (1.7)
Smoking History	Yes	5 (25)	8 (40)	9 (45)	22 (36.7)
	No	15 (75)	12 (60)	11 (55)	38 (63.3)
History of hypertension	Yes	10 (50)	13 (65)	11 (55)	34 (56.7)
	No	10 (50)	7 (35)	9 (45)	26 (43.3)

Table 3
The Average of Ankle Brachial Index (ABI) Before and After Intervention in 3 Intervention Groups at RSAL Mintohardjo Jakarta August-September 2020 (n = 60)

Variable	Group	Measures	Mean	SD	*P-value*
ABI	Acupressure	Before	0.8145	0.05934	0.200
		After	0.9015	0.09735	0.017
	Foot exercises	Before	0.7995	0.09305	0.013
		After	0.8445	0.07950	0.000
	Acupressure	Before	0.8030	0.08957	0.037
	And Foot Exercises	After	0.9245	0.06386	0.006

[a](data normality test)

In this research, the average age of the respondents was 54 years old (SD = 7,930), with the youngest age was 40 years old and the oldest age was 74 years old. The majority of respondents were women (n = 42; 70%), with a job as a housewife (n = 41; 68.3%), most of the respondents did not smoke (n = 38; 63.3%) and had a history of hypertension (n = 34; 56.7%). In both the intervention group and the control group, the ABI value was below 0.9 before the intervention was carried out, which was (0.8145 ± 0.05934) in the acupressure group, (0.7995 ± 0.09305) in the foot exercise group, and (0, 8030 ± 0.9245) in the combination of acupressure and foot exercises group. Because the data in this research were not normally distributed with P <0.005, the bivariate test was performed using the Wilcoxon Signed Ranks Test. (Tables 1, 2, and 3).

The Effect of Acupressure and Foot Exercises on the Ankle Brachial Index (ABI)

Table 4
Comparison of ABI Value According to The Measurement Stage in 3 Intervention Groups at Mintohardjo Hospital, Jakarta August-September 2020 (n = 60)

Variable	Group	Measures	Mean	SD	*p-value**
ABI	Acupressure	Before	0.8145	0.05934	0.000
		After	0.9015	0.09735	
	Foot exercises	Before	0.7995	0.09305	0.001
		After	0.8445	0.07950	
	Acupressure And Foot Exercises	Before	0.8030	0.08957	0.000
		After	0.9245	0.06386	

* *(Wilcoxon Signed Ranks Test)*

Participants in the acupressure intervention group experienced an increase in the ABI (0,9015± 0.09735) with an average increase of 0.087, in the foot exercise group the ABI value increased (0.8445 ± 0.07950) with an average increase of 0.045. While in the combination of acupressure and foot exercise group, it increased the ABI value (0.9245 ± 0.06386) with an average increase of 0.1215 which was statistically higher than the acupressure group and the foot exercise group. However, it was seen that the three intervention groups are effective but further analysis showed that there was a significant difference/average significant in the before and after value of ABI for the group given a combination of acupressure and foot exercises treatment. In other words, the combination of acupressure and foot exercise increases significantlyto the mean value of ABI ($p < 0.05$). (Table 4)

4. DISCUSSION

Characteristics of Respondents

Age

The results of this research indicated that the mean age of the respondents at RSAL DR. Mintohardjo was 54 years old, with an age range of 40-74 years old which was classified as elderly adults[1]. Age was closely related to the increase in blood glucose levels, therefore the older the age, the higher the prevalence of diabetes and impaired glucose tolerance. It also has an impact on complications of diabetes mellitus, including lower extremity blood circulation disorders [20]. The aging process after the age of 30 causes anatomical, physiological, and biochemical changes. Changes starting at the cellular level, continuing at the tissue level, and finally at the organ level which can affect the function of homeostasis. Components of the body that can undergo changes are pancreatic beta cells which produce the hormone insulin, target tissue cells that produce glucose, the nervous system, and other hormones that affect glucose levels [21].

Based on Kurniawaty's result (2016) the age of ≥ 50 years can increase the incidence of Type II Diabetes Mellitus because aging causes a decreased in insulin sensitivity and decreased function for glucose metabolism. This is supported by the research of Kekenusa (2013) that the age of ≥ 45 years old has 8 times the risk of developing diabetes mellitus than people aged <45 years old. According to Waspadji (2009) compared to younger ages, elderly people have increased insulin production from the liver (*hepatic glucose production*), tend to experience insulin retention, and impaired insulin secretion due to aging and apoptosis of pancreatic beta cells[22].

The analysis found that along with the increasing age, especially over 45 years, glucose intolerance begins to increase. The aging process causes interference with insulin and pancreatic beta cells, namely the reduced ability of pancreatic beta cells to produce insulin. In addition, the aging process results in changes in blood vessel walls so that it could affect the value of *the Ankle Brachial Index*, which indicates a peripheral vascular disorder so it could be concluded-that old age could affect the value of *Ankle Brachial Index*.

Gender

The majority of respondents in this research were female of a total of 42 (70%). Women have the hormone estrogen which was influenced by age. In older women, the decrease in estrogen happened and affected the blood glucose balance, especially women in menopause [23]. At menopause, the balance of blood glucose levels would be reduced so that it could make women more at risk of developing diabetes mellitus. Women are more at risk of developing diabetes because phys,ically women have a greater chance of increasing the body mass index, making the distribution of body fat easily accumulated due to this hormonal process so that women are at risk of suffering fromTs [24]. This study is also in line with the research of Shabana & Sasisekhar (2013) regarding the description of diabetes mellitus in RS India which showed that there were more women patients than men[21]. According to Corwin (2009) women tend to be obese due to an increase in the hormone estrogen which causes an increase in fat and sub-cutis tissue, so that they have a greater risk of developing diabetes if they have an unhealthy lifestyle[25].

Occupation

In this research, it was found that the majority are housewives (IRT). According to Anani (2012), housewives respondents and entrepreneurs had irregular meal schedules every day. Accordimg to the researchers' assumptions, work that is not related to lower limb movement activity results in a lack of flexibility in the leg vessels, resulting in impaired blood flow[26].

The results of Anani's (2012) research showed that there was a relationship between the respondent's eating habits and the respondent's blood glucose condition so that it had an effect on the increase for the value of the ankle-brachial index (ABI) in people with diabetes mellitus[26].

Smoking History

The history of smoking had an effect on the decrease of the Ankle Brachial Index value and indicated a disturbance in peripheral vascularization. Smoking habits in patients with type II diabetes mellitus can worsen the prognosis of the disease because the various toxins in the cigarette content can cause decreased insulin secretion, inhibitors of insulin release, and pancreatic beta-cell dysfunction [20].

Smoking habit was also one of the main factors causing peripheral artery disease. Peripheral artery disease usually clogs medium to large arteries and attacks the lower legs so that it can increase the incidence of gangrene in the legs of diabetes mellitus patients. Free radicals in cigarettes will trigger a decrease in endothelial function. As a result of this functional decrease, inflammatory cells, platelets, and LDL will easily adhere to the walls of blood vessels so that they can form plaque in blood ves cause atherosclerosis. If exposure to free radicals occurs cfurously it will cause damage to blood vessels and circulatory disorders [20].

Smoking is considered to be one of the important risk factors for peripheral artery (Erasso et al., 2014; Lu e2014). It is in line with research of Umer et al., (2018) which defines smoking of> 1 cigarette per day can lead to PAD. Data obtained from 100 respondents, it was found that 24.4% of patients with smoking had PAD compared to only 10.2% in the non-PAD group, p-value-= 0.0216 smoking was found a statistically significant risk factor for PAD (p-value < 0.01) [4].

History of Hypertension

In this research, it was found that most of the respondents had a history of hypertension which was for 34 respondents (56.7%). In type II diabetes patients, there was also disruption of blood flow to the heart due to blood viscosity. Based on the research of [29] , in 50 respondents of type II diabetes mellitus, it was found that 88% of respondents had hypertension and 12% of respondents did not suffer from hypertension. Besides, the results of the research of Valliyot et al., (2013) showed that people who had history of hypertension were 5 times at risk of suffering from type II diabetes mellitus compared to people who do not have a history of hypertension.

Hypertension can also affect the incidence of peripheral artery disease through its role in the process of arteriosclerosis. Hypertension can cause arteriosclerosis by various mechanisms, including endothelial dysfunction which causes remodeling of the artery walls and decreases the lumen diameter. Abnormalization of homeostatic factors causes the renin-angiotensin-aldosterone system to produce ACE and an increase in Angiotension causing increased in blood volume, and vasoconstriction. Cardiac output and peripheral resistance are not balance so that there is an increase in ventricular mass and smooth muscle cell proliferation, so blood vessels will be thickened and inelastic. From the results of the various mechanisms above, there are some of the causes of atherosclerosis [31]. High blood pressure can also cause arteries to dilate and be overstretched so that it causes injury to the endothelium. Endothelial dysfunction causes abnormalities of vascular smooth muscle tone, a proliferation of vascular smooth muscle cells, disorders of coagulation and fibrinolysis, and persistent inflammation [20].

This is supported by research conducted by Simatupang et al., (2013) which found that there are 34 people (89.5%) with normal blood pressure who have normal ABI values and there are only 4 people (10.5%) with abnormal ABI, whereas in hypertensive patients there were 44 people (71.0%) with normal ABI and 18 people (29.0%) with abnormal ABI.

The Effectiveness of Acupressure and Foot Exercices on ABI Value

In this research, the average value of the ankle-brachia index after acupressure and foot exercise was higher than the acupressure group and the foot exercise group, which is the ABI value in the acupressure group (0.9015 ± 0.09735) with an average increase of 0.087. In the foot exercise group the ABI value increased (0.8445 ± 0.07950) with an average increase of 0.045, while in the combination acupressure and foot exercise group the ABI value increased (0.9245 ± 0.06386) with an average increase of 0.1215. The results of this research support the research hypothesis which stated that the average ankle brachial index values after acupressure in the intervention group is lower than the control group. Thus, acupressure therapy and foot exercises are effective in increasing the ABI value for type 2 diabetes mellitus patients.

Acupressure is an effective method for reducing blood glucose and is beneficial for reducing complications due to diabetes [17]. We analyzed the relationship of meridian to the anatomical filament structure of the reciprocal action of the meridians, and biochemical activity and the key roles played by energy, internal energy, and entropy [33]. The absence of *dorsalis pedis* and/or *posterior tibial pulse* is an independent predictor of the main result of vascular in patients with type 2 diabetes. This simple clinical indicator should be used to increase risk stratification and patients treatment [34]. The increase in ABI correlates with a decrease in HbA1c, systolic, and

diastolic blood pressure, the effect of foot exercise also has significant value on ABI changes [35].

The basic mechanism of acupressure therapy to increase ABI in people with diabetes is to improve blood circulation to the legs. The main points of acupressure that are useful for stimulating increased blood flow to the legs of point LR3, KI3, SP6, ST36 and SP10. The distribution of these points is located in the lower legs and feet. Acupressure points are meridian nodes that have nerve endings and blood vessels so that they can provide simulation and response to blood flow to the legs [36], [37].

Stimulation conducted at acupressure points can stimulate sensory receptors and autonomic nerve function causing vasoactive neuropeptides such as *calcitonin gene-related peptide* (CGRP) and substance p (SP) and finally blood flow [38]. Acupressure also accelerates blood circulation at the place where the pressure is applied [39]. Providing acupressure therapy by doing massage at the acupressure points located on the foot can improve blood flow in the legs. The presence of nerve endings and blood vessels around the acupuncture point will increase the response of mast cells. Mast cells release histamine, heparin, and prosthetic kinins which cause vasodilation. Histamine causes the release of nitric oxide from the vascular endothelium, which is a mediator of various cardiovascular, neurological, immune, digestive, and reproductive reactions. Mast cells will also release platelet-activating factor (PAF) which is then followed by the release of serotonin from platelets [36]

According to Ingle et al., (2011), said that acupressure can activate *glucose 6 phosphates* (one of the most important enzymes in carbohydrate metabolism) and has an effect on the hypothalamus, s,o that it can stimulate the work of the pancreas to increase insulin synthesis, increase the number of receptors in cells target and accelerate glucose utilization, thereby lowering blood sugar levels and improving ABI values. Acupressure applies gentle pressure to the precise point which already defined as acupoint. Acupressure stimulates the central nervous system (i.e. the brain and spinal cord) to release chemicals hormones and influence the body's natural healing, promoting physical and emotional health. In the same way, acupressure treatments help normalize blood glucose levels naturally without side effects, but also improve physical and mental health [37]

This finding is in line with the research of Surya et al., (2018) where acupressure was effective in increasing the ABI value before and after acupressure therapy was given in the intervention group (p = 0.001). From the mean value, the mean value of ABI before treatment in the intervention group was 0.843, while the mean value after the intervention was 0.897. From the mean value, it can be seen that there was an increase in the ABI value in the intervention group after being given acupressure. It can be concluded that people with diabetes who received acupressure therapy experienced an increase in ABI.

Diabetic foot exercise is the right way to improve circulation, especially to the leg area. Foot exercises are one of the aerobic exercises whose movements in the foot area meet the criteria of continuous, rhythmical, interval, progressive, and endurance so that each stage of the movement must be carried out. An exercise that is recommended for DM patients, which is aerobic, means that it requires oxygen and can help blood circulation, strengthens the small muscles of the legs, prevents foot deformities which can increase the potential for diabetic injuries in the feet, increases the production of insulin which is used in glucose transport to cells so that helps reduce glucose in the blood[41], [42]. Foot movements that are performed during diabetic foot exercises are the same as foot massage, namely giving pressure and movement to the feet affecting hormones, namely increasing the secretion of endorphins which function as a decrease in pain, vasodilation of blood vessels resulting in a decrease in blood pressure, especially brachial systolic which is directly related to the value. ABI[43]. This study is in line with research Gibbs et al., (2013) found a significant increase in the ABI value after doing DM foot exercises with p-value = 0.027[35].

5. CONCLUSION

Based on the results of research and discussion of the effectiveness of acupressure and DM exercises on ABI values in type 2 diabetes mellitus patients at Mintohardjo Hospital, several conclusions can be drawn as follows:

1. The characteristics of the 60 respondents include: the average age is 54 years, most of them are female (n = 42; e a job as an IRT (n = 41; 68.3%), most of the respondents did not smoke (n = 38; 63.3%) and some respondents had a history of hypertension (n = 34; 56.7%).
2. The mean ABI value before acupressure was performed in the acupressure group was 0.8145 ± 0.05934 and in the DM exercise group was 0.7995 ± 0.09305, while in the combination group of Acupressure and foot exercise was 0.8030 ± 0.08957.
3. The mean ABI value after intervention in the acupressure group was 0.9015 ± 0.09735, in the foot exercise grobecaps 08f445 ± 0.07950 and 0.9245 ± 0.06386 in the acupressure and foot exercise group.
4. The mean ABI value in the combination acupressure and foot exercise group before and after the intervention was higher, namely 0.1215 (p = 0.000) compared to the acupressure group of 0.087 (p = 0.000) and in the foot exercise group 0.045 (p = 0.001).

Acupressure therapy and foot exercise intervention were implemented in this research, exploring the impact on changes in the ABI value of type 2 DM. The investigators concluded that acupressure intervention was clinically efficacious, which could increase the value of ABI. This requires the role of the medical-surgical nurse in helping DM

patients who have a low ABI value to increase the ABI value. Meanwhile, researchers consider this intervention as a new approach, especially medical-surgical nurses, to provide holistic care to type 2 DM patients who have a lower than normal ABI value. Nurses' competence for acupressure needs to be developed and evaluated before researchers can apply this intervention more broadly.

Suggestion

For Nursing Services

1. Developing a complementary acupressure and foot exercises therapy training program so that nurses can apply acupressure therapy for type 2 DM patients to increase the ABI value.
2. Modifying SOP that includes acupressure therapy and foot exercises to give more independent and comprehensive nursing care.
3. Developing hospital-level policies regarding complementary nursing care in type 2 DM patients who experience low ABI values by considering the results of this research as one of the references.

For Nursing Education

1. Includes material about complementary therapies that are often used, such as acupressure and therapy which has the same principles as the acupressure into the curriculum of nursing education and master's degree in nursing.
2. Building a cooperation program with health service fields in order to develop complementary therapy-based nursing practices, one of which is acupressure therapy and foot exercise.
3. Dissemformation and knowledge about complementary therapies such as acupressure and foot exercises through nursing seminars and workshops.

For Further Research

1. The need for further research on the effectiveness of acupressure and foot exercises on ABI values in type 2 DM patients with similar/equivalent respondent characteristics, for example,adding several acupressure points and using measuring instruments that have higher validity and reliability such as measurements made every time they intervene.
2. The need for further research about the effectiveness of acupressure and foot exercises on ABI values and foot sensitivity of type 2 DM patients.

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