SEKOLAH TINGGI ILMU KESEHATAN TELOGOREJO

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EFFECT OF FOOT EXERCISES ON INDEX BRACHIAL ANKLE VALUES IN PATIENTS WITH DIABETES MELLITUS

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ABSTRACT

Background *Diabetes Mellitus is a hereditary disease and a non-communicable disease which is always experiencing an increase in the number of patients. Diabetes Mellitus can cause complications of microangiopathy and macroangiopathy. One of the complications experienced by diabetes mellitus patients is neuropathy and peripheral arterial disease. One way to find out about circulation disorders is to carry out an Ankle Brachial Index (ABI) examination. One exercise to overcome vascular problems is diabetic foot exercises. Foot exercises are carried out with the aim of preventing complications of tissue damage in peripheral areas such as the feet and preventing complications such as diabetic ulcers. The aim of this study was to determine the effect of foot exercises on the Ankle Brachial Index value in Diabetes Mellitus patients.* ***This research method*** *uses quantitative research with a pre-experimental research type with a pre test-post test one group design approach.* ***The results of the statistical analysis*** *show that the sig (2 tailed) ABI value is 0.000 or <0.005 with an average change in the ABI value before and after 0.10, so from the results of the paired t test it is stated that Ho is rejected, which means there is an influence of leg exercises on ABI value.****Conclusion****, foot exercises can be an intervention that can be given by diabetes mellitus patients to prevent complications that can occur such as diabetic wounds because foot exercises will increase peripheral vascularization by increasing the ABI value.*

Keywords: Diabetes Mellitus, Foot Exercises, ABI Value

BACKGROUND

Diabetes Mellitus is one of the hereditary and non-communicable diseases that is constantly experiencing an increasing number of patients. *The International Diabetes Federation (IDF)* in 2021 stated that 537 million adults aged 20 - 79 years or 1 in 10 people are living with diabetes worldwide. This also makes *the International Diabetes Federation (IDF)* predict that there will be 44% of adults with undiagnosed diabetes, there are around 19.47 million diabetics in Indonesia. This figure makes Indonesia the country with the 5th highest number of diabetics in the world. (International Diabetes Federation, 2021).

Hyperglycemia in Diabetes Mellitus can result in complications of microangiopathy and macroangiopathy. Increased blood sugar levels will result in the appearance of chronic complications so that it has an impact on high morbidity. One of the complications experienced by patients with Diabetes Mellitus is neuropathy and Peripheral Artery Disease. The prevalence of the incidence of Diabetic neuropathy reaches 50%. Diabetic neuropathy is the third most common case of neurological disorders with an incidence of 54% out of 100,000 each year. Meanwhile, cases of Peripheral Artery Disease (PAP) have also increased. Currently, it is predicted that 202 million people in the world will experience PAP. In Indonesia, the prevalence of PAP reaches 9.7%. The risk of PAP increases in line with the severity and length

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of time the patient has experienced the disease. Complications that occur due to mechanical disturbances in the vascular or metabolic or both (Black, 2014) (Scott and Smith, 2016) (Ilminovia et al., 2015)

Early detection related to sensation problems is very necessary by means of a neurological examination. Neurological examination in patients with diabetes mellitus is a foot sensation examination, one of which is the *Ipswich Touch Test* which is a simple and non-instrumental method to perform an examination of diabetic feet. In addition to sensory disturbances, a decrease in circulation to the periphery is one of the things that can cause complications such as diabetic neuropathy, peripheral artery disease, and diabetic ulcers. (Switlyk & Smith, 2016). One way to find out circulation disorders is to carry out an Ankle Brachial Index (ABI) examination (Mangiwa et al., 2017). The results of the ABI measurement show the condition of blood circulation in the lower limbs which has a normal value limit of 0.90-1.3. This value is obtained from the comparative value of systolic pressure in the legs and hands (Mangiwa et al., 2017).

Prevention that can be done with the aim of overcoming peripheral vascularization and sensation problems in the pillar of DM management is included in non-pharmacological actions. One of the non-pharmacological actions that can be done is exercise. One of the exercises to overcome vascularity problems is Diabetic Foot Exercise. Foot exercises are done with the aim of preventing complications of tissue damage to peripheral areas such as the feet and preventing complications such as diabetic ulcers. Foot exercises can be done independently at home because it is a simple exercise. Foot exercises are performed so that circulation can increase and strengthen the small muscles of the legs as well as prevention of foot deformities, and can overcome the limited amount of insulin in diabetes mellitus. (Zheng et al., 2018).

RESEARCH METHODS

This study uses quantitative research with a pre-experimental research type with *a pre-test-post test one group design* approach by providing treatment to all respondents. In the treatment group, foot gymnastics intervention will be given (Scott, 2017) . This study was conducted to identify and measure the ABI value before and after the DM Foot Gymnastics intervention. The ABI value was measured before and after foot exercises were performed.The population in this study is all diabetes mellitus patients who underwent examinations at the Teling Manado Health Center with a total of 291 in September 2022.

The selection technique is with *the consecutive sampling technique*, which is the determination of the sample by selecting all the respondents encountered and in accordance with the criteria until the sample is sufficient. The formula for the sample size used in the study uses a formula for two *mean* independent groups The sample in this study totals 30 respondents. This research was conducted in the Teling Health Center Working Area. The research instrument uses (Ansori, 2022). *a calibrated Doppler ultrasound probe* and *spignomanometer* to measure ABI values and also uses observation sheets. Bivariate analysis was carried out after knowing the normality of the data of each variable. The normality test used *the Shapiro Wilk test* because the sample < 50. The result of data normality was obtained with a value of 0.006, which is < 0.05 which states that the data is distributed normally, so the test used is the Sample Paired T-Test.

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RESULTS AND DISCUSSION

Result

Univariate Analysis

1. Characteristics of Respondents by Gender (n:30)

Yes	Gender	Frequency	Percentage (%)
1	Male – Male	9	30
2	Woman	21	70
	Sum	30	100

Based on the results of the study, it was found that the majority of respondents were female, namely 21 (70%) and 9 male respondents (30%)

2. Characteristics of Respondents by Age (n:30)

Yes	Age	Frequency	Percentage (%)
1	Early Elderly (46-55)	8	26,6
2	Late Elderly (56-65)	19	63,3
3	Senior (65 and above)	3	10
	Sum	30	100

Based on the results of the study, it was found that the majority of respondents were in the late elderly (56-65), namely 19 respondents (63.3%) and the early elderly (46-55), namely 8 respondents (26.6%) and Seniors (65 and above), namely 3 respondents (10%)

3. Characteristics of Long Suffering Respondents (n:30)

No	Age	Frequency	Percentage (%)
1	< 5 Years	7	23,3
2	5 -10 Years	14	46,7
3	>10 Years	9	30
	Sum	30	100

Based on the results of the study, it was shown that the majority of respondents had long suffered from DM for 5-10 years, namely 14 respondents (46.7%), then suffered for a long time > 10 years, 9 respondents (30%) and long < 5 years, namely 7 (23.3%)

4. ABI value before DM foot exercise intervention (n:30)

Variabel	Mean	Min	Max	Std.Deviation
ABI Value Before	0.81	0.64	0.89	0.06135

Based on the results of the study, it was shown that the minimum ABI value before the foot gymnastics intervention was 0.64 and the maximum ABI value before the intervention was 0.89 with an average value of 0.81

5. ABI value after DM foot gymnastics intervention (n:30)

Variabel	Mean	Min	Max	Std.Deviation
ABI Value Before	0.92	0.63	1.03	0.09490

Based on the results of the study, it was shown that the minimum ABI value before the foot gymnastics intervention was 0.64 and the maximum ABI value after the intervention was 0.89 with an average value of 0.92

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Bivariate Analysis

Variabel	Mean	t	Sig 2 tailed
ABI Values Before and After	0.1053	8.853	0.000

The results of the study showed that the value of sig (2 tailed) ABI value was 0.000 or < 0.005 with an average change in the ABI value before and after 0.1, then from the results of the paired t test was shown to be Ho in rejection which means that there is an influence of foot gymnastics on the ABI value

Discussion

The results of the study showed that the majority of respondents were female. This is in line with a study conducted by Mangiwa, et al. (2017) at Pancaran Kasih Manado Hospital which stated that the respondents were female with a total of 17 respondents (56.6%). Guyton and Hall (2017) found that postmenopausal women's production of estrogen and progesterone hormones decreases, resulting in intolerable blood sugar levels, and a woman over the age of 40 may suffer from type II diabetes mellitus. It is stated that the risk of developing this disease is high. This is caused by an increase in blood sugar levels during pregnancy, otherwise called gestational diabetes, which can increase a woman's risk of developing type II diabetes, and the hormones estrogen and progesterone also play a role in regulating blood sugar levels in the body.

The results of the research were that the majority of respondents were at the final age stage (56-65), namely 19 respondents (63.3%). This is in accordance with the research of Trianto and Hastuti (2017), with respondents aged between 56 and 60 years old as 8 or 57.5% of respondents. This is in accordance with the findings of Smeltzer & Bare (2015) which explains the decline in organ function after the age of 45 which results in a decrease in the activity of insulin-producing pancreatic beta cells.

The results of this study show that the majority of respondents show a duration of 5-10 years. This is in accordance with the research of Wardani et al. (2018) the majority of perpetrators say they have suffered for more than 5 years. The length of time a person suffers from DM can aggravate the complications of diabetes. This is because blood sugar levels rise over a long period of time so that it damages the lumen of blood vessels and causes more tissue damage, one of which affects blood flow. vein. Glycemic control is essential to reduce the risk of microvascular complications in diabetic patients. Epidemiological analysis also shows that prolonged hyperglycemia is associated with a higher incidence of macrovascular complications (Clayton & Elasy, 2013; Vella & Petrie, 2015)

In this study, before being given an intervention in the form of foot exercises, the Ankle Brachial Index (ABI) measurement was first carried out using a doppler sphygmomanometer and then recorded on the observation sheet. The results were obtained from 30 respondents before foot gymnastics with a mean value of 0.81. The median ABI value before foot gymnastics shows at 0.9 mmHg. This shows that the Ankle Brachial Index (ABI) value in some respondents can still be within normal values. According to Maryunani (2015) the ABI test is one of the tests that can be used directly to examine the circulation of the arteries of the lower

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extremities. blood will be more susceptible to a decrease in ABI value. This is because patients do not know the development of blood sugar levels that can affect the occurrence of atherosclerosis, especially in the legs.

In this study, the respondents were then given foot gymnastics therapy. Foot exercise therapy was given 2 times in 1 week for 4 weeks for each respondent. After being given foot gymnastics therapy, then the respondents took measurements of the Ankle Brachial Index (ABI) again with a sphygmomanometer and doppler which were then written in an observation sheet. The results of the 30 respondents were obtained that the average ABI value after foot exercises was 0.92.This result shows that the respondent's ABI value can be interpreted as a normal value referring to the theory put forward by Carville (2012) in Maryunani (2015) which states that the ABI value is said to be normal if the ABI value is >0.9 – 1.2. This is in line with the research conducted by (Wahyuni, Aria & Arisfa, 2016) where in the results of the study the ABI value after foot exercises was obtained with an average ABI value of 0.93 with the normal category. In this case, it can be said that there is a difference in the ABI value or there is a change in the ABI value after foot exercises are performed. Leg movements during exercise are able to increase the secretion of endorphins which function as a decrease in high blood pressure or 60 increase blood pressure, especially systolic brachialis which is directly related to ABI values. Diabetic foot exercises are a therapy that is recommended to prevent complications because diabetic foot exercises can help improve blood circulation in the legs and strengthen the small muscles of the legs and prevent the occurrence of foot deformities (deformities).

The results of this study show that foot exercise exercises have an effect on ABI scores. Diabetic foot exercises can be used as an effective strategy for type II diabetic patients to avoid disease-related complications. The efficacy of exercises performed during foot exercise therapy has been associated with increased secretion of pain-relieving endorphins, vasodilation of blood vessels that lead to dysfunctional dilation of vessels, and effects in lowering blood pressure, especially brachial systolic pressure. , which is directly related to the value of ABI (Wahyuni, 2016). Exercising the legs relaxes the body and improves blood circulation, the muscles that contract during exercise increase blood flow, allowing the blood to carry more oxygen and nutrients to the body's cells and remove more toxins. (Natalia et al., 2012).

CONCLUSIONS AND SUGGESTIONS

Conclusion

The results of this study show that there is an effect of foot exercises on the value of ABI in patients with diabetes mellitus. Foot gymnastics is able to increase the value of ABI in patients with diabetes mellitus because the movements performed in foot gymnastics will increase vascularization in peripheral blood vessels so that it will increase blood circulation.

Suggestion

Foot gymnastics can be used as an intervention that can be applied to patients at Puskesmas or Hospitals to assist patients in preventing complications of diabetes mellitus such as diabetic wounds because foot gymnastics can increase the value of ABI as one of the indicators in increasing peripheral blood vessel circulation

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