

## The Effect Of Diabetic Foot Exercises On Lowering Blood Sugar Levels In Type II Patients In RSU Imelda Pekerja Indonesia Medan

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### ABSTRACT

Increased prevalence of type 2 Diabetes Mellitus in developed and developing countries so that it becomes a health problem or disease global on society. Therefore type 2 Diabetes Mellitus can be prevented by regular exercise, healthy and regular life. The objectives of this study are to: knowing the effect of foot gymnastics on changes in blood sugar levels in elderly people with type 2 diabetes mellitus at RSU Imelda Pekerja Indonesia Medan. This type of research is experimental with one group pre-post test. The population in this study was 30 elderly people with type 2 Diabetes Mellitus at RSU Imelda Pekerja Indonesia Medan. The samples in this study were all elderly people suffering from type 2 diabetes mellitus at RSU Imelda Pekerja Indonesia as many as 30 elderly. The sampling technique used is total sampling. The data collection method used observation sheets before and after foot gymnastics was given. The statistical test used in this study was Wilcoxon with a  $\alpha$  of 0.05. The results of the study found that there were changes in blood sugar levels before and after foot exercise with the mean before foot exercise was 182.80 mg / dl while the mean after foot exercise was 143.13 mg / dl. The results of Wilcoxon's analysis obtained a significance value of  $p\text{-value} = 0.000 < \alpha = 0.05$  meaning that there is an influence of foot gymnastics on changes in blood sugar levels of patients with type 2 diabetes mellitus at RSU Imelda Pekerja Indonesia Medan. From the results of foot exercise research can affect the decrease in blood sugar levels, besides that the age of respondents can also affect how often to do physical activity sports such as gymnastics every week.

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### INTRODUCTION

Diabetes Mellitus (DM) is one of the diseases that become a big problem for health such as heart disease because diabetes is often referred to as a silent killer. Diabetes mellitus comes from the Greek "diabainein" which means translucent or shower, while Mellitus comes from Latin which means sweet taste. In Indonesia, diabetes is often referred to as diabetes which is a metabolic disorder in the body that occurs due to many factors in the form of chronic hyperglycemia and impaired carbohydrate, fat and protein metabolism. Long-term complications include cardiovascular disease, chronic kidney failure, retinal damage can lead to blindness, as well as nerve damage that makes impotence and gangrene at risk of amputation (Lawiru, 2017).

According to the World Health Organization (WHO) World Health Organization in 2020 it is estimated that there are around 422 million people worldwide who suffer from diabetes mellitus and most of them come from low and middle income countries. The number of cases and prevalence of diabetes continues to increase every year due to diabetes and there are 1.6 million deaths directly linked to diabetes itself (WHO, 2020). According to the International Diabetes Federation (IDF), every 8 seconds there is a person in the world who dies from diabetes mellitus. Provinces with the highest prevalence of diabetes are DKI Jakarta, DI Yogyakarta, East Kalimantan, North Sulawesi, and East Java. People in the area need to pay more attention to their diet and activities so as not to get diabetes (Triwibowo, 2019).

According to data from the 2018 Basic Health Research (RISKESDAS), the prevalence of DM (Diabetes Mellitus) diagnosed by doctors in Indonesia is 2.0% and the highest prevalence of the disease is in DKI Jakarta 3.4%, East Kalimantan 3.0%, DIY 2.8%, and Central Java ranked 12th with 2.2% (Risksedas, 2018). According to Infodatin Diabetes Mellitus in 2020, Indonesia is ranked 7th out of 10 countries with the most people with diabetes mellitus, which is 10.7 million people (Ministry of Health of the Republic of Indonesia, 2020).

DM grouping can be done with pharmacological therapy and non-pharmacological therapy. Management of pharmacological therapy, namely insulin administration and oral hypoglycemic drug administration. While non-pharmacological 2 includes education, sports training, and diet (Aini and Ardiana, 2016). Physical exercise aims to increase insulin sensitivity, prevent obesity, improve blood flow, stimulate the formation of new glycogen, and prevent further complications (Hasdianah, 2012). Physical exercise is very important in the management of diabetes because its effect can lower blood glucose levels and reduce cardiovascular risk factors (Rumahorbo, 2014).

Foot gymnastics is an activity or exercise carried out by patients with diabetes mellitus to prevent injuries and help improve blood circulation in the legs. This leg exercise aims to improve blood circulation so that nutrients to the tissues are smoother, strengthen small muscles, calf muscles, and thigh muscles, and overcome joint motion limitations that are often experienced by diabetes mellitus patients (Wibisono, 2009 in Wibisana, 2017). This foot exercise is highly recommended for patients with diabetes mellitus, where this foot exercise aims to improve blood circulation, strengthen small muscles, prevent foot deformities, increase calf and thigh muscle strength, and overcome joint motion limitations (Widianti and Proverawati, 2010).

This diabetic foot exercise can be given to all patients with diabetes mellitus with type 1 and 2. However, it should be given since the patient is diagnosed with diabetes mellitus as an early preventive measure. The results of research conducted by Alfiyah and Virgianti (2010) in Wibisana (2017), about the effect of foot gymnastics on improving foot blood circulation in diabetes mellitus patients at RSU. IPI Medan. The results showed that before being given foot gymnastics treatment in diabetes mellitus patients, ABPI values were more than most experiencing mild arterial disease, namely 18 people (60%) and pulse, which was more than most experiencing bradycardia, which was 16 people (53.3%), and after being given foot gymnastics treatment, it increased, namely for ABPI values, most experienced normal blood circulation of 15.3 people (50%) and pulse more than most experienced normal pulse as much as 19 people (63.3%).

## METHOD

This research uses quantitative research methods with experimental research types. The design used in this study was one group pre test and post test design, where in this study compared the results of the foot gymnastics program intervention in the experimental group whose samples were observed first before being given treatment then after being given treatment the samples were observed again. (Nursalam, 2015). This study was conducted data collection on August 1 - August 30, 2022. The target population in this study was all hospitalized Diabetes Mellitus patients. The number of samples in the study was as many as 30 respondents. Independent Variable in this study is foot gymnastics and the dependent variable is the change in blood sugar levels.

This section contains the characteristics of respondents consisting of four questions which include age, gender, and education level, and the length of suffering from Diabetes Mellitus. The instrument used for independent variables is SOP. The dependent variable for the study was changes in blood sugar levels. The measuring instruments used for bound variables are Glukotest and SOP (Damayanti, 2015).

In conducting this research the procedures carried out are as follows:

1. Manage research permits to June – July 2022. by bringing a letter from Imelda University Medan.
2. After obtaining a research permit from RSU Imelda Pekerja Indonesia further equates the perception between researchers and research assistants including gymnastics movement procedures, goals, and time of foot gymnastics activities.
3. Provide explanations to prospective respondents about the purpose of research, research benefits, research procedures and if willing to become respondents are welcome to sign informed consent.
4. Explain the research time contract to respondents, which is according to a predetermined time.
5. Check respondents to check blood sugar before doing foot exercises
6. Document random blood sugar results on observation sheets.
7. Performing SOP fit foot gymnastics
8. Foot gymnastics is performed eight times in two weeks for 30 minutes.
9. Document the gymnastic movements performed by respondents on the Checklist sheet.
10. Ask respondents to check blood sugar after doing leg exercises.
11. Document random blood sugar results on observation sheets
12. Researchers process and analyze data.

The variables in this study are independent variables are foot gymnastics and dependent variables are blood sugar levels. The analysis in this study included name, age, education, occupation, history of suffering from DM, and the frequency of respondents in doing physical activity in one week (cycling, walking, swimming, gymnastics) and changes in blood sugar levels before and after foot gymnastics intervention. The requirements for the Paired T Test are that the samples used are interconnected, meaning that one sample will produce two data, normally distributed, ordinal scales, intervals, ratios, and paired samples. After analyzing the normality of the distribution of data, the results were abnormal, so the researchers used the Wilcoxon Sign Rank Test. The Wilcoxon Sign Rank Test is to test a treatment of a variable quantity that you want to study. Then researchers used the Shapiro Wilk normality test because the number of respondents was less than 30 respondents.

## RESULTS AND DISCUSSION

The average age of respondents in this study was  $44.00 \pm 5,067$  in the intervention group and  $44.13 \pm 4,784$  in the control group. Based on age grouping, respondents were in the age range of 35-54 years, namely 71.9% in the intervention group and 96.9% in the control group. Based on gender, respondents to this study were dominated by men, namely as much as 68.8% in the intervention group and 68.2% in the control group. Based on educational background, respondents graduated from high school as many as 71.9% in the intervention group and 7% in the control group. 81.3% of respondents were self-employed in the intervention group and 81.5% in the control group. Based on marital status, 90.6% were married in the intervention group and 87.5% in the control group. The largest tribe in this study came from the Batak tribe, which was 75.0% in the intervention group and 71.9% in the control group.

**Table 1.** Characteristics of research respondents

No.	Data	Intervention Group (n = 30)	
		F	%
1	Age	Mean: 44.00	SD : 5.607
	18-34 Years	4	12.5

	35-54 Years	21	71.9
	55-64 Years	5	15.6
<b>2</b>	<b>Sex</b>		
	Man	20	68.8
	Woman	10	31.3
<b>3</b>	<b>Education</b>		
	SMP	3	3.1
	SMA	25	71.9
	PT (Diploma / Bachelor)	2	25.0
<b>4</b>	<b>Work</b>		
	PNS	1	3.1
	Wiraswasta	22	81.3
	Housewives	2	6.3
	Not Working	3	9.4

**Table 2.** Blood Sugar Levels of Type 2 DM Patients Before doing foot exercises

Blood Sugar Levels	N	Mean	Median	Modus	SD	Min-Max
before gymnastics	30	182,20	189,00	170	28,207	117-230

Based on table 2 shows that blood sugar levels before and performed foot gymnastics with an average score of 182.80 mg / dl. The standard deviation value before foot gymnastics intervention was 28.207 mg/dl. And the minimum value before the foot exercise intervention was 117 mg / dl, while the maximum value before the intervention was 230 mg / dl.

**Table 3.** Blood Sugar Levels of Type 2 DM patients After doing foot exercises at RSU Imelda Pekerja Indonesia.

Blood sugar levels after foot exercises	N	Mean	Median	Modus	SD	Min -Max
	30	143,13	150,00	109	25,4445	99,182

Based on table 3 shows that blood sugar levels after foot exercise intervention with an average value of 143.13 mg / dl. The standard deviation value before foot gymnastics intervention was 25.445 mg/dl. And the minimum value after intervention became 99, while the maximum value after intervention became 182mg / dl.

**Table 4.** Analysis of the effect of foot gymnastics on reducing blood sugar levels RSU Imelda Pekerja Indonesia Medan

Blood Sugar Levels		N	Sig.
Blood sugar level score before-blood sugar level score after	Negative Ranks	30	,0000
	Positif Ranks	0	
	Ties	0	
	<b>Total</b>	<b>30</b>	

Based on the results of the analysis of blood sugar levels before and after the foot gymnastics intervention, it was explained that the negative ranks or the difference between the variables before and after the negative as many as 30 respondents suffering from type 2 diabetes mellitus or in other words there were 30 respondents decreased after the foot gymnastics intervention with a percentage of 100%. The Wilcoxon Sign Rank Test statistical test shows a value of  $p = 0.000 < \alpha = 0.05$ , this means

that  $H_0$  is rejected and  $H_a$  is accepted, meaning that there is a significant effect of foot exercise on changes in blood sugar levels in type 2 DM patients at RSU Imelda Pekerja Indonesia Medan.

## Discussion

### Blood Sugar Levels of Type 2 DM Patients Before Doing Leg Exercises

Blood sugar levels in patients with type 2 diabetes mellitus before foot gymnastics intervention at RSU Imelda Pekerja Indonesia Medan. The results of the study based on table 2 showed that the results of the study were conducted from 30 people, with blood sugar levels before being given foot gymnastics intervention with a mean or average of 182.80 mg / dl. The average blood sugar levels obtained in patients before the foot exercise intervention exceeded normal values by 8 people (26.7%) with blood sugar levels ranging from 200 mg / dl to 230 mg / dl, where normal values <200mg / dl. Blood sugar levels in this study exceeded 200 mg / dl. The results of the study based on age described in table 5.5 can be seen that the number of patients who do the most physical activity is 8 times in two weeks with a total of 30 respondents. Risk factors for diabetes mellitus include hereditary (genetic) factors, namely genetic factors can directly affect beta cells and change their ability to recognize beta cells and change their ability to recognize and disseminate insulin secretory stimulation. Obesity or overweight is overweight more than 20% of ideal body weight or BMI (Body Mass Index) more than 27 kg / m<sup>2</sup>.

Age factors at risk of suffering from type 2 DM are age over 30 years due to anatomical, physiological and biochemical changes. Blood pressure factor is someone who has high blood pressure (hypertension). Factors of insufficient physical activity cause insulin resistance in type 2 diabetes. Then the history factor of gestational diabetes, namely women who have a history of gestational diabetes or give birth to babies with a birth weight of more than 4 kg have a risk of suffering from type 2 DM Damayanti (2016). Physical activity carried out by a person will affect his blood sugar levels.

Increased use of glucose by muscles will increase when a person performs high physical activity. This is because endogenous glucose will be increased to keep sugar levels in the blood balanced. Under normal circumstances, the balance of blood sugar levels can be achieved by various mechanisms of the nervous system, glucose regulation and hormonal state. Another theory is that physical activity is directly related to the speed of muscle blood sugar recovery. When physical activity is done, the muscles in the body will react by using the glucose they store so that the stored glucose will decrease. In this situation there will be a muscle reaction where the muscles will take glucose in the blood so that glucose in the blood decreases and this can improve blood sugar control. These activities include gymnastics, walking, working Nurayati, et al (2017). Based on basic health research data in 2013, nationally the prevalence of DM was also found that the prevalence of DM according to sex characteristics with the age of 15 years and over in women tends to be higher than men.

Based on the results of measuring blood sugar levels of each patient, it was found that physical activity affects blood sugar levels in the blood because when someone does physical exercise, the body will increase the body's fuel needs by active muscles and complex body reactions include circulatory functions, metabolism and autonomic nervous system.

### Blood Sugar Levels of Type 2 DM Patients After Doing Leg Exercises

Blood sugar levels in patients with type 2 diabetes mellitus after being given foot gymnastics intervention at RSU Imelda Pekerja Indonesia Medan. The results of the study based on table 3 showed that the average value of blood sugar levels after foot exercise was 143.13 mg / dl average. Blood sugar levels after being given foot gymnastics intervention on average decreased whose blood sugar level values were lower than blood sugar levels before foot gymnastics intervention. The

difference in blood sugar levels before and after the foot exercise intervention was given an average value of 182.80 mg / dl and after the intervention the average value dropped to 143.13 mg / dl there was a decrease in the average value of 39.67 mg / dl.

When someone does physical exercise (gymnastics), the body will increase the body's fuel needs by active muscles and complex body reactions include circulatory functions, metabolism and autonomic nervous system. Where glucose is stored in the muscles and liver as glycogen, glycogen is quickly accessed to be used as an energy source in physical exercise (gymnastics) especially at some or the beginning of physical exercise (gymnastics) begins after doing physical exercise (gymnastics) 10 minutes, there will be an increase in glucose 15 times in ordinary needs. After 60 minutes it will increase up to 35 times (Damayanti, 2015). Where after a few minutes the body will compensate energy from fat. Physical exercise should be adjusted to age and physical fitness status (Damayanti, 2015). The decrease in respondents' blood sugar levels was also influenced by the achievement of good intensity during the gymnastics intervention.

The intensity of gymnastics can be assessed from the target pulse, blood pressure and blood glucose levels before and after gymnastics. This condition is in accordance with the concept that states exercise will be beneficial if it reaches optimal conditions, namely blood pressure after exercise is no more than 180 mmHg (Damayanti, 2015). The diagnosis of DM is established if the blood glucose level is <200mg/dL (Soegondo in Damayanti, 2015). After physical exercise in elderly patients is quite good if the blood glucose level is 100-199 mg / dL (Damayanti, 2015)

With exercise, foot exercises activate insulin bonds and insulin receptors in the plasma membrane so that they can reduce blood glucose levels. The benefits of physical exercise are lowering blood glucose levels by increasing glucose uptake by muscles and improving insulin use, improving blood circulation, and muscle tone, changing blood fat levels that increase HDL cholesterol levels and lowering total cholesterol and triglyceride levels.

### **The Effect of Foot Gymnastics on Lowering Blood Sugar Levels in Type 2 Diabetes Mellitus Patients at RSU Imelda Pekerja Indonesia Medan.**

The results of a study conducted by researchers on August 1-August 30, 2022, there were changes in blood sugar levels before and after foot exercise intervention. Researchers gave the gymnastics intervention 8x in two weeks. The results of these differences were obtained from the results of observation sheets conducted on patients with diabetes mellitus and then analyzed using statistical tests, so that there were results of differences in blood sugar levels before and after foot gymnastics intervention, namely before the intervention with an average value of 182.80 mg / dl and the value after the intervention average value of 143.13 mg / dl, so that there was a decrease in the average value of 39.67 mg / dl. This change shows that foot exercises affect blood sugar levels in people with diabetes mellitus. The effect of foot gymnastics on changes in blood sugar levels has been carried out statistical tests using the Wilcoxon Test at the level of meaning  $\alpha = 0.05$  with a value ( $\rho$ ) obtained of 0.000 with the help of spss 16. Because the value ( $\rho$ ) is smaller than the value ( $\alpha$ ),  $H_0$  was rejected  $H_a$  accepted so that there is a significant influence between foot gymnastics on changes in blood sugar levels in patients with diabetes mellitus.

This research is in line with research conducted by Damayanti (2015), when physical activity (gymnastics) insulin resistance decreases, when someone does physical exercise, the body will increase the body's fuel needs by active muscles and there are also complex body reactions including circulatory functions, metabolism and autonomic nervous system. Where glucose is stored in the muscles and liver as glycogen, glycogen is quickly accessed to be used as an energy source in physical exercise especially at some or the beginning of physical exercise begins after doing 10 minutes of physical exercise, there will be a 15 times increase in glucose in usual needs. After 60 minutes it will increase up to 35 times (Damayanti, 2015).

When exercise continues for more than 30 minutes, the main source of energy becomes free fatty acids derived from adipose tissue lipolysis. The availability of glucose and free fatty acids is regulated by various hormones, especially insulin, as well as catecholamines, cortisol, glucagon, and growth hormone (GH). During physical exercise glucagon secretion increases, as well as catecholamines to increase glycogenolysis, as well as cortisol which increases protein catabolism, liberating amino acids used in gluconeogenesis. All these mechanisms give rise to increased blood glucose levels. In type 2 DM, physical exercise plays a major role in regulating blood glucose levels. The main problem in type 2 diabetes is a lack of response to insulin (insulin resistance). The presence of these disorders causes insulin can not help the transfer of glucose into cells. Membrane permeability increases in contracting muscles so that during physical exercise insulin resistance decreases while insulin sensitivity increases. Regular physical exercise can improve the regulation of blood glucose levels and cells (Damayanti, 2015). The discussion above can be concluded that foot gymnastics on changes in blood sugar levels in people with diabetes mellitus has a significant influence on changes in blood sugar levels in people with diabetes mellitus.

### Research Limitations

In carrying out this study, researchers admit that there are many shortcomings and weaknesses that allow the existing results to be not optimal or cannot be said to be perfect. In conducting this study, researchers have research limitations, namely the accuracy of the diet that was not studied.

### CONCLUSION

Blood sugar levels in patients with type 2 diabetes mellitus before foot gymnastics intervention at RSU Imelda Pekerja Indonesia Medan averaged 182.80 mg/dl. Blood sugar levels in patients with type 2 diabetes mellitus after foot gymnastics intervention at RSU Imelda Pekerja Indonesia Medan averaged 143.13 mg/dl. There is an influence of foot gymnastics on changes in blood sugar levels in patients with type 2 diabetes mellitus at RSU Imelda Pekerja Indonesia Medan with a significant value  $p$  value = 0.000.

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