
Original Articles

THE EFFECT OF PHYSICAL ACTIVITY ON BLOOD SUGAR AND CHOLESTEROL LEVELS AMONG PEOPLE WITH DIABETES MELLITUS

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Abstract

Background: Diabetes mellitus is a chronic metabolic disorder characterized by hyperglycemia which can cause acute and chronic complications. Uncontrolled hyperglycemia could lead to high cholesterol that forms in fat metabolism to accumulate and threaten blood vessels. Physical activity is one of the pillars of diabetes mellitus management to reduce blood sugar and cholesterol.

Objective: This research aimed to determine the effect of physical activity on blood sugar and cholesterol levels in diabetes mellitus patients in the working area of Cakranegara Public Health Center.

Methods: This research is Quasi-experimental with one group pretest-posttest design without a control approach. The numbers of samples used in this research were 17 people, selected by purposive sampling technique. Data analysis used in this research were univariate and bivariate using Paired T-Test.

Result: Based on the Paired T-test analysis, it shows that physical activity was proven to have an effect in reducing blood sugar levels with a ρ -value of 0.000 (<0.05) and cholesterol with a ρ value of 0.000 (<0.05).

Conclusion: Based on the results, physical activity reduced blood sugar and cholesterol levels in patients with diabetes mellitus.

INTRODUCTION

Diabetes mellitus (DM), is one of the non-communicable diseases that will increase in number in the future (Soelistijo, 2021). Diabetes mellitus is a complex chronic disease involving abnormalities in carbohydrate, protein, and fat metabolism and macrovascular and neurological complications (AHA, 2019). In Diabetes mellitus, exercise plays a role in regulating blood glucose levels. The main problem in diabetes mellitus is the lack of response to insulin (insulin resistance) so that glucose cannot enter the cells. Physical exercise is helpful for blood sugar control and weight loss in Diabetes Mellitus type 2 (Prihanti et al., 2020).

Diabetes Mellitus occurs gradually and beware to the symptoms become particularly significant (Selano et al., 2020). Chronic complications arise when normal blood sugar levels are not maintained regularly. People with Diabetes Mellitus will probably experience diseases of the heart, blood vessels,

kidneys, eyes, and nerves diseases. The complications can be prevented by controlling blood sugar levels, maintaining normal blood pressure, and regular exercise (Rusli, 2015). In addition to elevated blood sugar levels, increased cholesterol can also appear. Cholesterol is a fatty substance that circulates in the blood. Cholesterol is produced by the liver and is indispensable to the body. However excess cholesterol will cause problems, especially in the blood vessels of the heart and brain. There are two types of cholesterol produced, namely HDL and LDL. When excess LDL cholesterol in the blood is deposited on the walls of blood vessels HDL cholesterol cleans blood vessels from excessive LDL cholesterol. In Diabetes Mellitus sufferers, if insulin levels are reduced in the blood, then blood sugar cannot be processed into energy, as a result of which blood glucose levels will increase excessively. Glucose that increases excessively will damage blood vessels because sugar cannot be processed into energy in diabetes mellitus sufferers. Then energy will be made from sources such as protein and fat. As a result, the cholesterol-formed metabolized fat will accumulate and threaten blood vessels. In patients with diabetes mellitus, fat deposits (cholesterol) will be stored in the cell wall, reducing the number of insulin receptors. In contrast, insulin receptor cells cannot capture sugar and cause blood glucose to be high (Imelda, 2019).

In patients with diabetes mellitus exercising or doing physical activity walking as a regulator of blood glucose levels, insulin production generally does not depend mainly on the beginning of the patient with Diabetes Mellitus. Lack of receptors on insulin becomes a significant problem in diabetes mellitus. Because of this disorder, insulin cannot help the transfer of glucose into cells. When exercising, insulin resistance is reduced. On the contrary, if insulin sensitivity increases, it causes the need for insulin in diabetes mellitus to decrease. This response only occurs every time exercising and is not have a persistent and long-lasting effect. Therefore, for people with diabetes mellitus, exercise must be done regularly (Nurayati & Adriani, 2017).

Doing physical activity causes muscle contractions mainly of the lower extremity muscles. As a result, insulin and exercise work together to increase muscle glucose uptake through translocation glucose transporter 4. Insulin provides signals that cause phosphorylation to insulin receptors, insulin receptor substrate-1/2 in tyrosine residues and activation of phosphatidylinositol 3-kinase (Stanford & Goodyear, 2014). The influence of physical activity or exercise is directly related to the increase muscle glucose recovery speed (how much muscle takes glucose from the bloodstream). When exercising, muscles use glucose stored in the muscles, and when glucose is reduced, the muscles fill the void by taking glucose from the blood. This process will decrease blood glucose, increasing blood glucose control (Barnes, 2012). Physical exercise such as walking also affects the body, namely losing weight. Fat and carbohydrate were burned during physical exercise, cardiovascular function and respiration improved, the heart's effectiveness increased, and lung capacity increased. Physical exercise also lowers low-density lipoprotein (LDL) cholesterol and increases high-density lipoprotein or lowers low-density lipoprotein (LDL). Increasing high-density lipoprotein (HDL) can prevent coronary heart disease. HDL stimulates epinephrine and non-epinephrine hormones to reduce blood pressure, reduce

the need for oral medicine and insulin, and prevent early diabetes mellitus, especially for people with a family history of diabetes mellitus or those who fall into the pre-Diabetes mellitus. Physical exercise will be useful when done correctly and regularly (ADA, 2018). The results of a preliminary study on 9 February 2019 at the Cakranegara Public Health Center found 76 people suffering from Diabetes Mellitus. Ten people with Diabetes Mellitus who were taken randomly found that 6 out of 10 people had blood sugar levels above the standard limit of 200-255 mg/dL and cholesterol of 343, and 4 had normal blood sugar levels of 130-140 mg/dL.

People with Diabetes Mellitus must manage by themselves. People with Diabetes Mellitus only do medical management by taking medication and rarely do activity. The formulation of the problem in this study is "Is there an Effect of Physical Activity on Blood Sugar and Cholesterol Levels in Diabetes Mellitus Patients?".

METHODS

Study Design

This study used a Quasi-Experimental Design with a pre and post-test without a control approach --- the study's design where the subjects of the study only intervened without comparison.

Settings

This research was conducted at Cakranegara Public Health Center in 2019.

Research subject

The population in this study was all people with diabetes mellitus in the Cakranegara Puskesmas Working Area in 2019 which amounted to 37. Meanwhile, the sample of some patients with diabetes mellitus was taken purposively as many as 17. The inclusion criteria in this study were people with diabetes mellitus who were in the working area of the Cakranegara Public Health Center in Mataram, aged 40-50 years, with blood sugar levels when respondents >200 mg/dl and cholesterol <200 mg/dl and did not take medicine.

Instruments

The preliminary data (*pre-test*) of blood sugar and cholesterol levels to the control group 1 day before carrying out physical activity walking with a Glucometer and Test Strip measuring instrument.

Data collection

Providing treatment in the form of physical activity walking within 30 minutes is carried out three times a week for four weeks. Blood sugar and cholesterol checks were carried out one day before the intervention. The post-test of blood sugar and cholesterol levels in the control group was conducted one day after the 12th intervention --- the effect of physical walking on blood sugar and cholesterol in Diabetes Mellitus patients.

Data Analysis

After collecting data, the statistical test used Paired T-Test with a confidence level of 95%.

Ethical Consideration

This research has received approval from STIKES Yarsi Mataram and the Health Office of Mataram City.

RESULTS*Characteristics of Respondents*

Table 1. Distribution Frequency of Respondents based on Age, Gender, Religion, and Long Suffering from Diabetes Mellitus in the Working Area of Cakranegara Public Health Center in 2019 (n=17).

Characteristic of Respondents	Frequency (f)	Percentage (%)
Age		
41 – 50 years	14	82.4
51 – 60 years	3	17.6
Total	17	100.0
Gender		
Male	2	11.8
Female	15	88.2
Total	17	100.0
Religion		
Islam	15	88.2
Hindu	2	11.8
Total	17	100.0
Duration of DM		
< 1 year	6	35.3
1 – 5 years	11	64.7
>5 years	0	0.0
Total	17	100.0

Sources: Primary Questionnaire, 2019.

Table 1 shows that the majority of the respondents' age was 41-50 years, with as many as 14 respondents (82.4%). Most respondents were female, with many as 15 respondents (88.2%) and male as many as two respondents (11.8%). Most of the respondents were Muslim as many as 15 respondents (88.2%) and were Hindu were as many as two respondents (11.8%), and 11 respondents (64.7%) had the most extended duration of DM, namely 1-5 years and the least, less than 1 year, 6 respondents (35.3%).

Distribution Frequency of Blood Sugar and Cholesterol Levels before Doing Physical Activity Walking

Based on table 2 below, it can be seen the difference in blood sugar and cholesterol levels before walking physical activity. The average blood sugar level value is 294.8 mg/dl. Meanwhile, the average cholesterol level before walking physical activity in diabetes mellitus patients was 286.4 mg/dl.

Table 2. Distribution Frequency of Blood Sugar and Cholesterol Levels before Physical Activity Walking in Cakranegara Public Health Center’s Working Area in 2019 (n=17).

Variable	Mean	SD	Min	Max	N
Pre-Test blood sugar	294.8	36.7	1	16	17
Pre-Test cholesterol	286.4	54.2	0	17	17

Sources: Primary Questionnaire, 2019.

Distribution Frequency of Blood Sugar and Cholesterol Levels after Doing Physical Activity Walking

Based on table 3 below, it can be seen that the difference in blood sugar levels after physical activity walking is on average 163.8 mg/dl. Meanwhile, cholesterol levels after physical activity walking are 205.4 mg/dl on average.

Table 3. Distribution Frequency of Blood Sugar and Cholesterol Levels after Physical Activity Walking in Cakranegara Public Health Center’s Working Area in 2019 (n=17).

Variable	Mean	SD	Min	Max	N
Post-Test blood sugar	163.8	33.1	1	17	17
Post-Test cholesterol	205.4	41.0	0	14	17

Sources: Primary Questionnaire, 2019.

Examination of the Effect of Physical Activity Walking on Blood Sugar and Cholesterol Levels among People with Diabetes Mellitus using Paired T-Test

Table 4. The Analysis of the Effect of Physical Activity Walking on Blood Sugar and Cholesterol Levels among People with Diabetes Mellitus in the Working Area of Cakranegara Public Health Center using Paired T-Test.

Variable	Action	Mean	SD	Dif.Mean	p-value
Blood sugar levels	Pre-test	294.8	36.7	131	0.000
	Post - test	163.8	33.1		
Cholesterol levels	Pre-test	286.4	33.1	81	0.000
	Post - test	205.4	54.2		

Sources: Primary Questionnaire, 2019.

Based on table 4, the paired T test obtained the effect of walking physical activity on blood sugar and cholesterol levels in diabetes mellitus sufferers with p -value = 0.000 ($p < 0.05$). The statistics result shows that there is an influence of physical activity walking on reducing blood sugar and cholesterol levels in Diabetes Mellitus patients. The H_0 fails to be rejected, meaning that walking has an effect on reducing blood sugar and cholesterol levels in diabetes mellitus patients in the working area of the Cakranegara Public Health Center in Mataram City.

DISCUSSION

The results showed influence of physical activity walking on reducing blood sugar and cholesterol levels among people with diabetes mellitus. Research conducted by Putri Indriana (2018) supports this result. The study entitled the effect of walking physical activity on cholesterol levels of DM patients at the Sigli City Health Center, Pidie Regency. Pre-experimental research with one group pre and posttest involved 40 respondents. The research results show the effect of walking on cholesterol levels with p -value = 0.000 (> 0.05). Supported by Indriana's research (2018), a study entitled the effect of physical activity walking on the cholesterol levels of diabetes mellitus patients in the health center of Sigli city of Pidie district. The pre-experiment study with pre and posttest one group involved 40 respondents. The study's results showed the effect of walking on cholesterol levels with p -value = 0.000 (> 0.05). What was found during the study found by researchers that the decrease in blood sugar and cholesterol levels was caused by respondents obeying in carrying out physical activities walking for 10-15 minutes carried out 3 times a week for 4 weeks. Based on the explanation above, it can be concluded that adherence to physical walking activities can reduce blood sugar and cholesterol levels in Diabetes Mellitus patients. They consider that regular doing physical walking activities can reduce blood sugar and cholesterol levels because previously blood sugar and cholesterol levels were still high.

Walking as a sport has health benefits according to (WHO, 2018) namely physical health and spiritual health and social well-being not only free from disease or weakness, Kuntaraf and Kathleen LK said in their book. Exercise has many benefits, one of which is: Therapy for people with diabetes mellitus, diabetes is a disease that arises due to insulin production. Receptor cells that cannot capture insulin cause sugar production to increase. Exercising the catching sensitivity level can increase and run normally so that cells are sensitive to insulin. It should be noted that diabetics can only do light exercise, so walking is suitable for people with Diabetes Mellitus.

LIMITATION

This study limitations: That only provides treatment to the intervention group.

CONCLUSION

Compliance with walking physical activity can reduce blood sugar and cholesterol levels in DM patients. They think that regular physical activity walking can lower blood sugar and cholesterol levels because previously, their blood sugar and cholesterol levels were still high.

AUTHOR CONTRIBUTION

Marthilda Suprayitna: Literature review, conceptualization, methodology, investigation, resources, formal and statistical analysis, writing-original draft validation, project administration, and manuscript drafting.

Baiq Ruli Fatmawati: Literature review, conceptualization, methodology, and manuscript drafting.

Kurniati Prihatin: Literature review, conceptualization, methodology, and manuscript drafting.

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Marthilda Suprayitna : None.

Baiq Ruli Fatmawati : None.

Kurniati Prihatin : None.

CONFLICT OF INTEREST

There is no conflict of interest in this study.

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