

PHYSICAL ACTIVITY CORRELATION WITH BLOOD SUGAR LEVELS IN DIABETES MELLITUS TYPE 2 PATIENT

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ABSTRACT

Data of World Health Organization (WHO) until September 2012 showed a tendency to increase the incidence rate and the prevalence of type 2 DM which is large enough in the year ahead. It is estimated that DM sufferers around the world reached 347 million people and more than 80%. The habit of doing physical activity and exercise affects blood sugar levels. Diabetes mellitus disease is characterized by high levels of blood glucose. This research aims to determine if there is a physical activity correlation with blood sugar levels in patients with diabetes mellitus type 2 in Cimandala Village area in 2019.

This type of research is quantitative analytic with cross sectional design and implemented in Cimandala Village area on 29 August – 31 August 2019 with population number 80 and total number of 40 respondents using Purposive sampling technique. The instruments used are questionnaire sheets and observation sheets.

Univariate analysis was discovered for a variable physical activity of 40 respondents who had a heavy activity of 25 people (62.5%), an activity of 8 people (20.0%), and a light activity of 7 people (17.5%). For the results of the analysis of univariate blood sugar content 100-199 as much as 25 people (62.5%) and > 200 as many as 15 people (37.5%).

It is known that from 40 respondents were able to do heavy activities with 19 respondents (47.5%) With blood sugar level 100-199 in patients with diabetes mellitus type 2. Based on the Statistical test table sufficient analysis of the acquired P Value = 0.028 then P, Value of $< \alpha$, so H_0 rejected which means that the statistical test indicates there is a correlation of physical activity with blood sugar levels in patients with Diabetes Mellitus type 2 in Kelurahan Cimandala year 2019.

Physical activity performed by a person can tighten the sensitivity of insulin receptors so that glucose can be converted into energy through metabolism. One of the benefits of physical activity is to lower blood sugar levels in people with diabetes mellitus.

Keywords : activity, sugar levels, Diabetes

INTRODUCTION

In line with the changing times, the pattern of disease in Indonesia has shifted from infectious diseases and malnutrition to degenerative diseases, one of which is diabetes mellitus.¹ Diabetes mellitus is a group of diseases metabolic characterized by hyperglycemia that occurs due to abnormalities in insulin secretion, insulin action, or both.² Diabetes is a dangerous disease that attacks all members of the body.

Indonesia is one of the 10 countries with the highest number of diabetics. Indonesia was ranked 7th in 1995 and is predicted to rise to 5th place in 2025 with an estimated number of sufferers of 12.4 million.³

Diabetes mellitus is a chronic disease characterized by blood glucose levels greater than normal (≥ 200 mg / dL).⁴ If left uncontrolled, this disease will cause diseases that can be fatal, such as heart disease, kidney disease, blindness, and amputation. Data from the World Health Organization (WHO) until September 2012 shows a fairly large trend of increasing incidence and prevalence of type 2 diabetes mellitus in the coming years. It is estimated that DM sufferers worldwide reach 347 million people and more than 80% of these cases occur in countries that have low and medium income per capita, including Indonesia.⁵

WHO predicts an increase in the number of diabetes mellitus sufferers in Indonesia from 8.4 million in 2000 to around 21.3 million in 2030. The International Diabetes Federation (IDF) in 2009, also predicts an increase in the number of people with diabetes mellitus from 7.0 million in 2009 to 12.0 million in 2030. Although there are differences in the incidence rate, the second report shows an increase in the number of people with diabetes mellitus by 2-3 times in 2030.³ Based on data from the Indonesian Central Statistics Agency in 2003, it is estimated that Indonesia's population aged over 20 years as many as 133 million people. The prevalence of diabetes mellitus in Indonesia ranges from 1.4 to 1.6% except in two places, namely in the Pekajangan area 2.3% and in Manado 6%.⁶

Most of the risk factors for diabetes mellitus are an unhealthy lifestyle such as lack of physical activity, unhealthy and unbalanced diet and obesity. Therefore, the most important thing from controlling diabetes mellitus is controlling risk factors. An important goal of diabetes mellitus management is to restore metabolic disorders so that all metabolic processes return to normal.³

The habit of doing physical activity and exercise will affect blood sugar levels. Diabetes mellitus is characterized by high blood glucose levels. In patients with diabetes mellitus, activities sedentary should be avoided such as watching television, using the internet, and sitting relaxed. Increased high physical activity such as brisk walking, cycling and muscle training is recommended. Exercise physical Regular aerobic in people with diabetes can improve insulin sensitivity and decrease cardiovascular risk. Walking, cycling, jogging, and swimming are aerobic exercises.

The number of diabetes mellitus sufferers is growing so fast, so many studies have been carried out aimed at reducing the number of sufferers and minimizing the impact of complications of diabetes mellitus which are closely related to blood sugar levels that are too high and can lead to death. Handling steps to minimize complications of type 2 diabetes mellitus can be done in various ways. One of them is by controlling the four main pillars in the form of education, food planning, physical exercise, and pharmacological interventions.

RESEARCH METHOD

The research design is the final result of a stage of decisions made by the researcher regarding how the research can be applied. The approach taken is *cross sectional*, which is a study to study the dynamics of the correlation between risk factors and effects, by approaching, observing or collecting data at once. The correlation in this method that will be examined is the relationship between physical activity and blood sugar levels in type 2 diabetes mellitus patients.⁷

This research was conducted in Cimandala Village, on the elderly suffering from diabetes mellitus accompanied by obesity. The reason for conducting this study was that there had never been a similar study regarding physical activity with blood sugar levels in patients with type 2 diabetes mellitus in Cimandala Village.

Population is the whole object of research or object under study.⁷ The population in this study was 80 respondents who suffered from type 2 diabetes mellitus in Cimandala Village in 2019.

Data processing and data analysis were computerized using the SPSS program *for windows*. The analysis consisted of univariate and bivariate analyzes.

RESEARCH RESULTS

This research was conducted in Cimandala Village in 2019. With primary data, questionnaires were distributed and blood sugar levels were measured to residents of Cimandala Village. This research was conducted on 29 August - 31 August 2019. This study aims to determine the relationship between physical activity and blood sugar levels in type 2 diabetes mellitus patients. The variables studied included physical activity (independent variable) and blood sugar levels (dependent variable). Respondents in this study were residents of Cimandala Village. The measuring instruments used were questionnaires and checking blood sugar levels by collecting data from 40 respondents. This research used method *quantitative analytic* with approach *cross sectional*, the sampling technique used was *purposive sampling technique*. After going through data collection, the next step is to find out the results of the research, the data processing is carried out, then the Univariate and Bivariate analysis are carried out. Univariate analysis is presented in the form of a frequency distribution which includes physical activity in Cimandala Village in 2019 and type 2 diabetes mellitus in Cimandala Output in 2019. Furthermore, bivariate analysis will be analyzed to determine the relationship between physical activity and blood sugar levels in type 2 diabetes mellitus patients.

Table 1
Frequency Distribution of Physical Activity in Patients with Type 2 Diabetes Mellitus

No	Physical Activity	Frequency	Percentage (%)
1	Heavy	25	62.5%
2	Moderate	8	20.0%
3	Mild	7	17.5%
Total		40	100%

Based on table 1 the frequency distribution of physical activity in type 2 diabetes mellitus patients in Cimandala Village in 2019 from 40 respondents, the results obtained were 25 respondents (62.5%) doing strenuous physical activity in type 2 diabetes mellitus patients.

Table. 2
Frequency Distribution of Sugar Levels Blood in Type 2 Diabetes Mellitus Patients

No	Blood Sugar Levels	Frequency	Percentage (%)
1	Normal	25	62.5%
2	Abnormal	15	37.5%
Total		40	100%

Based on table 2 the frequency distribution of blood sugar levels in type 2 diabetes mellitus patients in Cimandala Village in 2019 from 40 respondents, the results obtained were 25 respondents (62.5%) had normal blood sugar levels.

Table 3
Analysis of the Relationship between Physical Activity and Blood Sugar Levels in Patients Type 2 Diabetes Mellitus

Physical Activity	Blood Sugar Levels				Total	<i>P Value</i>	
	Normal		Abnormal				
	F	%	F	%	F		%
Weight	19	47.5%	6	15.0%	25	62.5%	0.028

Moderate	3	7.5%	5	12.5 %	8	20.0%
Mild	3	7.5%	4	10.0%	7	17.5%
Total	25	62.5%	15	37.5%	40	100%

Based on table 3 of the results of the bivariate analysis regarding the relationship between physical activity and blood sugar levels in type 2 diabetes mellitus patients in Cimandala Village in 2019, it is known that of the 40 respondents, it was found that doing strenuous activity with 19 respondents (47.5%) with normal blood sugar levels in patients with type 2 diabetes mellitus. Based on the statistical test of the bivariate analysis table, it was obtained *P Value* = 0.028 and $\alpha = <0.05$ then *P Value* $<\alpha$, so that H_0 is rejected, which means that the statistical test shows that there is a relationship between physical activity and blood sugar levels in Type 2 Diabetes Mellitus Patients in Cimandala Village in 2019.

DISCUSSION

a. Physical Activity in Type 2 Diabetes Mellitus Patients

Physical activity is any movement of the body with the aim of increasing and releasing energy or energy. Physical activity plays a role in controlling the body's blood sugar by converting glucose into energy.⁸

Lack of physical activity and obesity are the most important factors in the incidence of diabetes mellitus worldwide.⁹ According to WHO what is meant by physical activity is an activity of at least 10 minutes without stopping by doing light, moderate and heavy activities. Strenuous activity is body movement that causes a lot of energy expenditure (calorie burning) so that breathing is much faster than usual. For example lifting water, climbing, walking fast, lifting weights, cutting down trees. moderate activity is a movement of the body that causes a large expenditure of energy or in other words, a movement that causes the breath to be slightly faster than usual. For example household chores (washing clothes by hand, mopping). While examples of light activities are walking and office work such as typing. In other words, physical activity is any movement of the body that increases energy expenditure and energy burning. Physical activity is categorized as sufficient if a person does physical exercise or exercise for 30 minutes every day or at least 3-5 days a week.¹⁰

Physical activity and regular exercise are very important in addition to avoiding obesity, as well as preventing diabetes mellitus. When moving, the muscles use more glucose than when they are not moving. Thus the blood glucose concentration will decrease through exercise / physical activity, insulin will work better, so that glucose can enter the muscle cells to be burned.¹¹

Based on table 1 of the frequency distribution of Physical Activity in Type 2 Diabetes Mellitus Patients in Cimandala Village in 2019, from 40 respondents, 25 respondents (62.5%) performed strenuous activities.

From the research results that are in line with the research Anita Astuti 2017 with the title "The effect of physical activity on blood sugar levels in diabetes mellitus patients in the internal medicine clinic of Jombang Hospital". This study used approach *cross-sectional* with a sample of 83 respondents with type 2 diabetes mellitus in the general hospital in Jombang area who were taken by *consecutive sampling technique*. It is known that there were 42 respondents with heavy physical activity (50.6%) where 42 respondents (15.7%) had low blood sugar levels and 28 respondents (33.7%) had high blood sugar levels. Data were analyzed using the SPSS for Windows program. The result of the *Spearman Rank Pearson* correlation test showed that the value of $p = 0.000$. Then the results obtained H_1 are accepted and H_0 is rejected There is an effect of physical activity on blood sugar levels in diabetes mellitus in the internal disease clinic room of Jombang Regional Hospital, Jombang Regency.

So the conclusion from the results of theory and research can be concluded that physical activity weight will affect the decrease in blood sugar levels because when exercising the muscles use blood sugar levels stored in the muscles and if the sugar is reduced, the muscles fill the void by taking sugar levels from the blood. This will result in decreased blood sugar levels thereby improving blood sugar levels.

b. Blood Sugar Levels in Type 2 Diabetes Mellitus Patients

Blood sugar (glucose) levels are levels of sugar found in the blood which are formed from carbohydrates in food and stored as glycogen in the liver and skeletal muscles. Blood sugar levels are the main energy source for body cells in muscles and tissues.¹²

Factors that affect blood sugar levels are internal and external factors. Internal factors, such as disease and stress, obesity, food, physical activity, treatment either with tablets or with insulin. Meanwhile, external factors include education, knowledge, closeness and exposure to information sources.

The benefits of physical exercise or exercise as diabetes mellitus therapy have long been recognized as one of the efforts to overcome diabetes mellitus in addition to medication and diet.⁸ Physical exercise can increase tissue sensitivity to insulin. In type 1 diabetes mellitus, the increase in tissue sensitivity to insulin can reduce the need for insulin, whereas in type 2 diabetes mellitus the increase in tissue sensitivity is very important in the regulation of blood glucose levels.

Based on table 2 of the frequency distribution of blood sugar levels in type 2 diabetes mellitus patients in Cimandala Village in 2019, from 40 respondents, it was found that 25 respondents (62.5%) had normal blood sugar levels.

This research is in line with research conducted by Cicilia L, Wulan PJ Kaunang, Fima LFG Langi. about "the relationship between physical activity and the incidence of diabetes mellitus in outpatients at the Bitung City Hospital 2018". The research design used by researchers in this study was an analytic survey with approach *cross sectional*. Shows that the incidence of diabetes mellitus with moderate physical activity with the incidence of diabetes mellitus there were 13 respondents (28.2%) while those without diabetes mellitus with moderate physical activity were 33 respondents (71.8%). With a normal blood level interval 80-190 mg / dl. Based on the test, the results obtained were *p value* = 0.026, which means that there is a relationship between physical activity and the incidence of diabetes mellitus in patients who are hospitalized in the internal poly with a significance value of $\alpha = 0.05$.

From the results of the study, it can be concluded that between the theory and the results of research that those affecting blood sugar levels in type 2 diabetes mellitus patients in the Cimandala village area in 2019 get disease and stress can change diet, exercise, use of drugs that are usually obeyed and this causes hyperglycemia, obesity can cause insulin receptors on target cells throughout the body to be less sensitive and the number is reduced so that insulin in the blood cannot be utilized, a balanced diet as needed can maintain blood sugar levels close to normal values, physical activity can increase tissue sensitivity to insulin , treatment with tablets or with insulin can stimulate pancreatic beta cells to secrete insulin or reduce glucose absorption in the intestine so as to reduce glucose levels in the blood.

Education for the public to carry out physical activities so that they can control blood glucose levels to remain stable, good knowledge of diabetes mellitus can restore blood glucose levels, many sources of information about diabetes mellitus can increase patient knowledge so that patients can take appropriate action.

c. The Relationship between Physical Activity and Blood Sugar Levels in Type 2 Diabetes Mellitus Patients in Cimandala Village in 2019

In type 2 diabetes mellitus, exercise plays a role in regulating blood glucose levels. The main problem in type 2 diabetes mellitus is a lack of response to insulin (insulin resistance) so that glucose cannot enter the cells. The permeability of the membrane to glucose increases when the muscles contract because the muscle contracts insulin-like properties. Therefore, during physical activity such as exercise, insulin resistance decreases. Physical activity in the form of exercise is useful for controlling blood sugar and weight loss in type 2 diabetes mellitus.¹³

The major benefits of physical activity or exercise in diabetes mellitus include lowering blood glucose levels, preventing obesity, taking part in overcoming complications, blood lipid disorders. and increased blood pressure.¹³

Another theory states that physical activity is directly related to the speed at which muscle blood sugar recovers. When physical activity is carried out, the muscles in the body will react by using the stored glucose so that the stored glucose is reduced. In this situation there will be a muscle reaction in which the muscles will take up glucose in the blood so that glucose in the blood decreases and this can improve blood sugar control.

From the results of bivariate analysis regarding the relationship between physical activity and blood sugar levels in patients with type 2 diabetes mellitus in the cimandala village. It is known that of the 40 respondents, it was found that doing strenuous activity with 19 respondents (47.5%) with normal blood sugar levels in patients with type 2 diabetes mellitus. Based on the statistical test, the bivariate analysis table was obtained $P Value = 0.028$ and $\alpha = <0.05$ then $P Value < \alpha$, so that H_0 is rejected, which means that the statistical test shows that there is a relationship between physical activity and blood sugar levels in diabetes mellitus patients in the cimandala village in 2019.

This research is in line with the research conducted by Nurayati and Adriani Merryana 2017 conducted a study entitled The relationship of physical activity with fasting blood sugar levels in type 2 diabetes mellitus. This study used a design *cross sectional* with a study sample of 62 people. Collecting data with structured interview guides and questionnaires. Blood samples were taken using the spectrophotometer method by the medical analyst of the Mulyorejo Health Center laboratory. The analysis was performed using the test *Spearman's Rho statistical*. The results showed that 62.9% of respondents had heavy physical activity and 58.0% of respondents had low fasting blood sugar levels. The results showed that there was a relationship between physical activity and fasting blood sugar levels in type 2 diabetes mellitus sufferers ($p = 0.000$).

From the results of the study, it can be concluded between theory and research that physical activity with blood sugar levels in type 2 diabetes mellitus patients in Cimandala Village in 2019. It is known that of the 40 respondents, it was found that doing strenuous activity with 19 respondents (47.5%) with sugar levels 100-199 blood in patients with type 2 diabetes mellitus totaled 6 respondents (15.0%). Based on the statistical test of the bivariate analysis table, it was obtained $P Value = 0.028$ and $\alpha = <0.05$, then $P value < \alpha$, so that H_0 was rejected, which means test statistics show that there is a relationship between physical activity and blood sugar levels in type 2 diabetes mellitus patients in the Cimadala village in 2019.between physical activity and blood sugar levels in Type 2.

CONCLUSION

1. Based on the results of the frequency distribution of Physical Activity in Type 2 Diabetes Mellitus Patients, there were 25 respondents (62.5%) who did strenuous activities.
2. Based on the results of the frequency distribution of Blood Sugar Levels in Type 2 Diabetes Mellitus Patients, it is known that 25 respondents (62.5%) had normal blood sugar levels of 100-199.
3. Based on the results of bivariate analysis regarding the relationship between physical activity and blood sugar levels in patients with type 2 diabetes mellitus in the cimandala village. It is known that of the 40 respondents, it was found that doing strenuous activity with 19 respondents (47.5%) with normal blood sugar levels in type 2 diabetes mellitus patients. Based on the statistical test of bivariate analysis tables, it was obtained $P Value = 0.028$ and $\alpha = <0.05$ then $P value < \alpha$, so that H_0 is rejected, which means that the statistical test shows that there is a relationship between physical activity and blood sugar levels in patients with type 2 diabetes mellitus.

SUGGESTIONS

Based on the results of this study, there are several suggestions that the researcher can convey, including:

- a. For Science
The research results obtained are expected to add references to related research and also as a comparison material that will be carried out afterwards
- b. For Cimandala Village
Based on the results of the study, it was found that the relationship between physical activity and blood sugar levels in Type 2 Diabetes Mellitus Patients in Cimandala Village in 2019 has been carried out well.

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