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Analysis of the Relationship of Blood Glucose Levels with Total Cholesterol and Age of Diabetes Mellitus Patients

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Abstract

Background: One of the chronic complications of diabetes mellitus is fat metabolism disorders. The occurrence of dyslipidemia is a major disorder of fat metabolism in people with diabetes mellitus. Indonesia also faces a diabetes threat situation similar to the world. **Objective**: The objective of this study was to analyze the relationship between Blood Glucose levels and total cholesterol and the age of patients with diabetes mellitus in the working area of the Gunungsari Public Health Center. **Method**: This research is an observational analytic study with a cross-sectional study design. **Result**: The results that have a strong relationship with Blood Glucose Levels from the most significant t-count value are X^2 Age, which is 5.598 with a coefficient value of 0.000 and has a smaller p-value of 0.029, where p-value <0.05. Therefore, it can be concluded that the stronger relationship with Blood Glucose Levels when X^2 is Age compared to X^1, namely Total Cholesterol Levels, which have a p-value of 0.522, which has an insignificant value. **Conclusion and recommendation:** It are necessary to educate the public that non-transmit diseases can be prevented by keeping blood glucose levels and blood fat levels within normal limits by avoiding a diet high in sugar and fat and increasing physical activity.

Keywords: cholesterol; diabetes mellitus; hypertension

INTRODUCTION

Diabetes mellitus is a disorder of carbohydrate, fat, and protein metabolism characterized by increased glucose levels in the blood (hyperglycemia) due to abnormalities in insulin secretion, abnormalities in insulin action in the body, or both (1). Insulin is a hormone that functions to manage glucose levels in the blood. An increase in blood glucose levels is a common symptom in people with diabetes mellitus. Because of this, it causes various complications in the body, especially in the blood vessels to the brain, heart, periphery, nerve cells, eyes, and kidneys. If left unchecked, it can cause various complications, both acute and chronic (2).

World Health Organization (WHO), 2016, mentioned that the prevalence of DM sufferers over 18 years has increased from 47 in 1980 to 85 per 1,000 population. More than 80% of deaths due to DM occur in poor and developing countries. The prevalence of diabetes in all age groups was also predicted to rise from 28 in 2000 to 44 per 1,000 in 2030 (3). Indonesia is also facing a diabetes threat situation similar to the world. Indonesia is the sixth-ranked country globally after China, India, the United States, Brazil, and Mexico, with the number of people with diabetes aged 20-79 years around 10.3 million people (4). Data from the Ministry of Health in 2018 shows that nationally, the prevalence of DM based on a doctor's diagnosis in the age range of 55-64 years occupies the highest position at 6.3%, followed by age 65-74 years at 6.0%. In NTB, the prevalence of DM increased to 1.5% in 2018, which was initially 0.9% in 2013 and spread across all districts/cities, one of which is West Lombok district (5). DM remained in the top 10 most common diseases in NTB Province in 2017. Gunungsari Health Center is one of the health centers in the West Lombok district with a DM prevalence of 1,231, where DM is ranked 3rd after hypertension and gastritis.

One of the chronic complications of diabetes mellitus is fat metabolism disorders (6). The occurrence of dyslipidemia is a significant disorder of fat metabolism in people with diabetes mellitus. Dyslipidemia is a condition characterized by an increase and decrease in lipid components, namely an increase in total cholesterol, triglycerides, low-density lipoprotein (LDL), and a reduction of high-density lipoprotein (HDL) levels (7). In addition to diabetes mellitus, some factors also affect cholesterol levels, such as age, gender, diet, physical activity, obesity, and smoking. The presence of diabetic dyslipidemia means a low lipid profile. Diabetes mellitus tends to reduce good cholesterol levels and increase triglycerides and levels of bad cholesterol (low-density lipoprotein) (8,9).

People with diabetes are susceptible to infection due to hyperglycemia, impaired immune function, and vascular complications. Other factors related to comorbidities such as hypertension, dyslipidemia, and cardiovascular disease (9). In addition, people with high cholesterol levels are unhealthy. Much in the blood can settle in the blood vessels and block blood flow, blocking oxygen-rich blood from reaching certain body parts. This is what makes the arteries narrow due to the accumulation of fat. This condition is often referred to as atherosclerosis (10). Atherosclerosis is a significant complication of high cholesterol (dyslipidemia). Many initially did not know that they had atherosclerosis until complications a 612
Based on this background, the researcher is interested in knowing about the

OBJECTIVE

The study aimed to analyze the Relationship between Blood Glucose Levels with Total Cholesterol and Age of Diabetes Mellitus Patients in the Public Health Center of Gunungsari.

METHOD

Design

This research is an observational analytic study with a cross-sectional study design.

Sample, sample size, and sampling technique

The samples in this study are patients with diabetes mellitus in the working area of the Gunungsari Health Center. A purposive sampling technique were used to select the 30 respondents with diabetes mellitus in the working area of the Gunungsari Health Center will be taken who are willing to have their blood levels checked voluntarily.

Data collection process

The instrument used in this study was an observation sheet in the form of a checklist to record the results of the respondent's examination and a measuring device for Blood Glucose levels and total cholesterol in the form of sticks and tools that use batteries with the accessible touch brand.

Data analysis

The descriptive statistic was used to describe the data demographic. Researchers analyzed the relationship between blood sugar levels with total cholesterol and age using the multivariate analysis.

Ethical consideration

Previously, this research had been approved as an ethical consideration in the ethics committee of RSUD Provinsi NTB with the number 070.1/11/KEP/2020.

RESULTS

Characteristic of respondents

Half of the respondents (50%) graduated from elementary school, and 50% are not in school. Most respondents are non-smokers (63.3%). They have hypertension diseases (36.7%), whereas some did not have hypertension (53.3%) and living with DM for five years. Some of them had Temporary Blood Glucose Levels <200 mg/dL (10.0%). Whereas majority have 200 mg/dL (90.0%). For total cholesterol levels from 30 respondents, 18 respondents (60.0%) had cholesterol levels at the threshold value (200-239 mg/dL), and most of the respondents were in the 51-60 years age group, namely 20 people (66.7%)

Variables	F	%
Sex		
Male	11	36.7
Female	19	63.3
Education		
Education	15	50.0
Elementary	15	50.0
Smoking		
Yes	11	36.7
No	19	63.3
Hypertension		
Yes	19	63.3
No	11	36.7
Experience with DM		
< 5 years	14	46.7
≥ 5 years	16	53.3
Blood Glucose		
< 200 mg/Dl	3	10.0
≥ 200 mg/dL	27	90.0
Cholesterol		
< 200 (Normal)	3	10.0
200-239 (Treshold)	18	60.0
≥ 240 (High)	9	30.0
Age		
41-50 Tahun	3	10.0
51-60 Tahun	20	66.7
61-70 Tahun	7	23.3

Bivariate Analysis

Bivariate analysis was performed using Chi-Square. The results found that the p-value is 0.009. It was indicated that there is a significant relationship between Blood Glucose Levels and Total Cholesterol. While the value for the relationship between Blood Glucose Levels and Age is 0.021, it means that there is a significant relationship between Blood Glucose Levels and Age

Multivariate analysis

The findings showed that there is strong relationship with Blood Glucose Levels, the largest t-count value is X_2 Age which is 5.598 with a coefficient value of 0.000 and has a smaller p-value of 0.029, where p-value <0.05. Therefore, the conclusion that the more vital relationship with Blood Glucose Levels is Age χ_2 when compared to χ_1, namely Total Cholesterol Levels, which has a p-value of 0.522, which has an insignificant value; thus, the regression equation formed is $Y = 0.000+0.120\chi_1+0.425\chi_2$

Table 2. Bivariate Analysis

Variables	Blood Glucose Level		Total	*P-Value*
	< 200 gm/dL	≥ 200 mg/dL		
Cholesterol				
Normal	2 (6.6%)	1 (3.4%)	3 (10.0%)	0.009
Ambang Batas	0 (0.0%)	18 (60.0%)	18 (60.0%)	
Tinggi	1 (3.4%)	8 (26.6)	9 (30.0%)	
Age				
41-50 years	2 (6.6%)	1 (3.4%)	3 (10.0%)	0.021
51-60 years	1 (3.4%)	19 (63.3%)	20 (66.7%)	
61-70 years	0 (0.0%)	7 (23.3%)	7 (23.3%)	

Table 3. Multivariate Analysis

Variables	Coefisien	t-1	*P-value*	Interpretation
Constanta	0.000	5.598		
Cholesterol	0.120	0.648	0.522	No Significant
Age	0.425	2.300	0.029	Significant

DISCUSSION

Relationship of Blood Glucose Levels with Total Cholesterol

The total cholesterol levels in Kapek Village found that most people with diabetes mellitus had an upper threshold total cholesterol level (200-239 mg/dl) (60%). Some of them were high (> 240 mg/dl) (30%). The bivariate test found that the p-value was 0.009, which means a significant relationship between Current Blood Glucose Levels and Total Cholesterol. This research is in line with the results of Arifin's research (2018), which showed that blood glucose levels had a significant effect ($p<0.001$) on all parameters of blood lipid levels, namely total cholesterol, HDL cholesterol, LDL cholesterol, and triglycerides (11).

The closest relationship between blood glucose and total cholesterol was based on the lowest Chi-square value. The research conducted by Daboul (2011) states that an increase in triglyceride and cholesterol levels is closely related to a rise in blood glucose levels. Therefore, it can be concluded that preventing cardiovascular disease can be done by controlling the increase in blood glucose levels (12). Prevention of one risk factor parameter, such as blood glucose levels, can reduce the incidence of dyslipidemia. While the results of Winardi's research in 2019 showed that about 22.90% of diabetes mellitus patients had normal total cholesterol levels. The research results by Lili Nurmawati (2008) also showed that 66.7% of DM patients had total cholesterol levels of more than 200 mg/dl. Around 43.3% of subjects had HDL cholesterol levels lower than 45 mg/dl, and 80% of subjects had LDL cholesterol levels. more than 100 mg/dl, and 50% (13).

High cholesterol levels in DM patients are caused by low insulin levels where the hormone inhibits the work of the lipase enzyme (as lipolysis), resulting in an acceleration of fat metabolism, namely the formation of free fatty acids in plasma to be two times more (14). According to Setyorini (2021), the application of diet is one of the main components in the success of diabetes management. However, it is often an obstacle in diabetes services because it requires compliance and motivation from the patient himself (15). Food is one of the factors that cause cholesterol. Cholesterol usually comes from animal fats such as goat meat and vegetable fats such as coconut milk and coconut oil. Eggs include foods

that contain high cholesterol. Foods that contain lots of saturated fat can cause an increase in cholesterol levels (16).

Alodiea's research (2017) said that there was no relationship between a high-fat diet and total cholesterol levels (p=0.285) (17). Dietary intake of fat does not affect total cholesterol levels. Low HDL is a significant risk factor that causes acute myocardial infarction and is not influenced by dietary fat intake. A person's lack of physical activity is a trigger factor that can increase blood cholesterol levels, especially LDL cholesterol (18). High cholesterol levels will cause more cholesterol to stick to the walls of blood vessels and cause blood vessel cavities to narrow (19). Based on the results of research in Simpang Tiga Village, Kuantan Tengah District, Kuantan Singing Regency, Riau. it was found that 17 people who did not exercise were classified with normal total cholesterol levels. Nine people who did exercise were classified as having upper threshold total cholesterol levels. Mamat's research (2010) shows a relationship between activity and HDL cholesterol levels. The results of this study are also in line with the results of Danchin's research (2018) which says that the level of activity has a significant relationship to the reduction of total cholesterol and HDL cholesterol (20).

The Covid-19 pandemic becomes a threatening condition for DM sufferers when exposed to this viral infection coupled with hyperglycemia conditions that occur if the patient does not control their disease (21). In situations without a pandemic, high glucose levels have a significant contribution as a cause of DM complications so that patients are required to control their disease. In pandemic conditions, high glucose levels are also a trigger for DM sufferers to be susceptible to infection (22). High blood glucose levels play a role in impaired neutrophil function, which weakens the immune system of DM patients and is susceptible to disease (23). Efforts to empower DM patients and their families in diet management need to be done to control the patient's Blood Glucose levels and, in particular, increase the patient's immunity during the Covid-19 pandemic. Based on the description above, one of the efforts nurses can make is providing education to patients. DM control and control is an action that DM patients must take to prevent disease complications and increase immunity during this Covid-19 pandemic. The proportion of diabetes mellitus control efforts that DM sufferers have carried out is 80.2% eating arrangements, 48.1% exercise, and 35.7% herbal alternatives. Judging from these results, the highest diabetes control effort is eating arrangements (24,25).

Relationship of Blood Glucose Levels with Age

Most of the respondents are 51-60 years (66.7%) in this study. They also had Current Blood Glucose Levels of 200 mg/dL (90%). It was only 10% among respondents with Blood Glucose Levels < 200 mg/dL. The p-value showed a significant relationship between Blood Glucose Levels with Age. This research is in line with Aihara's study (2021), which offers a correlation between the age variable and the blood glucose variable with a significance value of 0.000 (<0.05) (26).

The age variable has a positive correlation with BLOOD GLUCOSE with a correlation value of 0.710. It was indicated that the strength of the correlation is moderate. The results of linear regression analysis also show that everyone's increase in the age score will increase the BLOOD GLUCOSE score by 0.831 (p<0.001, 95%CI 0.420;1.241). In line with the age variable, Trisnawati and Setyorogo's (2013) research showed an increase in the risk of Type 2 DM with an OR of 0.212, meaning that each increase in age can increase the risk of DM by 0.212 times. In addition, there is a 35% decrease in mitochondrial activity in muscle cells in older individuals. Research by Trisnawati and Setyorogo (2013) showed that age, family history, physical activity, blood pressure, stress, and cholesterol levels were associated with Type 2 DM. 14; 95% CI 0.037-0.524) (27). This is associated with an

increase in fat muscle levels by 30% and triggers insulin resistance (28).

Analysis of the Relationship of Blood Glucose Levels with Total Cholesterol and Age

In this study, it was found that age was more related to Blood Glucose levels when compared to total cholesterol levels, which had no significant analytical value. Based on Arifin's research (2018), 2092 respondents concluded that blood glucose levels have a substantial relationship with increasing fat blood levels (11). It was consistent with a previous study that reported that everyone's increase in the age score would increase the blood glucose score by 0.831 ($p<0.001$, 95%CI 0.420;1.241). In Multiple linear regression also showed the calculati0n of Adjusted R Square was 0.719., Therefore, age, stress, and a high-carbohydrate diet are simultaneously able to explain 72% of BLOOD GLUCOSE variations. While the rest was explained by other variables that were not examined, and the results of the correlation of the three variables, namely age, stress, and a high-carbohydrate diet on Blood Glucose levels, were statistically significant ($p<0.05$) (29).

CONCLUSION

This study showed age was a predictive factor in blood glucose levels compared to total cholesterol levels. It is necessary to educate people that non-communicable diseases can be prevented by maintaining blood glucose levels and blood fat levels within the normal line by avoiding a diet high in sugar and fat and increasing physical activity.

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