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The relationship of diabetes mellitus diet with blood sugar level control in inpatients at PKU Muhammadiyah Gamping Hospital Yogyakarta

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ABSTRACT

The high incidence of type 2 diabetes mellitus is caused by several factors. One way to reduce the incidence of type 2 diabetes mellitus is to undergo nutritional therapy or a diabetes mellitus diet so that patients can avoid various complications of diabetes mellitus that lead to death. This study was conducted by interviews using a food recall form and using medical record data to see the patient's blood sugar levels before breakfast, lunch and evening. The sample of this study consisted of 39 respondents. The data obtained were analyzed using the chi square & T-test statistical test. The results showed that most respondents were aged 44-58 years (56.4%), female gender was more dominant (53.8%). The results obtained on energy, carbohydrate, protein and fat intake were not significant with p values> 0.05. Meanwhile, the T-test results showed a significant difference between the average blood sugar levels of patients with sufficient and insufficient energy intake with a p value 0.023. However, there was no significant difference between the average blood sugar levels of patients with carbohydrate, protein and fat intake with insufficient and sufficient intake with p values> 0.05. There is no significant difference between energy, carbohydrate, fat and protein intake on blood sugar levels of inpatients at PKU Muhammadiyah Gamping Hospital.

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INTRODUCTION

Diabetes Mellitus is known as a non-communicable disease but is a major cause of death in many developing countries (Ahuja et al., 2020). Diabetes in many citizens in Africa are undiagnosed (Muhammad, 2020). Diabetes mellitus is a metabolic disorder in which blood sugar levels in the body are high because the body is unable to respond to or produce insulin, a hormone that helps

stabilize blood sugar levels by helping cells take up glucose and inhibiting glucose production in the liver (Khan et al., 2019). When the pancreas produces insulin in small amounts or the body is unable to use the insulin produced properly, then DM occurs . The absence of insulin will make the body unable to metabolize glucose so that it cannot be used for body functions leading to a state of chronic hyperglycemia (Simanjuntak, 2021).

Diabetes mellitus is also known as The Silent Killer because diabetes can affect all organs of the body, causing various complaints (Hasniah et al., 2020). Complications that occur in Type 2 DM patients are physical, psychological, social and economic complications. Complications of the disease that will arise from this disease are heart disease, stroke, diabetic retinopathy, kidney failure, neuropathy which can increase the incidence of foot ulcers and even the need for foot amputation (Yusnita et al., 2021). According to the World Health Organization, it is estimated that in 2014 as many as 422 million people in the world aged over 18 years have diabetes mellitus (Roglic, 2016). The number of diabetes sufferers has increased worldwide between 1980 and 2014, increasing from 108 million to four times that of 422 million. The largest number of diabetes mellitus cases comes from the western Pacific and Southeast Asia. Meanwhile, according to the Basic Health Research (Riskesdas) in Indonesia 2018, in 2018 the number of diabetes mellitus cases doubled. The number of cases of diabetes mellitus in Indonesia is 10.9%, this shows that diabetes mellitus is a serious public health problem in Indonesia (KEMENKES RI, 2018).

Among the four types of diabetes, type 2 diabetes is the most common type of diabetes found in patients. According to the results of the Basic Health Research (Riskesdas) Indonesia, almost 90% of cases are type 2 diabetes. This continues to grow due to the influence of genetic factors, demographic factors and lifestyle changes that can cause obesity due to excessive food intake (PERKENI, 2019). Type 2 Diabetes Mellitus sufferers are more susceptible to complications both in the short and long term which lead to premature death because type 2 DM is rarely detected, especially in developing countries. Complications are generally divided into two, namely acute and chronic. Acute complications include Diabetic Ketoacidosis (DKA), Hypoglycemia, and Hyperglycemic Hyperosmolar State (HHS) while chronic complications include microangiopathy and macroangiopathy (Satriawibawa & Saraswati, 2021).

There are two risk factors for Type 2 DM, namely factors that can be changed including food consumed, rest patterns, physical activity and stress management while factors that cannot be changed include age and genetics (Azzahra Utomo et al., 2020). The high incidence of type 2 diabetes mellitus is caused by risk factors such as gender, smoking habits, alcohol consumption, consumption of drinks containing lots of sugar, unhealthy lifestyles, stress, lack of sleep, economic status, and food consumption that can cause obesity . Obesity has a possibility of experiencing Diabetes by 2.03 times and 1.05 times prediabetes (Wang et al., 2021). Diabetes control can be done in various ways such as diabetes care and management so that blood sugar levels are controlled (Rahayu et al., 2018).

Management of Type 2 DM can be done by means of a drug-free approach and using drugs (Widodo, 2014). To reduce the incidence of type 2 diabetes mellitus 2 by consuming oral medication and insulin. For the management of Type 2 DM without medication, it can be done by implementing education related to diabetes and improving lifestyle such as quitting smoking, quitting alcohol consumption, increasing physical activity and undergoing a diabetes diet (PERKENI, 2019). Lifestyle interventions that can be done to reduce the prevalence of Type 2 DM are Physical activity interventions, Healthy eating, Behavior change interventions, Obesity management (Debnath et al., 2024).

Diet or nutritional therapy is the initial treatment for diabetes mellitus. By implementing a low-carbohydrate diet it is very effective in reducing hemoglobin A1c (HbA1c) levels in diabetes patients and is able to improve lipid profiles. So if patients follow the diet properly, they can avoid diabetes and various complications of diabetes mellitus that lead to death (PERKENI, 2019). This Type 2 DM disease continues for life, therefore, patients should be equipped with treatment

therapy management, one of which is nutritional therapy that can reduce the prevalence of type 2 DM. A diet in accordance with doctor's recommendations will stabilize blood sugar (Susanti & Bistara, 2018). The recommended macronutrient composition for consumption is carbohydrates 45-60%, protein 10-20%, polyunsaturated fat 10-20%, monounsaturated fat 5-10% and saturated fat 5-10%, carbohydrates have a low glycemic index.

RESEARCH METHOD

The study used a cross-sectional approach, meaning that the observation of dependent and independent variable data was only carried out once. This study seeks to find the relationship between diabetes mellitus diet and blood sugar control inpatients at PKU Muhammadiyah Gamping Hospital, Yogyakarta.

The sample in the study was obtained using the Purposive Sampling technique that met the inclusion and exclusion criteria. The sample inclusion criteria included patients with diabetes mellitus who were being treated as inpatients in class 2 and 3 at PKU Muhammadiyah Gamping Hospital, patients who were willing to be respondents, both male and female. The sample exclusion criteria were patients with diabetes mellitus with severe complications that made it impossible to become respondents, and patients with diabetes mellitus who were accompanied by COVID-19. The number of samples in this study was 39 patients.

Data collection was carried out directly using a food recall form to record the food that had been consumed by patients in the past 24 hours. Next, the researcher contacted the nutrition installation to obtain standard diet menu data along with a list of respondents' menu calories in the previous 24-hour period. After the data was obtained, the researcher then observed the results of blood sugar levels taken before consuming food in the morning, afternoon and evening.

RESULTS AND DISCUSSIONS

Based on table 1, the majority of patients who were sampled were female, namely 21 people (53.8%). In addition, the age range of the largest sample was 44-58 years, namely 22 people (56.4%), which is included in the category of late adulthood and elderly.

Table 1. Overview of respondent characteristics

Variables	N=39	%
Sex		
Men	18	46,2
Women	21	53,8
Age's (years)		
44-58	22	56,4
59-74	13	33,3
75-89	4	10,3

Table. 2 Results of examination of blood sugar levels of inpatients

Random blood sugar levels	N=39	%
Controlled	18	46,2
Un Controlled	21	53,8

Based on table 2, it shows that the majority of blood sugar levels in hospitalized DM patients are still in the uncontrolled category (53.8%).

Table 3. Relationship between nutrient intake and random blood sugar of patients

Amount of nutrient intake	Blood Glucose				%	P
	Controlled		Uncontrolled			
	N	%	N	%		
Energy						
Good	7	70	3	30	25,6	
Less	10	35,7	18	64,3	71,7	0,096
Over	1	100	0	0	2,5	
Carbohydrate						
Good	1	20	4	80	12,8	
Less	13	46,4	15	53,6	71,7	0,302
Over	4	66,6	2	33,4	15,3	
Protein						
Good	8	53,3	7	46,7	38,4	
Less	5	29,4	12	70,6	43,5	0,133
Over	5	71,4	2	28,6	17,9	
Fat						
Good	8	57,1	6	42,9	35,8	
Less	9	39,1	14	60,9	58,9	0,563
Over	1	50	1	50	5,1	

Based on table 3, most patients are in low energy intake (71.1%) spread in the controlled blood sugar level category of 70%, from the results of the chi square analysis showed that there was no relationship between energy intake and the patient's random blood sugar level ($p>0.05$). Some patients were also in low carbohydrate intake, which was 71.1% and spread in uncontrolled blood sugar levels of 53.6%.

The chi square analysis, it showed that there was no relationship between carbohydrate intake and the random blood sugar level of DM patients ($p>0.05$). The results of protein consumption data processing showed that the majority of patients had a protein intake in the low category (43.5%) spread in the uncontrolled category of 70.6%. The chi square test analysis showed that there was no significant relationship between protein intake and the patient's random blood sugar level ($p>0.05$). The patient's fat intake level was 58.9% less than the requirement, this was mostly in patients who had uncontrolled blood sugar levels (70.6%). Based on the chi square test analysis, protein intake was not related to blood sugar level control in DM patients ($p>0.05$).

Table 4. Differences in mean blood sugar levels in patients with insufficient and adequate macronutrient intake

Macronutrients	Average Blood Sugar Levels (mg/dL)		P
	Adequate Intake	Inadequate intake	
Energy	167,113	227,236	0,023
Carbohydrate	203,954	212,763	0,748
Protein	200,836	222,498	0,381
Fat	218,409	205,725	0,621

Based on table 4 based on the T-test results, it shows that there is a significant difference between the average blood glucose in patients with sufficient energy intake and insufficient energy intake ($p<0.05$). Meanwhile, when viewed from the amount of carbohydrate intake, there is no difference in the average blood glucose in patients with sufficient carbohydrate intake and insufficient carbohydrate intake and patients with sufficient protein intake and insufficient protein intake ($p>0.05$). There is also no difference in the average blood glucose in patients with sufficient fat intake and insufficient fat intake ($p>0.05$).

Table 5. Multivariate analysis of energy, carbohydrate, protein, and fat intake on blood glucose

Variabel	B	P
Energy	1.130	0,153
Carbohydrate	-1.073	0,144
Protein	-220	0,672
Fat	622	0,312

Based on the multivariate analysis in Table 5, it shows that the p value>0.05, which indicates that there is no relationship between energy, carbohydrate, protein and fat intake with random blood sugar levels in DM patients. Based on table 2, it is known that the majority, namely 64.3% of patients with insufficient energy intake have uncontrolled glucose levels. Meanwhile, patients who have good energy intake, 70% have controlled blood sugar. Based on the results of the chi square test, there was no relationship between energy intake and random blood sugar levels in patients with diabetes mellitus (p≥0.05). Meanwhile, based on the results of the T-test, it showed that there was a significant difference between the average blood glucose in patients with sufficient energy intake and insufficient energy intake (p<0.05). The results of this study are in line with research conducted by Wati AH and Rodliah R (2019), which explained that there was no relationship between energy intake and blood sugar levels in patients with type II diabetes mellitus at Jatinegara Hospital (p value = 0.148) (Wati & Rodliah, 2019).

This study found that 71.1% of diabetes mellitus patients had insufficient carbohydrate intake, and the majority (53.6%) had uncontrolled blood sugar levels and 46.4% had controlled blood sugar levels. From the results of the chi square analysis, it was found that there was no relationship between carbohydrate intake and blood sugar levels in diabetes patients (p ≥ 0.05). The results of the T-test showed that there was no significant difference between the average blood glucose in patients with sufficient carbohydrate intake and insufficient carbohydrate intake (p> 0.05). There was no relationship between carbohydrate intake and random blood sugar levels, possibly caused by several factors such as a history of DM, complications of the patient's disease, lack of accuracy when conducting a recall of consumption, patient treatment history and other habits that were not known by the researcher. The results of this study are in line with research that reported that there was no relationship between carbohydrate intake and blood sugar levels in diabetes mellitus patients (Levine & Haft, 1970).

The results of this study are not in line with the results of the theory by study Susanti, Bistara (2018) which states that carbohydrate intake has an effect on blood sugar levels (Susanti & Bistara, 2018). Blood glucose is the result of carbohydrate metabolism which is one of the sources of energy in our bodies. If there is excessive carbohydrate intake, the body will store it in the form of glycogen in the liver and muscles for energy reserves. Glycogen stored in the liver and muscles will be converted into glucose if the body's glucose needs exceed the glucose levels in the blood, which will result in an increase in blood sugar levels.

In this study it is known that the majority (70.6%) of patients with insufficient protein intake have uncontrolled glucose levels. Meanwhile, patients who have good protein intake, 53.3% have controlled blood sugar. It was found that there was no relationship between protein intake and random blood sugar levels in diabetes mellitus patients (p≥0.05). This is similar to research conducted by Hatting (2018) that there is no relationship between protein intake and blood sugar levels because the main function of protein is to replace damaged cells as well as for growth. If carbohydrates and fats are unable to provide sufficient energy sources through the gluconeogenesis process, then protein will be converted into an energy source(Henggu & Nurdiansyah, 2021) (Hatting et al., 2018)(Probosari, 2019).

This study obtained that in patients with diabetes mellitus, 58.9% had insufficient fat intake, and the majority had uncontrolled blood sugar (60.9%) levels and 39.1% had controlled blood sugar levels. In statistical analysis, it was found that there was no relationship between fat intake and blood sugar levels in patients with diabetes mellitus (p≥0.05). This is different from the

study conducted by Garonzi et al., (2021) which stated that there is a relationship between fat intake and blood sugar levels, especially with HbA1c levels. Glycated hemoglobin or HbA1c examination is a blood sugar examination that can provide an overview of blood sugar for six to twelve weeks before the examination. If blood sugar levels are high, it will bind to hemoglobin. So, if blood sugar levels are high, HbA1c levels will also be high (Garonzi et al., 2021).

The multivariate analysis in table 4, it was obtained that energy intake (p = 0.153), carbohydrates (p = 0.144), protein (p = 0.672), and fat (p = 0.312) obtained a p value> 0.05 which means there is no effect between micronutrient intake consumption and random blood sugar levels in patients. The insignificant relationship is because random blood sugar can be influenced by various factors, such as diet, history of therapy, physical activity, history of other diseases suffered by the patient, and other metabolic conditions. In this study, some respondents had other comorbidities or diseases due to complications of diabetes. Therefore, patients were also given drugs that could possibly affect the increase in blood sugar levels.

One of the diseases found in respondents as a result of diabetes complications is cardiovascular disease. The risk factor for cardiovascular complications in people with diabetes mellitus is high levels of lipids in the blood. The most widely used anti-hyperlipid drug is simvastatin. However, the use of simvastatin can increase blood sugar levels, this has been proven by research conducted by Kim et al., (2018) which states that simvastatin has an effect on increasing blood sugar levels or hyperglycemia because it can increase the concentration of calcium in islet cells which ultimately can cause a decrease in insulin release (Kim et al., 2018).

In addition to simvastatin, in DM patients who consume ciprofloxacin, it can also interfere with the effects of insulin therapy. The effects that can be caused are hypoglycemia or hyperglycemia due to disturbances in the balance of blood sugar levels. This reaction is caused because pancreatic beta cells (which are sensitive to calcium channels) are unable to regulate insulin secretion properly. This mechanism can also be found in DM patients who consume quinolone antibiotics. The use of isoniazid consumed together with insulin can also interfere with the effects of insulin so that blood sugar levels cannot be controlled properly. The use of isoniazid with a dose of 300-400 mg per day can increase fasting blood sugar levels by 40% and cause glycosuria. As a result of the hyperglycemic condition, it occurs due to isoniazid poisoning (Repaske, 2016). Results of research conducted by Rosen (2009), showed that giving insulin and anti-diabetic drugs had a greater effect on blood glucose compared to choosing food sources that took into account the Glycemic Index or giving a diabetic diet (Rosén et al., 2009). In this study, the patient's blood sugar levels were influenced by giving diabetes drugs in combination with a diabetic diet, so that it could support improvements in blood glucose.

CONCLUSION

The conclusion that can be drawn based on the discussion that has been described above is that there is no significant difference between energy, carbohydrate, protein and fat intake on blood sugar levels of inpatients at PKU Muhammadiyah Gamping Hospital. There is a significant difference between the average blood glucose in patients with sufficient energy intake and insufficient energy intake.

Diabetes mellitus patients are expected to be able to maintain a diet according to the diet that has been provided by the hospital so that blood sugar levels are always controlled within normal limits. Research is needed that is able to consider other risk factors that can affect blood sugar levels that are at risk for diabetes mellitus.

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