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The Relationship Between Diet, Nutritional Status, and Blood Sugar Levels in Type 2 Diabetes Mellitus Outpatients at RSUD Ibnu Sina Gresik

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ABSTRACT

Type 2 Diabetes Mellitus is a chronic disease with an increasing incidence in Indonesia and is closely related to blood sugar control. This study was conducted aimed to analyze the relationship between diet and nutritional status with blood sugar levels in outpatients with Type 2 Diabetes Mellitus at Ibnu Sina Gresik Hospital. A cross-sectional study design was employed along with observational analysis. The sample included 34 patients selected using the Accidental Sampling technique. Data were collected through interviews, questionnaires, measurements of height and weight, and laboratory results. The study was conducted from December 2023 to April 2024, and the data were analyzed using univariate and bivariate analysis using the chi-square test. The results showed that patients with poor diet and overweight tend to have abnormal blood sugar levels, with p=0.014 for diet and p=0.023 for weight gain, both significant (p<0.05). In conclusion, there is a relationship between diet and nutritional status and blood glucose levels in patients with Type 2 Diabetes Mellitus. It is recommended, patients should implement a diet according to the 3J principle, do sufficient physical activity, regularly monitor blood sugar levels, and make dietary changes such as reducing simple carbohydrates and sugar to manage blood sugar levels.

INTRODUCTION

Diabetes Mellitus (DM) is a long-term disease that develops when blood sugar levels rise as a result of insufficient or ineffective insulin production by the body[1]. One type of DM is type 2 DM, characterized by hyperglycemia, insulin resistance, and relatively low insulin production[2]. Type 2 DM is caused by insulin resistance, which leads to increased blood sugar levels. Type 2 diabetes can cause major consequences such as cardiovascular disease, kidney damage, amputation, nerve damage, and vision problems if not controlled effectively. However, these complications can be avoided with proper treatment[1].

High blood sugar levels are directly related to DM and are regulated by insulin. DM is diagnosed by blood glucose and HbA1c tests, with the diagnostic criteria for plasma glucose at ≥ 200 mg/dL and major symptoms such as polyuria, polyphagia, and unexplained weight loss[3]. Type 2 diabetes management involves controlling daily energy and carbohydrate intake using the 3J diet principle, namely amount, type, and schedule[4].

Diet is a combination of the type and amount of food consumed at a given time and affects blood sugar levels, especially in people with type 2 diabetes[5]. Blood sugar spikes can occur when certain foods heavy in fat and sugar are consumed[6]. Nutritional status, assessed through the Body Mass Index (BMI), reflects the balance of nutrient intake and use. Increased weight and insulin resistance are associated with overnutritional status increasing blood sugar levels[7].

The number of diabetes cases in adults worldwide increased in 2000 by 151 million (4,6%) and in 2021 to 537 million (10,5%). Without adequate action, this number is estimated to reach 783 million (12,2%) by 2045[1]. According to the 2018 Basic Health Research In Indonesia, the prevalence of diabetes mellitus among those who are 15 years of age or older is 2.0%. The highest rate is 3.4% for DKI Jakarta, while the lowest is 0.9% for NTT[8]. East Java ranks fifth with a prevalence of 2,6%. In Gresik Regency, the number of sufferers increased from 44.071 people in 2021 to 45.284 people in 2022 (an increase of 2,75%)[9].

Based on a preliminary study conducted at Ibnu Sina Gresik Regional Hospital in September, Diabetes Mellitus was the second most common outpatient disease at Ibnu Sina Gresik Regional Hospital from March to August 2023. Based on data on type 2 Diabetes Mellitus patients from March to August 2023, there were more outpatients than inpatients.

Risk factors for type 2 DM include overweight, lack of physical activity, hypertension, dyslipidemia, gestational diabetes, and unhealthy diet, as well as non-modifiable factors such as age, race, family history, and birth history[3]. The success of DM management is influenced by education, nutritional therapy, physical activity, and pharmacology[10]. considering the importance of diet and nutritional status in managing blood sugar levels in Type 2 DM patients. However, the diet and nutritional status of outpatients at Ibnu Sina Gresik Regional Hospital are not yet specifically known.

Therefore, the purpose of this study was to examine how blood sugar levels in type 2 DM outpatients at Ibnu Sina Gresik Hospital relate to food and nutritional status. It is intended that this study's findings can provide important information for the management of DM in the hospital and provide suggestions for improving education and nutritional counseling for patients.

MATERIALS AND METHODS

Analytical observational research using a cross-sectional study technique is part of the research design that was employed, aiming to find the relationship between variables through analysis of data collected at a certain point in time without intervention. This research was conducted at RSUD Ibnu Sina Gresik from December 2023 to April 2024. The population for this study comprised all outpatients with Type 2 Diabetes Mellitus aged >20 years at Ibnu Sina Hospital,

Gresik in the period of August 2023 totaling 949 patients. The research sample was 34 patients with inclusion criteria in the form of Type 2 Diabetes Mellitus Patients aged >20 years, willing to be respondents, respondents were able to communicate well and clearly, patients had checked their blood glucose levels. Accidental sampling was the method of sampling that was applied. Cross-sectional design is chosen because of its ease of implementation, but it can limit the ability to show cause-and-effect relationships and only provides a picture of the relationship of variables at one point in time. While accidental sampling can cause selection bias, so the sample may not be representative of the population as a whole.

In this study, data collection began with filling out an informed consent form to obtain respondents' approval. Furthermore, dietary data were collected using SQ FFQ and Food Picture for types of food and number of calories, and using a questionnaire for meal schedules. Nutritional status was measured by Body Mass Index through weighing and measuring height. Random blood sugar levels were collected from laboratory result sheets. The SQ FFQ was tested for validity and reliability by comparing the results with other methods that have similar principles, such as food records, to improve accuracy and consistency. While BMI is a valid and reliable standard tool with extensive validation in the health literature to assess nutritional status.

The collected data were analyzed using the SPSS program, with the variables displayed as percentages through a frequency distribution table for univariate analysis. A chi-square test with a p-value of 0.05 was used in bivariate analysis to determine the association between blood sugar levels, nutritional status, and diet.

RESULTS

Table 1. Frequency Distribution Based on Characteristics of Outpatients with Type 2 Diabetes Mellitus at Ibnu Sina Hospital, Gresik

Variable	n	%
Age (Years)		
20-44	5	14.7
45-59	17	50
≥60	12	35.3
Gender		
Male	11	32.4
Female	23	67.6
Total	**34**	**100**

Source: Primary Data, 2024

Table 1 demonstrates that there were 34 patients in all, the majority of respondents were aged 45-59 years, 17 people (50%) and the majority were women, 23 people (67.6%).

Table 2. Frequency Distribution Based on Diet and Nutritional Status in Outpatients with Type 2 Diabetes Mellitus at Ibnu Sina Hospital, Gresik

Variable	N	%
Diet		
Less good	31	91.2
Good	3	8.8
Total Calories		
More	1	2.9
Normal	4	11.8
Mil deficit	1	2.9
Moderate deficit	10	29.4
Severe deficit	18	53.0
Food Type		
Less	6	17.6
Enough	28	82.4
Meal Schedule		
Not quite right	25	73.5
Right	9	26.5
Nutritional Status		
Underweight	1	2.9
Normal	10	29.4
Overweight	7	20.6
Obesity 1	9	26.5
Obesity 2	7	20.6
Total	**34**	**100**

Source: Primary Data, 2024

Table 2 demonstrates that the majority of patients had bad diets, with 31 people (91.2%) having poor diets and 3 people (8.8%) having healthy diets. Most patients experience a severe level of deficit in the number of calories as many as 18 people (53.0%), patients consume sufficient types of food as many as 28 people (82.4%) and inappropriate meal schedules as many as 25 people (73.5%). The nutritional status of the majority of patients is in the obesity category 1 as many as 9 people (26.5%) and normal as many as 10 people (29.4%), while only a small portion is in the underweight category as many as 1 person (2.9%).

Table 3. Frequency Distribution Based on Blood Sugar Levels in Outpatients Type 2 Diabetes Mellitus at Ibnu Sina Hospital, Gresik

Variable	n	%
Blood Sugar Levels		
Abnormal	22	64.7
Normal	12	35.3
Total	**34**	**100**

Source: Primary Data, 2024

Table 3 demonstrates that of the 34 patients, 22 people (64.7%) had abnormal blood sugar levels, and the blood sugar readings of 12 individuals (35.3%) were within the usual range.

Table 4. Cross Tabulation of Dietary Patterns and Nutritional Status with Blood Sugar Levels in Outpatients with Type 2 Diabetes Mellitus at Ibnu Sina Hospital, Gresik

Variable	Random Blood Sugar Levels				*p-value*
	Abnormal		Normal		
	n	%	n	%	
Diet					
Less good	22	64.7	9	26.5	0.014
Good	0	0	3	8.8	
Nutritional Status					
Underweight	1	2.9	0	0	0.023
Normal	3	8.8	7	20.6	
Overweight	7	20.6	0	0	
Obesity 1	5	14.7	4	11.8	
Obesity 2	6	17.7	1	2.9	

Source: Primary Data, 2024

Based on Table 4's cross-tabulation, The results of processing research data using the Chi-Square test found that the p value for diet was 0.014 and for nutritional status was 0.023, both of which were less than 0.05. Thus, it may be concluded that there is a connection between blood sugar levels and nutrition and food.

DISCUSSION

Diet affects blood sugar levels, especially in individuals with type 2 diabetes mellitus[11]. Diet includes the appropriateness of the amount, type, and frequency of food consumption, including staple foods, side dishes, vegetables, and fruits[12]. Adhering to a healthy diet ensures the body receives the necessary nutrients, helps maintain health and prevent disease. While it does not guarantee full protection from disease, a balanced diet can reduce the risk of disease[13]. Diet assessment methods include various techniques such as food memory, food weighing, food recording, meal frequency, semi-frequency meals, food amount, dietary history, and food ingredient balance[14]. This study uses the SQ-FFQ method, a method of collecting information about the frequency of food consumption in a given period, providing a qualitative picture and allowing long-term analysis and separation based on nutrient intake[15].

A good diet is characterized by the fulfillment of the number of calories, types of food, and meal schedules. Of the 34 respondents, most of them had poor diets totaling 31 people (91.2%), of which most showed abnormal blood sugar levels of 22 people (64.7%). Only a few respondents had a good diet with normal blood sugar levels as many as 3 people (8.8%). The main problem is the

inability to meet the 3J principle, especially the number of calories. The majority of respondents also experienced a severe energy deficit amounting to 18 people (53.0%), while the majority of others had quite varied types of food totaling 28 people (82.4%). Meal schedules were also an issue, with most respondents not following the right schedule for 25 people (73.5%).

The dietary rules for Diabetes Mellitus involve eating more often in small portions to split calorie intake throughout the day and reduce pancreatic workload[16]. The selection of food types is important to keep blood sugar levels stable, including carbohydrates, fats, proteins, fruits, and vegetables. The exact schedule is three main meals and three interlude meals. This approach helps to keep blood glucose levels stable and prevent blood sugar spikes that can worsen diabetic conditionssusa[6].

The results showed a p-value of 0.014, indicating that among outpatients at Ibnu Sina Gresik Hospital with type 2 diabetes, there was a connection between blood sugar levels and nutrition. This is in line with the research of Suisanti and Bistara (2018), which stated that there is a strong relationship between diet and blood sugar levels, with a p-value of 0.000. Instability of blood sugar levels occurs due to an unhealthy diet, as recommended by the 3J principle. This principle helps patients control portions (Amount), choose the right type of food (Type), and maintain consistent meal times (Schedule), so that it can support more stable blood sugar level management.

Nutritional status is an assessment of the condition of the body through the analysis of diet and the use of nutrients in the body[17]. Nutritional status is considered optimal if the intake and utilization of nutrients are sufficient[18]. Evaluation of nutritional status can be carried out directly by anthropometric, clinical, biophysical, and biochemical methods, or indirectly through food consumption surveys, vital statistics, and environmental factors. Anthropometry is the most common method of evaluating nutritional status, including Body Mass Index (BMI), measuring a person's normalized weight relative to height by dividing body weight (kg) by the square of height (m^2)[19]. Overweight or obesity is a risk factor for degenerative diseases, including Diabetes Mellitus[20].

The bulk of the 34 respondents, according to the data, had nutritional statuses that fell into the obese group, out of 7 respondents with 2 obese nutritional status, 6 people had abnormal blood sugar levels. In 9 respondents with obesity 1, 5 had abnormal blood sugar levels. The high obesity in respondents was caused by several factors, namely some were in the elderly who found it difficult to exercise, ate excessive food but did not meet their daily calorie needs, avoided vegetables for one week, and did not eat fruit more than three times a week.

The study's findings revealed a p-value of 0.023, indicating that among outpatients with type 2 diabetes mellitus at Ibnu Sina Gresik Hospital, a correlation was found between diet and blood sugar levels. This study agrees with Masruroh (2018), who discovered a p-value of 0.000, which is less than $\alpha = 0.05$ ($0.000 < 0.05$), for a link between blood sugar levels and nutritional status in

patients with Type 2 Diabetes Mellitus. Nutritional status, especially overnutrition, often causes the accumulation of energy in the form of fat can result in the accumulation of energy in the form of fat. These fats then become free fatty acids that disrupt glucose balance. An increase in free fatty acids in the blood inhibits the absorption of glucose by muscles, leading to hyperglycemia in patients with type 2 diabetes mellitus[21].

Blood sugar levels are the amount of glucose in the blood. Glucose is tightly regulated in the body and reflects serum glucose concentrations. An imbalance in blood sugar levels, either too high or too low, can have adverse health effects in the short and long term[22]. Diabetes Mellitus is a chronic and complex condition that requires constant medical treatment and an approach to reduce the risk. Ongoing education and self-management support are important to prevent sudden complications and chronic problems[23].

Type 2 diabetes can generally be managed through dietary adjustments and regular exercise. However, in some cases where blood sugar is difficult to control with diet alone, diabetes management needs to be supported with medications, including insulin therapy[24]. Diabetes Mellitus management involves managing factors that can be changed, such as maintaining normal nutritional status to prevent obesity, implementing a balanced diet in terms of nutrition, and regular physical activity or exercise according to age[25].

CONCLUSION

In light of the study's findings, the characteristics of the respondents were mostly aged of 45 to 59 years with a total of 17 individuals and 23 individuals of the female gender. 31 persons (91.2%) have type 2 diabetes mellitus, and their diet falls into the poor group. The nutritional status of type 2 Diabetes Mellitus patients is in the obesity 1 category with a total of 9 persons (26.5%). Random blood sugar levels of type 2 Diabetes Mellitus patients are in the abnormal category with a total of 22 persons (64.7%). This study shows blood glucose levels and food had a significant connection (p-value = 0.014), as well as between nutritional status with the levels of blood glucose (p-value = 0.023). Type 2 Diabetes Mellitus patients are expected to implement a diet according to the 3J principle, sufficient physical activity, and routine monitoring of blood sugar levels. In addition, hospitals need to provide structured and ongoing education programs on the management of type 2 diabetes mellitus. This program is important to help patients understand diabetes management properly. Patients also need to be scheduled for regular consultations with a nutritionist so that diet can be monitored and adjusted.

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