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Determinants of Behavioral Aspects Related to Blood Sugar Levels of Type II Diabetes Mellitus Patients in the Working Area of the Banjar Baru Health Center, Tulang Bawang Regency

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Abstract

Diabetes mellitus tipe II is a chronic disease characterized by high blood glucose levels due to insulin resistance or insufficient insulin production. This study aims to determine behavioral determinants related to blood glucose levels in *diabetes mellitus tipe II* patients. This research used a cross-sectional survey analytic design with 83 *diabetes mellitus tipe II* patients as respondents in the working area of Banjar Baru Health Center, Tulang Bawang Regency. Data were collected through questionnaires and blood glucose measurements. Data analysis used univariate, bivariate (chi-square), and multivariate (logistic regression) analyses. The results showed that 55.4% of patients had abnormal blood glucose levels (>200 mg/dl). Bivariate analysis revealed significant relationships between knowledge (p=0.005; OR=4.34), attitude (p=0.000; OR=9.717), age (p=0.009; OR=4.545), abdominal obesity (p=0.000; OR=5.143), physical activity (p=0.000; OR=5.903), and dietary patterns (p=0.000; OR=9.72) with blood glucose levels. Multivariate analysis showed that dietary patterns were the most dominant factor (p=0.020; OR=10.946) after controlling for attitude, obesity, and physical activity variables. *Diabetes mellitus tipe II* patients with irregular dietary patterns have a 10.946 times higher risk of experiencing elevated blood glucose levels compared to those with regular dietary patterns.

Keywords: diabetes mellitus type II, behavioral determinants, blood glucose levels, dietary patterns, risk factors

INTRODUCTION

Diabetes mellitus is a chronic metabolic disease characterized by persistent hyperglycemia due to impaired carbohydrate, fat, and protein metabolism, caused by either relative or absolute insulin deficiency (Goyal, 2023; Dilworth, 2021). It is classified into two main types: type 1 diabetes (Insulin Dependent Diabetes Mellitus/IDDM), which results from autoimmune destruction of pancreatic beta cells, and type 2 diabetes (Non-Insulin Dependent Diabetes Mellitus/NIDDM), which is marked by insulin resistance and progressive insulin secretion impairment (Solis-Herrera, 2018; American Diabetes Association [ADA], 2024a). These metabolic disturbances lead to systemic dysfunctions that affect various body tissues and contribute to both macrovascular and microvascular complications (Antar, 2023; ADA, 2024b). Additionally, impaired lipid metabolism in diabetic patients accelerates atherosclerosis, thus increasing cardiovascular risk (Dilworth, 2021; ADA, 2024a). Therefore, diabetes mellitus requires long-term management involving glycemic control, dietary regulation, physical activity, and structured pharmacological interventions (Goyal, 2023; Antar, 2023). A deep understanding of the pathophysiology of both types of diabetes is essential for determining appropriate therapeutic approaches and long-term prognosis (Solis-Herrera, 2018).

Diabetes mellitus (DM) is a chronic metabolic disorder better known as a silent human killer or "Silent killer." Often, individuals are unaware when they have diabetes, which delays treatment and increases the risk of complications (Balaji et al., 2019). Diabetes is also known as the "Mother of Disease" because it is the precursor of other illnesses such as hypertension, cardiovascular disease, stroke, kidney failure, and blindness. *Diabetes mellitus* can affect all age groups and socioeconomic levels. If left uncontrolled, the disease can lead to complications that threaten health (Anani, 2012).

The World Health Organization (WHO) estimates that 177 million people worldwide suffer from diabetes. This number is projected to exceed 300 million by 2025. Diabetes is spreading rapidly in Asia compared to other regions globally. In 2025, the number of diabetes patients is expected to reach 170 million, with 100 million of these cases in India and China alone. Most Asian countries are not prepared to face this health crisis, which results in overcrowded hospital services and strained national health budgets (Hadibroto, 2013).

According to the World Health Organization (WHO) report, diabetes mellitus cases in Indonesia in 2010 amounted to 3% of the total population (239,870,937 people), or about seven million individuals with diabetes mellitus. This means that three out of every 100 Indonesians have *diabetes mellitus*. By 2013, the prevalence had doubled to 6% of Indonesia's 247 million population, or approximately 14,820,000 people with *diabetes mellitus*.

Based on the National Basic Health Research (Riskesdas) report in 2013, diabetes mellitus cases diagnosed based on clinical symptoms in Indonesia were around 2.1%. However, after laboratory blood testing of biomedical samples from residents, the prevalence was much higher, at 6.9% (consistent with WHO data). This indicates that among Indonesians aged 15 years and older, about 7 out of every 100 people suffer from *diabetes mellitus* (Marewa, 2015).

Data from the Lampung Provincial Health Office from 2014 to 2016 showed that *diabetes mellitus* patients numbered 115,780 in 2014, 124,260 in 2015, and 131,766 in 2016 (Lampung Provincial Health Office, 2016). Meanwhile, data from Tulang Bawang Regency showed that in 2014 there were 8,792 *diabetes mellitus* patients, which increased to 9,792 in 2015, and dramatically rose to 27,488 in 2016 (Tulang Bawang Regency Health Office, 2016).

Given the high prevalence and treatment costs for DM patients, efforts are necessary to prevent and manage the disease by enhancing education, promoting adherence to anti-diabetic medication, encouraging physical exercise (physical activity), regulating diet, and conducting regular blood glucose checks. The management behavior of DM differs among patients; this variation is one factor influencing differences in disease recovery levels (Anani, 2012).

Based on preliminary data collected by researchers on May 27, 2018, in the working area of Banjar Baru Health Center, Tulang Bawang Regency—which covers 12 villages in Banjar Baru District and operates Posbindu PTM (Non-Communicable Disease) programs focused on diabetes mellitus (DM), cancer, heart disease, chronic obstructive pulmonary disease (COPD), injuries, and violence—Banjar Baru Health Center has 8 active Posbindu units out of 12. PTM data showed 523 participants with 224 (42.83%) *diabetes mellitus* patients in 2015; in 2016, PTM data was 688 with 305 (44.33%) *diabetes mellitus* patients; and in 2017, PTM data was 503 with 224 (44.53%) *diabetes mellitus* patients.

Based on this background, there was an increase in the incidence of type II *diabetes mellitus* in Lampung Province from 2014-2016, as well as in the working area of Banjar Baru Health Center, Tulang Bawang Regency from 2015-2017. This increase is attributed to low public awareness of healthy living, insufficient physical activity, irregular eating patterns, and habits of consuming coffee or tea with excessive sugar more than once a day, which increases the risk of diabetes complications. Therefore, the researchers are highly motivated to conduct this study on "*Determinants of Behavioral Aspects Related to Increased Blood Sugar Levels of Type II Diabetes Mellitus Patients in the Working Area of Banjar Baru Health Center, Tulang Bawang Regency, 2018*."

METHOD

This type of research is quantitative, where research data is in the form of numbers and analysis using statistics (Sugiyono, 2015). The research design uses analytic survey with cross-sectional approach, which is very important in research, which allows maximization of control

of several factors that can affect the accuracy of results. This research aims to determine behavioral aspect determinants related to type II diabetes mellitus patients in the Working Area of Banjar Baru Health Center, Tulang Bawang Regency in 2018.

This research was conducted in the Working Area of Banjar Baru Health Center, Tulang Bawang Regency, and the research time was conducted in June-July 2018. The population in this study was non-communicable disease patients in the Working Area of Banjar Baru Health Center, Tulang Bawang Regency. The total population was 503 and diabetes mellitus patients were 224 (44.53%) people in 2017.

The sample is a part taken from the entire object to be studied and is considered to represent the entire population (Notoadmodjo, 2012). According to Arikunto (2012): "Sample is part of the population (part or representative of the population studied)". If the population is more than 100 or for small populations or smaller than 10,000, a simple formula can be used as follows (Ridwan, 2010).

Sample size calculation formula for population proportion estimation:

$n = Z^2_{1-\alpha/2} \times p \times (1-p) / d^2$

$n = (1.960)^2 (0.3) (1-0.3) / 0.1^2$

$n = (3.9416) (0.21) / 0.01$

$n = 82.7736$

So, the sample used was 83 type II DM patients in the Working Area of Banjar Baru Health Center, Tulang Bawang Regency in 2017.

The sampling technique used simple random sampling, which is taking sample members from the population randomly without considering the strata in the population (Sugiyono, 2014).

RESULTS AND DISCUSSION

Univariate Analysis

Table 1. Frequency Distribution of Behavioral Aspects Related to Blood Sugar Levels of Type II Diabetes Mellitus Patients

No	Variable	Frequency (n)	Percentage (%)
1	**Type II DM Occurrence**		
	Abnormal	46	55.4
	Normal	37	44.6
2	**Knowledge**		
	Poor	55	66.3
	Good	28	33.7
3	**Attitude**		
	Negative	48	57.8
	Positive	35	42.2
4	**Age of Respondents**		
	At Risk	62	74.7
	Not at Risk	21	25.3
5	**Abdominal Obesity**		
	Overweight	48	57.8
	Normal	35	42.2
6	**Physical Activity**		
	Inactive	46	55.4
	Active	37	44.6
7	**Dietary Pattern**		
	At Risk	46	55.4
	Not at Risk	37	44.6

Based on Table 1, it is known that 83 type II DM patients who became respondents in the Working Area of Banjar Baru Health Center, Tulang Bawang Regency had an average random blood glucose level of 228 mg/dl, which is the abnormal category (RBS > 200 mg/dl) of 46 (55.4%) respondents and normal category (RBS ≤ 200 mg/dl) of 37 (44.6%) respondents.

Bivariate Analysis

Table 2. Relationship between Knowledge and Blood Sugar Levels of Type II DM Patients

No	Knowledge	Type II DM Blood Sugar		Normal		Total		P-value	OR
		Abnormal							
		N	%	N	%	N	%		
1	Poor	37	67.3	18	32.7	55	100	0.005	4.34
2	Good	9	32.1	19	67.9	28	100		(1.64-11.47)
	Total	46	55.4	37	44.6	83	100		

Table 3. Relationship between Attitude and Blood Sugar Levels of Type II DM Patients

No	Attitude	Type II DM Blood Sugar		Normal		Total		P-value	OR
		Abnormal							
		N	%	N	%	N	%		
1	Negative	37	77.1	11	22.9	48	100	0.000	9.717
2	Positive	9	25.7	26	74.3	35	100		(3.52-26.77)
	Total	46	55.4	37	44.6	83	100		

Table 4. Relationship between Age and Blood Sugar Levels of Type II DM Patients

No	Age	Type II DM Blood Sugar		Normal		Total		P-value	OR
		Abnormal							
		N	%	N	%	N	%		
1	At Risk	40	64.5	22	35.5	62	100	0.009	4.545
2	Not at Risk	6	28.6	15	71.4	21	100		(1.54-13.389)
	Total	46	55.4	37	44.6	83	100		

Table 5. Relationship between Abdominal Obesity and Blood Sugar Levels of Type II DM Patients

No	Abdominal Obesity	Type II DM Blood Sugar		Normal		Total		P-value	OR
		Abnormal							
		N	%	N	%	N	%		
1	Overweight	41	85.4	7	14.6	48	100	0.000	5.143
2	Normal	5	14.3	30	85.7	35	100		(1.165-11.5)
	Total	46	55.4	37	44.6	83	100		

Table 6. Relationship between Physical Activity and Blood Sugar Levels of Type II DM Patients

No	Physical Activity	Type II DM Blood Sugar	Normal	Total	P-value	OR
		Abnormal				

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No	Physical Activity	Type II DM Blood Sugar		Normal		Total		P-value	OR
		N	%	N	%	N	%		
1	Inactive	34	73.9	12	26.1	46	100	0.000	5.903
2	Active	12	32.4	25	67.6	37	100		(2.278-15.29)
	Total	46	55.4	37	44.6	83	100		

Table 7. Relationship between Dietary Pattern and Blood Sugar Levels of Type II DM Patients

No	Dietary Pattern	Type II DM Blood Sugar		Normal		Total		P-value	OR
		Abnormal							
		N	%	N	%	N	%		
1	At Risk	36	78.3	10	21.7	46	100	0.000	9.72
2	Not at Risk	10	27.0	27	73.0	37	100		(3.545-26.65)
	Total	46	55.4	37	44.6	83	100		

Multivariate Analysis

After conducting bivariate selection, all variables were related with p-values <0.25. Therefore, all variables are very important in relation to the nutritional status of type II DM occurrence.

Table 8. Final Model

Variable	P-value	Exp (B)
Attitude	0.029	7.344
Obesity	0.025	7.949
Physical Activity	0.022	8.96
Dietary Pattern	0.020	10.946

From the multivariate analysis results, the variables significantly related to type II DM patients are attitude, obesity, physical activity, and dietary pattern variables. The Odds Ratio (OR) of the dietary pattern variable is 10.946, meaning that type II DM patients in the category of irregular dietary patterns will be at risk of experiencing blood sugar levels 10.946 times higher than type II DM patients in the category of regular dietary patterns after controlling for attitude, obesity, and physical activity variables.

Discussion

Univariate Analysis

The univariate results based on type II DM patient variables showed that 83 respondents in the Working Area of Banjar Baru Health Center, Tulang Bawang Regency had an average random blood glucose level of 228 mg/dl, which is the abnormal category (RBS > 200 mg/dl) of 46 (55.4%) respondents and normal category (RBS ≤ 200 mg/dl) of 37 (44.6%) respondents.

According to Hadibroto (2013), type II DM or called DM that is not dependent on insulin. This DM is caused by insulin that cannot work properly, insulin levels can be normal, low, or even increased but the insulin function for glucose metabolism is absent/lacking. As a result, glucose in the blood remains high, resulting in hyperglycemia. 75% of type II DM patients have obesity or are very overweight and are usually diagnosed with DM after age 45 years.

Bivariate Analysis

Relationship between Knowledge and Blood Sugar Levels of Type II DM Patients

Statistical test results obtained p-value = 0.005, meaning there is a relationship between knowledge and blood sugar levels of type II diabetes mellitus patients in the Working Area of Banjar Baru Health Center, Tulang Bawang Regency in 2018. Statistically, the OR value = 4.34, meaning that type II diabetes mellitus patients with poor knowledge about type II DM disease have a 4.34 times greater chance of blood sugar levels compared to type II diabetes mellitus patients with good knowledge.

Relationship between Attitude and Blood Sugar Levels of Type II DM Patients

Statistical test results obtained p-value = 0.000, meaning there is a relationship between attitude and blood sugar levels of type II diabetes mellitus patients in the Working Area of Banjar Baru Health Center, Tulang Bawang Regency in 2018. Statistically, the OR value = 9.717, meaning that type II diabetes mellitus patients with negative attitudes toward type II DM disease have a 9.717 times greater chance of blood sugar levels compared to type II diabetes mellitus patients with positive attitudes.

Relationship between Age and Blood Sugar Levels of Type II DM Patients

Statistical test results obtained p-value = 0.009, meaning there is a relationship between age and blood sugar levels of type II diabetes mellitus patients in the Working Area of Banjar Baru Health Center, Tulang Bawang Regency in 2018. Statistically, the OR value = 4.545, meaning that type II diabetes mellitus patients aged >45 years have a 4.545 times greater chance of blood sugar levels compared to type II diabetes mellitus patients aged ≤45 years.

Relationship between Abdominal Obesity and Blood Sugar Levels of Type II DM Patients

Statistical test results obtained p-value = 0.000, meaning there is a relationship between abdominal obesity and blood sugar levels of type II diabetes mellitus patients in the Working Area of Banjar Baru Health Center, Tulang Bawang Regency in 2018. Statistically, the OR value = 5.143, meaning that type II diabetes mellitus patients with overweight waist circumference have a 5.143 times greater chance of blood sugar levels compared to type II diabetes mellitus patients with normal waist circumference.

Relationship between Physical Activity and Blood Sugar Levels of Type II DM Patients

Statistical test results obtained p-value = 0.000, meaning there is a relationship between physical activity and blood sugar levels of type II diabetes mellitus patients in the Working Area of Banjar Baru Health Center, Tulang Bawang Regency in 2018. Statistically, the OR value = 5.903, meaning that type II diabetes mellitus patients with inactive physical activity (<3 times per week) have a 5.903 times greater chance of blood sugar levels compared to type II diabetes mellitus patients with active physical activity.

Relationship between Dietary Pattern and Blood Sugar Levels of Type II DM Patients

Statistical test results obtained p-value = 0.000, meaning there is a relationship between dietary patterns and blood sugar levels of type II diabetes mellitus patients in the Working Area of Banjar Baru Health Center, Tulang Bawang Regency in 2018. Statistically, the OR value = 9.72, meaning that type II diabetes mellitus patients with irregular dietary patterns have a 9.72 times greater chance of blood sugar levels compared to type II diabetes mellitus patients with regular dietary patterns.

Multivariate Analysis

Based on multivariate logistic regression model analysis, a p-value = 0.02 was obtained, which means <0.05, and the analysis value obtained an Odds Ratio (OR) of the dietary pattern variable of 10.946, meaning that type II DM patients in the category of irregular dietary patterns will be at risk of experiencing blood sugar levels 10.946 times higher than type II DM patients in the category of regular dietary patterns after controlling for attitude, obesity, and physical activity variables. To see which variable has the greatest influence on the dependent variable, it is seen from the exp (B) for significant variables. The larger the exp (B) value, the greater the influence on the dependent variable being analyzed. In this data, dietary patterns have the greatest influence on type II DM patients.

CONCLUSION

This study demonstrates a significant association between various behavioral factors and blood glucose levels in type II diabetes mellitus patients, with all variables—knowledge, attitude, age, abdominal obesity, physical activity, and dietary patterns—showing meaningful relationships. Among these, dietary patterns emerged as the most dominant determinant, as irregular eating habits increase the risk of elevated blood glucose levels by nearly eleven times compared to regular patterns, even after adjusting for other factors. These results highlight the critical need for comprehensive diabetes management programs that prioritize dietary modifications, enhance patient knowledge and attitudes, promote weight control, and encourage physical activity to improve glycemic outcomes. Future research should explore intervention strategies that effectively integrate behavioral changes, particularly focusing on sustainable dietary and lifestyle habits, to optimize long-term blood sugar control in diverse patient populations.

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