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Factors Associated with Blood Sugar Control Behavior on Patients with Diabetes Mellitus in Blang Kuta Community Health Center Area, Pidie Jaya District in 2023

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ABSTRACT

Introduction: Diabetes mellitus has become one of the increasingly alarming global health challenges. As a chronic disease, diabetes results in various detrimental consequences, including high mortality rates and significant healthcare costs.

Objective: This research aims to determine the factors associated with blood sugar control behavior among diabetes mellitus patients in the Blang Kuta Community Health Center's service area.

Method: This study is a quantitative research with a cross-sectional approach. The population in this study consists of all DM patients in 4 villages in the Blang Kuta Community Health Center's service area, totaling 252 individuals. Sampling was conducted using proportional random sampling techniques, involving 72 DM patients. Data collection was performed through interviews using questionnaires and analyzed through univariate, bivariate analysis using chi-square test, and multivariate analysis using logistic regression test using the SPSS program.

Result: The univariate analysis results revealed that the majority of respondents exhibited poor behavior (54.2%). Bivariate analysis results indicated a significant relationship between knowledge (p-value 0.000), level of education (p-value 0.002), gender (p-value 0.005), and self-efficacy (p-value 0.000) with blood sugar control behavior. However, variables such as family history (p-value 0.471) and duration of diabetes mellitus (p-value 0.277) did not show a significant relationship. Multivariate analysis results indicated that knowledge (p-value = 0.035, OR = 5.114) and self-efficacy (p-value = 0.000, OR = 13.278) are important determinants of blood sugar control among patients with diabetes mellitus.

Conclusion: There is a significant relationship between knowledge, education, gender, and self-efficacy with blood sugar control behavior. However, variables such as family history of diabetes mellitus and duration of diabetes mellitus do not show a significant relationship. Nonetheless, factors strongly associated with blood sugar control behavior in diabetic patients are knowledge and self-efficacy.

Keywords: Diabetes Mellitus; Blood Sugar Control Behavior; Knowledge; Education; Self-Efficacy

INTRODUCTION

Diabetes Mellitus (DM) is a group of metabolic diseases characterized by high blood sugar levels caused by impaired insulin secretion, impaired insulin function, or a combination of both [1]. In cases of uncontrolled DM, insulin can increase blood sugar levels and the body's inability to produce insulin can worsen the condition. This situation is known as hyperglycemia. As a result, high blood sugar levels can lead to damage and impaired function in various tissues and organs in the body [2].

The World Health Organization (WHO) indicates that non-communicable diseases are the leading cause of death worldwide, accounting for 71%. Additionally, WHO reports an 8.5% increase in the number of adults with DM, totaling 422 million people affected by the disease globally. This is particularly prevalent in low- and middle-income countries. It is estimated that around 2.2 million deaths due to DM occur in people under the age of 70. Moreover, it is projected that the number of people with DM will rise to 600 million by 2035 [3].

Countries in the Arab-North Africa and Western Pacific regions have the highest prevalence of diabetes among the 20-79 year-old population across seven global regions, at approximately 12.2% and 11.4%, respectively. The Southeast Asia region, including Indonesia, ranks third with a prevalence of around 11.3%. The International Diabetes Federation (IDF) also projects the number of DM cases in several countries and has identified the 10 countries with the highest numbers of DM sufferers. China, India, and the United States top the list with approximately 116.4 million, 77 million, and 31 million cases of DM, respectively. Indonesia ranks seventh among the 10 countries with the highest number of DM sufferers, with around 10.7 million cases. Thus, Indonesia is the only Southeast Asian country listed, indicating Indonesia's significant contribution to the prevalence of DM cases in the Southeast Asia region [4].

The Aceh Health Office recorded 184,527 people with DM in Aceh in 2021. Pidie Jaya Regency has 7,737 people with DM, making it one of the regencies with a high number of DM cases and ranking fifth among other regencies. The highest number of DM sufferers is in Bireun Regency, with 13,061 people [5]. At the Blang Kuta Health Center, the number of recorded DM cases in 2021 was 470. Of these, 171 cases were male and 299 cases were female. In 2022, the number of recorded DM cases was 471, with 178 male patients and 293 female patients. Thus, there was an increase of 1 case from 2021 to 2022. However, when considering the female patients, there was a decrease of 6 cases, which was attributed to a reduction in the number of patient visits to the Health Center [6].

As a chronic disease, DM results in various adverse consequences, including high mortality rates and substantial healthcare costs. Patients suffering from DM are at high risk for serious and even fatal side effects, such as retinal damage and blindness, peripheral neuropathy, heart attacks, peripheral vascular problems, end-stage renal disease (ESRD), diabetic foot, and amputations. These conditions arise when blood sugar levels are not adequately controlled, which can lead to severe damage and even death [7]. Patients with DM also experience delayed wound healing and may even never heal, leading to amputation and death [8]. The most important factor in preventing DM complications involves managing self-care in DM patients. Activities and desired outcomes of self-care management for DM include exercising, consuming healthy foods, correctly taking medication, monitoring glucose levels, reducing risk factors, addressing emerging issues, and implementing healthy coping strategies [9].

Research conducted by Putri (2017) identified several factors that can influence DM care behaviors, including age, gender, level of education, duration of diabetes, social support, and healthcare provider behavior. Some demographic characteristics such as gender and level of education are considered determinants of compliance or behavior in DM patients [10]. Furthermore, individual vulnerability factors will influence intra-personal factors such as the level of determination, coping strategies, self-confidence, and family support. These factors will ultimately affect how individuals manage their self-care, both directly and indirectly [11].

Several previous studies have yielded diverse findings. In a study conducted by Agustina and Muflihatin (2020), the results showed a significant relationship between the level of knowledge and the control of blood sugar levels in type 2 DM patients [12]. This statement is also supported by the research of Lendu and Wibowo (2022), indicating a relationship between gender and blood sugar levels in DM patients [13]. Similarly, research conducted by Paramita and Lestari (2019) showed that a family history of DM influences the increase in blood sugar levels [14]. Another study conducted by Azis and Yulianti (2021) indicates that there is a relationship between self-efficacy and blood sugar control behavior [15]. Similarly, research by Selano (2023) shows that the duration of having DM has a significant relationship with self-care behavior and blood sugar control in DM patients. The longer the duration of having DM, the lower the self-care behavior and the worse the blood sugar control in DM patients [16].

Based on the current situation where DM patients tend to inconsistently follow daily care routines, they experience difficulties in actively preventing and controlling blood sugar levels. The significant impact caused by DM is not only on mortality but can also lead to complications that severely affect the quality of life of DM patients. One of the factors contributing to the occurrence of complications in DM patients is poor blood sugar

control behavior. The difficulty in accessing healthcare services due to the remote location of the Blang Kuta Health Center's working area has sparked researchers' interest in conducting research in that area, and there have been no previous researchers who have studied DM cases. The aim of this research is to determine the factors related to blood sugar control behavior in Diabetes mellitus patients in the Blang Kuta Health Center's working area.

METHOD

This study is a quantitative research with a cross-sectional approach. The research was conducted in December 2023. The population in this study consisted of all DM patients in four villages in the Blang Kuta Health Center's working area, totaling 252 individuals. The sampling technique used in the research was proportional random sampling or random sampling using Microsoft Excel with the Rand formula, resulting in a sample size of 72 DM patients. The samples were randomly selected based on the names of patients classified as type 2 DM. Data collection was carried out through interviews using questionnaires and analyzed using univariate, bivariate with chi-square test, and multivariate with logistic regression test. The software used to analyze the data was the Statistical Package for the Social Sciences (SPSS). This study utilized two types of data sources: primary data (collected directly by the researcher) and secondary data (obtained from other sources).

RESULTS
Univariate Analysis

Table 1. Distribution of respondents based on blood sugar control behavior (dependent variable of the study)

Blood Sugar Control Behavior	Frequency	(%)
Good Behavior	33	45,8
Poor Behavior	39	54,2
Total	**72**	**100**

Based on Table 1, it is found that the majority of respondents exhibit poor blood sugar control behavior, amounting to 54.2%.

Table 2. Distribution of Respondents Based on Independent Research Variables (N=72)

Variable	Frequency	(%)
Knowledge		
Good	47	65,3
Poor	25	34,7
Education		
High	5	6,9
Medium	40	55,6
Low	27	37,5
Gender		
Male	16	22,2
Female	56	77,8
Family History of DM		
Exists	43	59,7
Does not exist	29	40,3
Self Efficacy		
Sure	30	41,7
Less confident	42	58,3
Duration of Suffering From DM		
<5 Years	26	36,1
≥5 Years	46	63,9

Based on Table 2, it is found that the majority of respondents have good knowledge (65.3%), have a medium level of education (55.6%), are female (77.8%), have a family history of DM (59.7%), are less confident about self-efficacy (58.3%), and have been suffering from DM for ≥5 years (63.9%).

Bivariate Analysis

Table 3. Results of bivariate tests examining the relationship between each independent variable and the dependent variable of the study

Variable	Blood Sugar Control Behavior				Total		p-*value* (95% CI)
	Poor Behavior		Good Behavior				
	n	%	n	%	n	%	
Knowledge							
Poor	22	88,0	3	12,0	25	100	0,000
Good	19	40,4	28	59,6	47	100	
Education							
Low	21	77,8	6	22,2	27	100	0,002
Medium	20	50,0	20	50,0	40	100	
High	0	0	5	100,0	5	100	
Gender							
Male	14	87,5	2	12,5	16	100	0,005
Female	27	48,2	29	51,8	56	100	
Family History of DM							
Does not exist	18	62,1	11	37,9	29	100	0,471
Exists	23	53,5	20	46,5	43	100	
Self Efficacy							
Less confident	35	83,3	7	16,7	42	100	0,000
Sure	6	20,0	24	80,0	30	100	
Lama Menderita DM							
<5 Years	17	65,4	9	34,6	26	100	0,277
≥5 Years	24	52,2	22	47,8	46	100	

Based on Table 3, the bivariate analysis was conducted using the chi-square test. The table shows that the variables of knowledge, education, gender, and self-efficacy have a significant relationship with blood sugar control behavior (p-value < 0.05). However, the variables of family history of DM and duration of suffering from DM do not have a significant relationship with blood sugar control behavior (p-value > 0.05). To perform multivariate analysis, a selection of independent variables to be included in the multivariate test is carried out. Variables with p-values < 0.25 are selected for multivariate analysis. Based on Table 3, it is found that the variables of knowledge, education, gender, and self-efficacy are included in the multivariate modeling using logistic regression, while the variables of family history of DM and duration of suffering from DM are not included in the multivariate modeling because their p-values are > 0.25.

Multivariate Analysis

Table 4. Final Results of Multivariate Modeling

Variable	p-*value*	OR
Knowledge	0,035	5,114
Self efficacy	0,000	13,278

Based on Table 4, in the final stage of multivariate modeling using logistic regression, it is observed that the variables of knowledge (p-value 0.035) and self-efficacy (p-value 0.000) have the most significant relationship with blood sugar control behavior. With an Odds Ratio (OR) of 5.114, this means that individuals with good knowledge are 5 times more likely to engage in good blood sugar control behavior compared to those with poor knowledge. Meanwhile, self-efficacy has an OR of 13.278, indicating that individuals who have confidence in their abilities are 13 times more likely to engage in good blood sugar control behavior compared to those who are less confident.

DISCUSSION
The Relationship between Knowledge and Blood Sugar Control Behavior
In this study, the group of patients with good knowledge tend to exhibit a higher percentage of good blood sugar control behavior compared to those with poor knowledge. This can be influenced by several factors such as

gender, family history, and duration of suffering from DM. The research findings indicate that the majority of respondents are female (77.8%), have a family history of DM (59.7%), and have been suffering from DM for ≥5 years (63.9%). Individuals who are female generally have higher knowledge and awareness about diabetes mellitus compared to males. Ullya's study (2024) explains that the respondents' gender distribution shows the highest percentage among females (69.44%), while males account for (30.56%) [17]. Similarly, individuals with a family history of diabetes generally have higher knowledge and awareness about diabetes mellitus compared to those without a family history of diabetes. Additionally, DM patients with a duration of illness ≥5 years have enough experience to understand diabetes mellitus.

The research conducted by Agustina and Muflihatin (2020), titled "The Relationship between Knowledge Level and Blood Sugar Control in Type II DM Patients at AWS Regional Hospital," yielded significant results indicating a relationship between knowledge level and blood sugar control in Type II DM patients, with a p-value of 0.000 < α (0.05) [12]. This finding is supported by a study conducted by Hasani and Wulan Majid in 2019, which also found a significant relationship between knowledge level and blood sugar levels (p-value 0.000) [18].

The Relationship between Education and Blood Sugar Control Behavior

In this study, the group of DM patients with higher levels of education tends to have a higher percentage of good blood sugar control behavior compared to the groups with moderate and low levels of education. This can be explained by the fact that individuals with higher levels of education typically have better knowledge about DM and how to control it. This good knowledge can enhance individuals' understanding of the importance of blood sugar control and how to achieve it. Additionally, individuals with higher levels of education often have better access to information and resources that can aid them in blood sugar control. For example, they may be more likely to have access to the internet and social media, which can serve as sources of information about diabetes mellitus and its management. Moreover, individuals with higher levels of education are more likely to have access to quality healthcare facilities, which can provide the necessary support and information needed for blood sugar control.

This study aligns with research conducted by Mayasari and Salmiyati (2020) titled "The Relationship between Education Level and Type 2 Diabetes Mellitus Care Behavior." Their findings indicate a significant relationship between education level and Type 2 diabetes mellitus care behavior [19]. Another study by Mustipah (2019) found a relationship between education level and self-care in Type 2 DM patients at the Depok III Sleman Yogyakarta Health Center, with a p-value of 0.002 < 0.05 [20].

Individuals with higher levels of education are more likely to be exposed to information about DM and its management through formal education, informal education, and mass media. This information can enhance individuals' knowledge and awareness of the importance of blood sugar control. Additionally, individuals with higher levels of education are also more likely to have role models who can serve as examples in blood sugar control behavior.

The Relationship between Gender and Blood Sugar Control Behavior

In this study, the group of male DM patients tends to have a lower percentage of good blood sugar control behavior compared to the group of female DM patients. This difference may be attributed to several factors including variations in knowledge and social support. There may be differences in knowledge and awareness regarding diabetes mellitus. Generally, females have higher knowledge and awareness of diabetes mellitus compared to males.

Differences in social support. Females generally have stronger social support from family and friends, making it easier for them to engage in good blood sugar control behavior [21]. The results of this study are supported by several other research findings indicating that women with diabetes mellitus have better blood sugar control behavior compared to men with diabetes mellitus. This study aligns with research by Lilmawati et al. (2022), which found a significant relationship between gender and glycemic control, with a p-value of 0.001 < 0.05 [22].

The Relationship between Family History of DM and Blood Sugar Control Behavior

Knowledge and awareness of diabetes mellitus: Individuals with a family history of diabetes generally have higher knowledge and awareness of diabetes mellitus compared to individuals without a family history of diabetes. Individuals with a family history of diabetes are more likely to seek information about diabetes mellitus, both from family members and other sources. Additionally, individuals with a family history of diabetes are more likely to participate in health education programs about diabetes mellitus.

Concern about diabetes mellitus complications, Individuals with a family history of diabetes generally have higher concerns about diabetes mellitus complications compared to individuals without a family history of

diabetes. This can motivate them to be more serious about controlling their blood sugar levels. Differences in patient characteristics: The group of DM patients with a family history of diabetes and the group without a family history of diabetes may have different characteristics, such as education level, gender, or age. These differences in characteristics can influence patients' blood sugar control behavior.

This study contradicts the findings of research conducted by Nuraisyah et al. (2021), which found that the group with a family history had higher fasting blood sugar levels compared to the group without a family history (OR=3.7; p-value:0.04; 95% CI: 0.89-22.30). Therefore, individuals with a family history are more likely to have higher fasting blood sugar levels than those without a family history of Type 2 Diabetes Mellitus (DMT2) [23].

The research conducted by Cahyani (2024) indicates that there is an association between family history and the occurrence of diabetes mellitus in the case group, with a proportion of 33.33% lower compared to the respondents in the control group, which was 72.22%. Meanwhile, the proportion of respondents with a family history of diabetes mellitus in the case group was 66.67% higher compared to the proportion of respondents in the control group, which was 27.78%. The statistical test results show a value of OR = 5.2, CI 95% = 1.90 – 14.22, P-Value = 0.001, indicating that respondents with a family history are 5.2 times more likely to suffer from diabetes mellitus compared to respondents without a family history of diabetes mellitus. With this P-Value, there is an association between family history and the occurrence of diabetes mellitus [24].

The Relationship between Self-Efficacy and Blood Sugar Control Behavior

Self-efficacy is an individual's belief in their ability to perform a specific task or action. Individuals with high self-efficacy believe that they are capable of performing the task or action, while those with low self-efficacy believe that they are not capable of doing so. Albert Bandura's theory of self-efficacy states that individuals' beliefs in their own abilities to overcome tasks or specific situations can influence their behavior. In the context of this study, respondents with high levels of self-efficacy may have confidence in their ability to manage blood sugar effectively, thus increasing the likelihood of good blood sugar control behavior.

High self-efficacy can motivate individuals to take necessary actions to achieve their goals. In this case, the goal is to control blood sugar levels. Individuals with high self-efficacy are more motivated to make lifestyle changes necessary to control their blood sugar, such as consuming healthy foods, exercising regularly, and taking medications consistently.

High self-efficacy can help individuals overcome barriers they may encounter in achieving their goals. In this case, barriers individuals may face in controlling their blood sugar levels include fatigue, hunger, and boredom. Individuals with high self-efficacy are better able to overcome these barriers [25]. This is also supported by research conducted by Irawan and Adisty (2022), which found a significant relationship between self-efficacy and self-care management in DM patients in the Karangayu Health Center catchment area, with a p-value of 0.000 < 0.05 [26].

The Relationship between Duration of Suffering from DM and Blood Sugar Control Behavior

Differences in patient characteristics: The group of DM patients suffering from the disease for less than 5 years and the group suffering for more than 5 years may have different characteristics, such as education level, gender, or severity of diabetes mellitus. These differences in characteristics can influence patients' blood sugar control behavior.

This could be due to differences in understanding of DM and the importance of blood sugar control. DM patients with a duration of less than 5 years may still have limited understanding of diabetes mellitus and the importance of blood sugar control. They may have been recently diagnosed with diabetes mellitus, thus lacking sufficient experience to understand the condition fully. Additionally, DM patients with a duration of less than 5 years may not have received adequate education about diabetes mellitus and the importance of blood sugar control.

This is also consistent with previous research conducted by Rahayu and Saraswati (2018), which found no significant relationship between the duration of suffering from DM and blood sugar control, with a p-value of 0.91 > 0.05 [27].

CONCLUSION

This study concludes that there is a significant relationship between knowledge, education, gender, and self-efficacy with blood sugar control behavior. However, variables such as family history of DM and duration of suffering from DM show no significant relationship. Although not statistically significant, the group of patients with a family history of DM demonstrates better blood sugar control behavior compared to the group without a family history of DM. Similarly, regarding the duration of suffering from DM, although not statistically significant, the group of DM patients suffering for ≥5 years exhibits better blood sugar control behavior compared to the group

suffering for <5 years. Moreover, the most significant factor associated with blood sugar control behavior is self-efficacy.

SUGGESTION

This study recommends several suggestions to the Health Center to provide more comprehensive education, including nutrition education, physical exercise, meal planning, and the importance of blood sugar control to all DM patients. Assisting patients in developing the necessary skills and knowledge to control blood sugar, including self-management skills. Building intervention programs such as spiritual care or fulfilling spiritual needs to enhance self-efficacy in DM patients, which impacts physical, psychological, and social health, especially patients with low self-efficacy.

Suggestions for further research include using a larger sample size to ensure the relationship between family history of diabetes and duration of suffering with blood sugar control behavior. Additionally, it is necessary to examine other factors that may affect blood sugar control behavior, such as marital status, employment status, psychological aspects, and socio-cultural aspects. Furthermore, conducting blood sugar level checks to assess compliance with patients' behaviors in controlling blood sugar is also recommended.

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