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THE EFFECT OF SELF-CARE BEHAVIOR ON BLOOD GLUCOSE CONTROL LEVELS AMONG PATIENTS WITH TYPE II DIABETES MELLITUS

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ABSTRACT
Diabetes mellitus is characterized by elevated blood glucose levels above normal, with random blood glucose levels ⩾ 200 mg/dl and fasting blood glucose levels ⩾ 126 mg/dl. This study employed a quantitative research method with a quasi-experimental design and an equivalent control group design approach. The study utilized power analysis with consecutive sampling techniques. Data collection techniques involved distributing questionnaires to 74 diabetes mellitus patients in the Onolalu Health Center Working Area, South Nias District. Data analysis techniques used independent t-test statistical analysis and presented in the form of a T-test table. The results of the study indicate that there is an influence of self-care behavior on blood sugar control levels in type II diabetes mellitus patients in the Onolalu Health Center Working Area, South Nias Regency, with a Sig. (2-tailed) of 0.024 < 0.05. Therefore, in the independent sample t-test, it can be concluded that the null hypothesis (HO) is rejected and the alternative hypothesis (Ha) is accepted. Thus, it can be concluded that there is a significant (statistically significant) difference between the average blood sugar levels of type II diabetes mellitus patients in the intervention group and the control group.

Keywords: blood sugar control; diabetes; self-care behavior

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INTRODUCTION

Type 2 diabetes mellitus (DM) is one of the chronic diseases with a continuously increasing prevalence worldwide. Globally, diabetes affects 537 million people (10.5%) aged 20–79 years, with projections indicating it will rise to 783 million (12.2%) by 2045. Additionally, it is estimated that 1.28 billion adults aged 30–79 years worldwide suffer from hypertension (WHO, 2023). Diabetes mellitus in Indonesia is increasing year by year. According to the International Diabetes Federation in 2021, there were 537 million adults aged 20-79 years with diabetes mellitus, and this number is projected to reach 643 million by 2030 and is estimated to increase to 783 million by 2045. According to data from Rikesdas (2020) in North Sumatra Province, the prevalence of diabetes mellitus cases among individuals aged ≥15 years in North Sumatra was diagnosed at 1.8%. According to data from the Health Department of Medan City in 2018, there were 319 diabetes mellitus patients, while in 2019, the number increased to 402 patients, and further rose to 512 patients in 2020 (Medan City Health Department, 2020).

High diabetes mellitus has a negative impact on patients' health, leading to various complications and poor quality of life (Abedini et al., 2020). The worst-case scenario for diabetes mellitus patients is an increase in mortality if treatment and control of diabetes are not carried out properly. Poorly managed diabetes mellitus can cause new problems for patients. Therefore, diabetes mellitus patients must practice *self-care behavior* to reduce the risk of complications. *Self-care behavior* can be part of patients' efforts to control blood sugar levels within normal limits, thereby having a positive impact on their health (Munir, 2021).

Self-care behavior is an effort by an unhealthy individual to become healthy in order to maintain their health consistently (Muridyanti, Effendy, & Suhoyo, 2022).

Self-care behavior is an individual's actions to maintain their health and manage their medical conditions with appropriate treatment. People with diabetes mellitus have good behavior in regulating their diet, physical activity, monitoring blood sugar levels, and managing stress. The implementation of good self-care behavior can help individuals control their blood sugar levels effectively. Good self-care behavior improves diabetes patients' satisfaction, confidence, independence, and quality of life (Romadhon, Aridamayanti, Syanif, & Sari, 2020). Knowledge about diabetes and the ability to understand and apply self-care behaviors are crucial for controlling diabetes with blood sugar levels within normal limits and preventing the risk of complications (Wahyuni, Setiasih, & Aditama, 2021).

Culture plays a significant role in self-care behavior. The Nias culture, where most of the Nias population resides, has unique traditions and cultural values that influence how they maintain their health. Understanding the influence of local culture on self-care behavior can provide insights into designing more effective health interventions. The traditional diet of the Nias community, particularly in South Nias District, is often high in carbohydrates and low in fiber, which can affect blood sugar control. Therefore, it is important to explore how cultural knowledge and practices can be integrated into healthier self-care behaviors. The Nias community has many local foods that can be utilized to create healthier options.

Understanding local foods, social customs, and traditional cultural practices can play an important role in *self-care behavior* (Karota, Lufthiani, Nasution, Rusdi, & Rokhima, 2024). *Self-care behavior* can influence communities, and consuming foods that are low on the glycemic index and rich in fiber can help regulate blood sugar levels, while traditional activities such as dancing and community work can contribute to increased physical activity. Blood sugar control, local wisdom, and social structures in Nias can create an environment that supports patients with type II diabetes mellitus in implementing self-care behaviors.

The implementation of culturally based self-care behaviors can enhance patients' motivation and adherence in managing diabetes. This has a positive impact on their blood sugar control (Karota & Lufthiani, 2020). Self-care behaviors influenced by Nias culture have the potential to improve blood sugar control in patients with type II diabetes mellitus. Based on previous research conducted by Wahyuni, Setiasih & Aditama (2021) on the influence of education on *self-care behaviors* of type 2 diabetes patients at the Diabetes Ubaya Home, it was found that there is an influence *of self-care behavior* on blood sugar control levels in diabetes patients. The same was also stated by the study by Hendra, Bachtiar, and Fauziyah (2024), who stated that self-care, including diet management, blood sugar monitoring, medication management, physical activity, and foot care, can be used to control blood sugar levels in diabetes mellitus patients.

The Onolalu Health Center in Onolalu District, South Nias Regency, has been implementing various health services specifically for diabetes mellitus patients since 2016. Based on interviews with nurses at the Onolalu Health Center, it was found that the average community members, especially those with diabetes mellitus, still find it difficult to control their blood sugar levels and lack understanding of self-care behaviors for diabetes mellitus patients. The implementation of *self-care behavior* or self-care practices among diabetes mellitus patients in the Onolalu Health Center's service area needs to be optimized and implemented to address the challenges and obstacles faced by patients and the implementation of these practices by nurses at the Onolalu Health Center. This study aims to examine the effect of self-care behavior on the level of blood sugar control in patients with type II diabetes mellitus.

METHOD

The type of research used in this study is quantitative research with a quasi-experimental design and *an equivalent control group* design approach. The population in this study consisted of all diabetes mellitus patients in the Onolalu Health Center working area in South Nias District, totaling 237 people. The sample in this study consists of type II diabetes patients who have received treatment at the Onolalu Health Center in Onolalu District, South Nias Regency, and meet the inclusion and exclusion criteria. The sample size was determined using a power analysis table with equal power set at (1-β) = 0.80, an estimated effect size of 0.70, and a significance level (α) of 0.05. resulting in a sample size of 33 respondents. Therefore, the final sample required for this study is 37 respondents for the control group and 37 respondents for the intervention group, totaling 74 respondents. The sampling technique used in this study was *non-probability sampling* with *consecutive sampling* as the sampling method. The most commonly used instrument to assess the implementation of "*Seven Self-Care Behaviors"* is *the Diabetes Self-Management Questionnaire* (DSMQ).

The DSMQ questionnaire has a calculated r value of 0.200 - 0.743, a tabulated r value of 0.361, and a Cronbach's alpha value of 0.812 (r alpha = 0.361), thus the questionnaire is considered reliable. Validity testing of the hardiness scale using construct validity indicates that the hardiness scale, consisting of 16 items, is valid. The tool used to measure blood sugar control levels is a *point-of-care test (POCT) glucose meter*, the Bivariate analysis was conducted to identify the effect of self-care behavior on blood sugar control levels in patients with Type II diabetes using an *independent t-test* and presented in the form of *a t-test* table. After the data was distributed normally and homogeneously, bivariate analysis was conducted using *a t-test* to identify whether there were differences in blood sugar control levels among Type II DM patients after receiving *self-care behavior* intervention in each group. *A p-value* less than 0.05 indicates a significant difference in means.

RESULT

Data collection was conducted from February 10 to February 28, 2025, in the Onolalu Health Center Work Area, Onolalu Subdistrict, South Nias District. The researcher described and explained the results of the study conducted. Univariate analysis was conducted to determine the characteristics of the respondents, presented in the form of frequency distributions and percentages, including age, gender, educational level, occupation, marital status, and duration of diabetes. Bivariate analysis was performed to identify the effect of *self-care behavior* on blood sugar control levels in type II diabetes mellitus patients in the Onolalu Health Center work area, South Nias District. Data collection was conducted from February 10 to February 28, 2025. Respondents were divided into two groups: 37 respondents as the intervention group and 37 respondents as the control group. The results of the study on 74 respondents, where 37 respondents were in the intervention group and 37 respondents were in the control group, revealed the characteristics of type II diabetes mellitus patients based on age, gender, highest level of education, occupation, marital status, and duration of diabetes mellitus, as shown in Table 1.

Based on the table 1, it shows that the distribution of respondent characteristics according to age in the intervention group is predominantly aged 30-60 years with 54.1%, and in the control group, the majority are aged 30-60 years with 51.4%. The characteristics of respondents according to gender in the intervention group are predominantly male, with 24 people (64.9%), and in the control group, predominantly male, with 19 people (51.4%). Characteristics of respondents according to educational attainment in the intervention group were predominantly elementary school graduates, with 14 people (37.9%), and in the control group, the majority were also elementary school graduates, with 15 people (40.6%). Characteristics of respondents according to occupation in the intervention group were

predominantly employed, with 19 people (51.4%), and in the control group, the majority were also employed, with 24 people (68.4%). Characteristics of respondents according to marital status in the intervention group were mostly married, with 27 people (73.0%), and in the control group, mostly married, with 21 people (56.8%). Characteristics of respondents according to the duration of diabetes mellitus in the intervention group were predominantly 5–10 years (17 people, 45.9%), while in the control group, the majority had diabetes for <5 years (24 people, 64.9%).

Table 1.
Frequency Distribution and Percentage of Demographic Characteristics of Respondents in the Intervention and Control Groups (n = 74)

Characteristics	Intervention Group		Control Group	
	f (37)	%	f (37)	%
Age:				
30–60 years	20	54.1	19	51.4
> 60 years	17	45.9	18	48.6
Gender:				
Male	24	64.9	19	51.4
Female	13	35.1	18	48.6
Highest Level of Education:				
Elementary	14	37.9	15	40.6
Junior High School	12	32.4	7	18.9
High School	4	10.8	8	21.6
Advanced Diploma (D3)	5	13.5	4	10.8
Undergraduate Education (S1)	2	5.4	3	8.1
Occupation:				
Employed	19	51.4	24	64.8
Not working	18	48.6	13	35.2
Marital Status:				
Married	27	73.	21	56.8
Not Married	10	27	16	43.2
Duration of Illness:				
< 5 years	13	35.2	24	64.9
5–10 years	17	45.9	10	27.0
> 10 years	7	18.9	3	8.1

Table 2.
Frequency Distribution and Percentage of *Self-Care Behavior* in the Intervention and Control Groups (n = 74)

Self-Care Behavior	Intervention Group		Control Group	
	f (37)	%	f (37)	%
Conducted	37	100.0	0	0.0
Not done	0	0	37	100.0

Based on the table 2, it shows that the frequency distribution and percentage *of self-care behavior* in the intervention group were all implemented in 37 individuals with a presentation of 100%, while in the control group, no *self-care behavior* intervention was conducted in 37 individuals with a presentation of 100%.

Table 3.
Frequency Distribution and Percentage of Blood Sugar Control Levels in Type II Diabetes Mellitus Patients in the Intervention and Control Groups (n = 74)

Blood Sugar Control Levels in Type II Diabetes Mellitus Patients	Intervention Group		Control Group	
	f (37)	%	f (37)	%
Controlled (<200 mg/dL)	27	73.0	15	40.5
Uncontrolled (>200 mg/dL)	10	27	2	59.5

Based on the table 3, it shows that the frequency distribution and percentage of blood sugar control levels in diabetes mellitus patients in the intervention group were mostly controlled, with 27 out of 37 patients having controlled blood sugar levels after receiving *self-care*

behavior intervention, representing 73%. In the control group, out of 37 patients, 22 had uncontrolled blood sugar levels, representing 59.5%. The research data was analyzed using *an independent t-test* and presented in the form of a *t-test* table. After the data was distributed normally and homogeneously, bivariate analysis was performed using *a t-test* to identify whether there were differences in blood sugar control levels in type II diabetes patients after being given *self-care behavior* intervention in each group. Normality tests were conducted to determine whether the data were normally distributed or not. The Shapiro-Wilk test was used because the data were interval and ratio scaled. The data were considered normally distributed if $\alpha > 0.05$.

Table 4.
Normality Tests

Tests of Normality

	Group	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
		Statistic	df	Sig.	Statistic	df	Sig.
Self-Care Behavior	Intervention Group	.104	37	.200*	.978	37	.647
	Control Group	.129	37	.124	.942	37	.053

*. This is a lower bound of the true significance.

Based on the table 4, it can be seen that the significance value of Asymp. 2 tailed is 0.760. Since the significance value is > 0.05, the data is homogeneous.

Table 5.
Group statistics on the effect of *self-care behavior* on blood sugar control levels in type II diabetes mellitus patients in the Onolalu Health Center working area South Nias District (n = 74)

Group Statistics

	Self-Care Behavior	N	Mean	Std. Deviation	Std. Error Mean
Blood Glucose Level	Conducted	3	177.89	62.56	10,286
	Not implemented	37	211.14	61,331	10,083

Based on the table 5, it can be seen in *the Group Statistics* that the number of blood glucose levels measured through *self-care behavior* was 37 people, and those who did not perform *self-care behavior* were also 37 people. The mean blood glucose level for those who practiced *self-care behavior* was 177.89, and for those who did not practice *self-care behavior*, it was 211.14. The standard deviation for blood glucose levels in those who practiced *self-care behavior* was 26.567, and for those who did not practice *self-care behavior*, it was 61.331.

Table 6.
Independent Samples Test on the Effect of *Self-Care Behavior* on Blood Glucose Control Levels in Type II Diabetes Mellitus Patients in the Work Area of the Onolalu Health Center, South Nias District, in the Intervention and Control Groups (n = 74)

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig	t	df	Sig. (two-tailed)	Mean Difference	Std. Error of the Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Blood Glucose Level	Assuming equal variances	.094	.760	-2.308	72	.024	-33,243	14,404	-61,956	-4,530
	Equal variances not assumed			-2.308	71.971	.024	-33.243	14.404	-61,957	-4,530

Based on the table above, it can be seen that the Sig. value of Levene's Test for Equality of Variances is 0.760 > 0.05, which means that the variance of the data between the intervention group and the control group is homogeneous or the same. Therefore, the interpretation of the Independent Samples Test output table above is based on the values in the "Equal variances assumed" table. Based on the research results, it was found that the Sig. (2-tailed) value was *p-value* 0.024 < 0.05, so as the basis for decision-making in the independent sample t-test, it can be concluded that HO is rejected and Ha is accepted. Thus, it can be concluded that there is a significant (statistically significant) difference between the average blood sugar levels of type II diabetes mellitus patients in the intervention group and the control group. The "Mean Difference" value is -33.243. This value indicates the difference between the average blood sugar levels of type II diabetes mellitus patients -II in the intervention group and the average blood glucose level in the control group, or 177.89 - 211.14 = -33.243, with a difference range of -61.956 to -4.530 (95% Confidence Interval of the Difference Lower Upper).

DISCUSSION

Self-care behavior can be defined as the actions an individual takes to maintain their life, health, development, and the well-being of their surroundings. Orem defines self-care as activities performed by an individual of their own volition with the aim of improving or maintaining their well-being and health (Aligood & Tomey, 2016). *Self-care behavior* is an evolutionary process of knowledge or awareness development to survive the complexity of diabetes mellitus in a social context (Shrivastava et al., 2023). Health education is important for diabetes patients to encourage better behavioral changes to improve the independence of people with diabetes. The views of nurses and patients indicate that *self-care behavior* is an individual activity carried out to maintain health independently and comprehensively (Karota, Lufthiani, Nasution, Rusdi, & Rokhima, 2024).

The results of this study indicate that patients who received *self-care behavior* interventions demonstrated better self-care behavior changes. This aligns with diabetes care, which enables patients to adopt a healthy lifestyle. There are three levels of nursing care designed to meet patients' self-care needs. One of these levels is supportive education, which includes assistance provided to patients who require educational support and is implemented in nursing tasks following health education (Karota & Lufthinai, 2020). Therapeutic processes that facilitate diabetes patients in knowledge, skills, and self-care abilities are crucial for diabetes patients. Effective and proper self-care includes preventive, curative, and rehabilitative actions to prevent complications (Karota, Purba, Simamora, Lufthiani, & Siregar, 2020). Health education aims to encourage patients to follow therapeutic recommendations regarding diabetes mellitus treatment and care, including knowledge, attitudes, and actions (Kurniawati, Huriah, & Primanda, 2019).

Self-care in diabetes mellitus is an effort to control blood glucose levels. Diabetes mellitus *self-care* is an action taken by individuals to control diabetes mellitus, which includes treatment and prevention of complications (Sigurdardottir, 2019; Karota & Lufthiani, 2020). According to Sousa & Zauszniewski (2018), *self-care* for diabetes mellitus is defined as an individual's ability to perform self-care and demonstrate *self-care* actions for diabetes mellitus to improve blood sugar regulation.

Blood glucose control is an action taken to regulate blood glucose levels based on the difference between carbohydrate metabolism levels and normal values. The results of blood glucose control are used to establish the diet to be followed, assess the effectiveness of treatment, provide guidelines for physical exercise, and determine the medications needed to maintain blood glucose levels within normal limits, thereby preventing hypoglycemia or hyperglycemia (Karota, Purba, Simamora, Lufthiani, & Siregar, 2020). Most patients have

blood sugar levels in the moderate category, ranging from 100-199 mg/dL. Diabetes patients in this study were predominantly over 50 years old. Factors influencing blood sugar levels include lack of regular exercise, diet, insulin use, and age, with age being the most significant factor (Bulu, Wahyuni, & Sutriningsih, 2019).

According to the Indonesian Ministry of Health (2019), DM is caused by genetic or hereditary factors, as well as frequent stress and smoking addiction. Diabetes mellitus (DM) is a chronic condition characterized by elevated blood glucose levels and the onset of characteristic symptoms such as excessive urination and a sweet taste. The standard method for evaluating DM control is by monitoring blood glucose levels to determine whether the implemented measures are effective or not. The results of random blood glucose monitoring include: Random Blood Glucose Level < 100 mg/dL is categorized as Good, 100–199 mg/dL as Moderate, and ≥ 200 mg/dL as Poor (Soegondo et al., 2015).

These results are consistent with a study conducted by Priyanto & Juwariah (2021) on type II diabetes mellitus patients at Delta Surya Hospital in Sidoarjo, which showed that half of the patients had moderate blood sugar stability, with 17 respondents (35.4%) having high blood sugar stability, moderate in 24 respondents (50%), and low in 7 respondents (14.6%). Diabetes patients should have a regular schedule for blood sugar level checks to avoid delays in receiving medical care. The sooner changes in blood sugar levels are detected, the easier it is to control and reduce the risk of complications that may arise.

Previous studies found that 32 patients (61.5%) had elevated blood sugar levels in the poor category, and 7 patients (13.5%) had blood sugar levels in the good category. The results of this study indicate that patients in the poor category outnumber those in the good category. This suggests that the increase in the number of DM patients may be attributed to various factors, including: genetic/hereditary factors, obesity, lifestyle changes, unhealthy dietary patterns, medications that affect blood glucose levels, lack of physical activity, aging, pregnancy, smoking, and stress. Adam & Tomayahu (2019; Karota, Lufthiani, Nasution, Rusdi, & Rokhima, 2024).

Based on the research results, it was found that the variance of data between the intervention group and the control group was homogeneous or the same. Therefore, the interpretation of the Independent Samples Test output table above is based on the values in the "Equal variances assumed" table. Based on the research findings, the Sig. (2-tailed) value is 0.024 (<0.05). Therefore, based on the decision-making criteria in the independent sample t-test, it can be concluded that the null hypothesis (HO) is rejected and the alternative hypothesis (Ha) is accepted. Thus, it can be concluded that there is a significant difference between the average blood sugar levels of type-II diabetes mellitus patients in the intervention group and the control group. Based on the results found, there is a difference between the average blood sugar levels of type II diabetes mellitus patients in the intervention group and the average blood glucose levels in the control group, as well as the difference between the two groups.

The study conducted by Rahman et al. (2023) showed a relationship between self-care and blood sugar levels in patients with type 2 diabetes mellitus, with a P-value of 0.002, and found that 4 people had poor self-care with good blood sugar levels. This occurred because the respondents in the study always maintained a healthy diet and reduced the consumption of foods containing glucose. There were also 3 individuals with good self-care practices but poor blood glucose levels, which occurred because the respondents in the study did not adhere to the medication prescribed by the doctor and instead opted to use traditional medicine.

The results of this study are consistent with those of Pangestu & Hidayat (2020), who found that one of several factors that can affect blood glucose levels is the nutritional components required by the body. In their study, respondents reported a lack of knowledge about good eating habits, healthy lifestyles, and infrequent physical activities such as exercise. According to the American Diabetes Association (2020), it is important to implement good and routine self-management behaviors to assess the progress achieved by patients with type II diabetes mellitus. This is reflected in the individual's ability to manage their daily life, thereby preventing acute complications and long-term risks such as diabetic retinopathy, neuropathy, and even the risk of death. Based on PERKENI in 2019 and 2021, physical activities such as exercise, diet management, medication management, and knowledge about foot care and blood sugar control can minimize the increase in blood glucose levels. Therefore, *self-care* or diabetes management is very important to be carried out.

CONCLUSION

The frequency distribution and percentage of self-care behavior in the intervention group showed that all 37 participants received self-care behavior intervention, with a presentation of 100%, while in the control group, no self-care behavior intervention was conducted for all 37 participants, with a presentation of 100%. The frequency distribution and percentage of blood sugar control levels among diabetes mellitus patients in the intervention group showed that the majority were controlled, with 27 out of 37 patients having controlled blood sugar levels after receiving self-care behavior intervention, representing 73%, while 10 patients had uncontrolled blood sugar levels, representing 27%. while in the control group, out of 37 patients, 15 were controlled with a presentation of 40.5% and 22 were uncontrolled with a presentation of 59.5%. In the "Equal variances assumed" section, the Sig. (2-tailed) value was $0.024 < 0.05$. Therefore, based on the decision-making criteria in the independent sample t-test, it can be concluded that the null hypothesis (HO) is rejected and the alternative hypothesis (Ha) is accepted. Therefore, it can be concluded that there is a significant (statistically significant) difference between the average blood sugar levels of type II diabetes mellitus patients in the intervention group and the control group.

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