Jurnal Ilmiah STIKES Yarsi Mataram
http://journal.stikesyarsimataram.ac.id/index.php/jik
p-ISSN: 1978-89-40 | e-ISSN: 2807-940X
Vol. XVI, No. 1, Januari 20XX, pp. 68-77

The Relationship Between Diabetes Self-Management Education and Blood Glucose Levels in Patients with Type 2 Diabetes Mellitus

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Article History:

Received : 31-10-2025
Revised : 28-01-2026
Accepted : 30-01-2026
Online : 31-01-2026

Keyword:

Blood Glucose;
Diabetes Mellitus;
DSME;
Self-Management

ABSTRACT

Diabetes mellitus is a chronic metabolic disease characterized by elevated blood glucose levels, which can cause serious damage to the heart, blood vessels, kidneys, eyes, and nerves. This study aimed to determine the relationship between diabetes self-management education and blood glucose levels in patients with type 2 diabetes mellitus at the Balerejo Public Health Center. This study used an observational analytical study with a cross-sectional design using consecutive sampling. Data were collected prospectively and analyzed using Spearman's Rank Test on 50 patients. The results of the analysis of the diabetes self-management education questionnaire, in the domain of diet with a good category of 32 people (64%), physical exercise 8 people (16%), foot care 34 people (68%), drug therapy 34 people (68%), and glucose level monitoring 17 people (34%). The blood glucose level values in the normal range are GDP 21 people (42%), GD2PP 27 people (54%), HbA1c 20 people (40%), and lipid profile values of total cholesterol 27 people (54%), LDL 28 people (56%), HDL 29 people (58%), triglycerides 27 people (54%). The results of the Spearman Rank analysis showed that there was a relationship between diabetes self-management education with GDP p-value 0.022; r 0.32, G2PP p-value 0.004; r 0.4, HbA1c p-value 0.036; r 0.3, total cholesterol p-value 0.027; r 0.31, LDL p-value 0.015; r 0.34, HDL p-value 0.008; r 0.37, triglyceride p-value 0.004; r 0.4. Conclusion: There is a significant relationship between diabetes self-management education and blood glucose levels as well as lipid profiles.

ABSTRAK

Diabetes mellitus merupakan penyakit metabolik kronis yang ditandai oleh peningkatan kadar glukosa darah, yang dapat menyebabkan kerusakan serius pada organ seperti jantung, pembuluh darah, ginjal, mata, dan saraf. Penelitian ini bertujuan menganalisis hubungan antara diabetes *self-management education* dengan kadar glukosa darah pada pasien diabetes melitus tipe 2 di Puskesmas Balerejo. Penelitian ini menggunakan jenis penelitian observasional analitik dengan desain *cross sectional* secara *consecutive sampling*. Pengumpulan data dilakukan secara prospektif dan dianalisis menggunakan Spearman Rank sebanyak 50 pasien. Hasil analisis kuesioner diabetes *self-management education*, pada domain pola makan dengan kategori baik sebanyak 32 orang (64%), latihan fisik 8 orang (16%), perawatan kaki 34 orang (68%), terapi obat 34 orang (68%), dan pemantauan kadar glukosa 17 orang (34%). Nilai kadar glukosa darah dalam rentang normal yaitu GDP 21 orang (42%), GD2PP 27 orang (54%), HbA1c 20 orang (40%), dan nilai profil lipid pada kolesterol total 27 orang (54%), LDL 28 orang (56%), HDL 29 orang (58%), trigliserida 27 orang (54%). Hasil analisis Spearman Rank menunjukkan ada hubungan diabetes *self-management education* dengan GDP *p-value* 0,022; r 0,32, G2PP *p-value* 0,004; r 0,4, HbA1c *p-value* 0,036; r 0,3, kolesterol total *p-value* 0,027; r 0,31, LDL *p-value* 0,015; r 0,34, HDL *p-value* 0,008; r 0,37, trigliserida *p-value* 0,004; r 0,4. Kesimpulan: terdapat hubungan yang signifikan antara diabetes *self-management education* dengan kadar glukosa darah dan profil lipid.

A. INTRODUCTION

Diabetes mellitus is a leading cause of disability, mortality, and a high economic burden. Therefore, diabetes control efforts are crucial in mitigating the impact of complications that place a significant burden on individuals, families, and the government, such as impacting the quality of human resources and significantly increasing healthcare costs (PERKENI, 2021). One of the efforts to control diabetes mellitus is education. Education is the starting point for diabetes mellitus management, aiming to change patient behavior and lifestyle. Education for patients with type 2 diabetes mellitus is crucial as a step in diabetes mellitus control. The goal is to improve patient knowledge and skills, enabling them to manage their diabetes independently and sustainably, known as diabetes self-management education (Rahmawati et al., 2016).

According to the International Diabetes Federation (IDF) in 2021, diabetes is one of the fastest-growing global health emergencies of the 21st century. The global prevalence of diabetes mellitus continues to increase every year. In 2021, 537 million people worldwide were living with diabetes. This number is projected to reach 643 million by 2030 and 783 million by 2045. Indonesia ranks fifth in the world with the highest number of diabetes sufferers, with 19.5 million sufferers in 2021, and this number is predicted to increase to 28.6 million by 2045. (IDF, 2021).

Diabetes self-management refers to behaviors that control diabetes mellitus, both in terms of treatment and prevention of complications. Several factors influence self-management, including direct factors (confidence in therapy, disease duration, self-efficacy) and indirect factors (communication with healthcare professionals, education, social support, and knowledge) (Maulidya & Oktianti, 2021). Chronic complications can be prevented by self-management education, with criteria such as fasting blood sugar (FBS) of 80-100 mg/dL, 2-hour postprandial blood sugar (2HBP) of 80-144 mg/dL, and Hemoglobin A1c (HbA1c) <6.5% (Fathurrahman et al., 2023). HbA1c describes blood glucose levels over a 3-month period and is one of the parameters used to control diabetes mellitus (Anggriani et al., 2020). Effective diabetes management involves maintaining blood glucose levels as close to normal as possible through regular and adherent therapy (Muhaymin & Andini, 2023).

Another study used the Diabetes Self-Management Education questionnaire, with 12 (13.8%) categorizing treatment as poor and experiencing poor glucose levels, 14 (22.2%) categorizing under-controlled and experiencing uncontrolled glucose levels, 18 (28.6%) categorizing moderate and experiencing normal glycemia, 31 (49.2%) categorizing moderate and experiencing normal blood sugar, and 12 (13.8%) categorizing good and experiencing normal blood sugar. Spearman rank test results showed a significant relationship between self-management treatment and blood sugar levels in type 2 diabetes mellitus patients, with an α value of 0.05, P value of 0.000, and a correlation coefficient of 0.598 (Farida et al., 2023). The results of other research show that self-management is in the category of less than 20.0%,

sufficient at 42.9% and good at 37.1% (Puspitasari et al., 2024). Another study by Susilowati et al (2024), showed that self-management results were categorized as poor at 36.7% and good at 63.3%.

Self-management education is closely linked to blood glucose control in diabetes mellitus patients. This education improves patients' knowledge and skills in managing diet, physical activity, and medication, which directly helps maintain normal blood sugar levels and prevent complications. Although good self-management has been shown to help control blood sugar levels, many type 2 diabetes patients still have difficulty implementing consistent self-management behaviors. Based on this description, further studies are needed to determine the relationship between diabetes self-management education and blood glucose levels and lipid profiles in type 2 diabetes mellitus patients at Balerejo Community Health Center.

B. METHODS

This study used an observational cross-sectional design conducted prospectively in patients with type 2 diabetes mellitus. The sampling technique used the consecutive sampling method, where sample selection was carried out based on consideration of inclusion and exclusion criteria. The research implementation period began in July - August 2024. The total research sample was determined based on the research budget determined by the researcher, namely 50 samples. The inclusion criteria were patients diagnosed with type 2 diabetes mellitus who were undergoing outpatient care at the Balerejo Community Health Center, aged 18 years or older, willing to be respondents in the study by completing an informed consent form, and able to read and write. Exclusion criteria were patients who had never had routine check-ups and patients who had died. Blood samples were taken simultaneously with the administration of the DSME questionnaire. Subsequently, participants completed the diabetes self-management education (DSME) questionnaire and underwent blood glucose (GDA, GD2PP, HbA1c) and lipid profiles (total cholesterol, HDL, LDL, and triglycerides) tests. The DSME questionnaire consists of 17 questions, where questions 1-6 are diet, 7-8 physical exercise, 9-13 foot care, 14-15 drug therapy, and 16-17 blood glucose monitoring. Favorable data 0 = 0, 1 = 1, 3 = 3, 4 = 4, 5 = 5, 6 = 6, 7 = 7. The assessment of unfavorable questions 3 and 6 is: 0 = 7, 1 = 6, 2 = 5, 3 = 4, 5 = 2, 6 = 1, 7 = 0. The highest score is 119 and the lowest is 0. In this questionnaire there are five domains, namely diet, physical exercise, foot care, drug therapy, and glucose monitoring. Examination of blood glucose levels and lipid profiles by taking venous blood samples was carried out at the Balerejo Madiun Health Center Laboratory. The tool used to check blood glucose levels is an Analyzer (Automated Analyzer/Biochemistry Analyzer), while the tool for checking lipid profiles is a Lipid Profile Analyzer. Data analysis used in this study used the Spearman Rank test. The test was used to examine the relationship between diabetes self-management education and blood glucose levels in patients with type 2 diabetes mellitus. This research protocol received ethical approval from the STRADA University Health Research Ethics Committee under No. 001652/EC/KEPK/I/10/2024.

C. RESULT AND DISCUSSION

1. Result

a. Demographic Data Results

Table 1. Demographic Data of Type 2 Diabetes Mellitus Patients

Patient Demographics	F	%
Gender		
Man	20	40
Woman	30	60
Age		
26-35 year	7	14
36-45 year	30	60
46-55 year	13	26
Education		
No school	4	8
SD	7	14
SMP	8	16
SMA	9	18
PT	22	44
Pekerjaan		
Housewife	8	16
Farmers/Livestockmen/Traders	14	28
Entrepreneur/Self-Employed	5	10
Private employees	5	10
PNS	10	20
Other	8	16
IMT		
Not enough (<18.5 kg/m^2)	6	12
Normal (18,5-22,9 kg/m^2)	28	56
Excessive (23-29,9 kg/m^2)	13	26
Obesity (>30 kg/m^2)	3	6

Based on the results of demographic data, the most common gender is female, 30 patient (60%), aged 36-45 years 30 patient (60%), college education 22 patient (44%), occupation farmer/livestock breeder/trader 14 patient (28%), and normal body mass index (BMI) (18.5-22.9 kg/m2) 28 patient (56%).

b. Laboratory Examination

Table 2. Laboratory Examination Result Data

Glucose Levels	Mean	Median	SD
GDP	151.76	125	73.151
GD2PP	134.26	137	28.196
HbA1c	7.186	7.65	2.4369
Total cholesterol	202.94	196	30.266
LDL	100.8	98	15.558
HDL	47.48	47	6.955
Triglycerides	140.26	140	33.017

Laboratory examination results showed an average value of PDB 151.76 mg/dL, GD2PP 134.26 mg/dL, HbA1C 7.186%, total cholesterol 202.94 mg/dL, LDL 100.8 mg/dL, HDL 47.48 mg/dl, and triglycerides 140.26 mg/dL.

c. Glucose Levels and Lipid Profile

Table 3. Glucose Level and Lipid Profile Data

Glucose Levels and Lipid Profile	**F**	**%**
GDP (Normal: 70 – 99 mg/dl)		
Normal	21	42
Abnormal	29	58
G2PP (Normal: 70 – 139 mg/dL)		
Normal	27	54
Abnormal	23	46
HbA1c (Normal: < 5,7%)		
Normal	20	40
Abnormal	30	60
Lipid Profile		
Total cholesterol (Normal: < 200 mg/dL)		
Normal	27	54
Abnormal	23	46
LDL (Normal: <100mg/dL)		
Normal	28	56
Abnormal	22	44
HDL (Normal: Male > 40mg/dl; Female > 50 mg/dL)		
Normal	29	58
Abnormal	21	42
Triglycerides (Normal: < 150 mg/dL)		
Normal	27	54
Abnormal	23	46

Based on the data, there were several patients who showed blood glucose levels in the normal range, namely GDP 21 patient (42%), GD2PP 27 patient (54%), HbA1c 20 patient (40%), and lipid profile values for total cholesterol 27 patient (54%), LDL 28 patient (56%), HDL 29 patient (58%), triglycerides 27 patient (54%).

d. DSME Dimensions

Table 4. DSME Dimensional Analysis

DSME	**F**	**%**
Dietary Management		
Good	32	64
Poor	18	36
Physical Exercise		
Good	8	16
Poor	42	84

Foot Care		
Good	34	68
Poor	16	32
Medication Therapy		
Good	34	68
Poor	16	32
Blood Glucose Monitoring		
Good	17	34
Poor	33	66

Based on data from the analysis of the Diabetes Self-Management Education (DSME) questionnaire, which covers five dimensions, the domains categorized as good were diet (32 patients) (64%), physical exercise (8 patients) (16%), foot care (34 patients) (68%), drug therapy (34 patients) (68%), and glucose monitoring (17 patients) (34%).

e. Analysis of the Relationship between DSME and Blood Glucose Levels and Lipid Profiles

Table 5. Relationship Analysis Results Data

Blood Glucose and Lipid Profile	*p-value*	r
GDP	0.022	0.32
GD2PP	0.004	0.4
HbA1c	0.036	0.3
Total cholesterol	0.027	0.31
LDL	0.015	0.34
HDL	0.008	0.37
Triglycerides	0.004	0.4

The analysis results showed a relationship between diabetes self-management education and GDP p-value 0.022, r 0.32 (weak-moderate correlation); GD2PP p-value 0.004, r 0.4 (moderate correlation); HbA1c p-value 0.036, r 0.3 (weak-moderate correlation); total cholesterol p-value 0.027, r 0.31 (weak-moderate correlation); LDL p-value 0.015, r 0.34 (very weak correlation); HDL p-value 0.008, r 0.37 (weak-moderate correlation); triglycerides p-value 0.004, r 0.4 (moderate correlation).

2. Discussion

a. Diabetes Self-Management Education (DSME)

One of the efforts to control diabetes mellitus is education. Education is the starting point for diabetes mellitus management, aiming to change patient behavior and lifestyle. Education for patients with type 2 diabetes mellitus is crucial as a step in diabetes mellitus management. The goal is to improve patient knowledge and skills so they can manage their diabetes independently and sustainably, known as Diabetes Self-Management Education (Rahmawati et al., 2016).

Diabetes Self-Management Education is an ongoing process designed to facilitate the knowledge, skills, and abilities of diabetes mellitus patients to perform self-care. The overall goal of Diabetes Self-Management Education is to support informed decision-making, behavior, self-care, problem-solving, and active collaboration with the healthcare team to improve clinical outcomes, health status, and quality of life. Self-management is used to regulate glucose levels within normal limits and can be a major factor in determining the long-term prognosis of type II diabetes mellitus (Rahmawati et al., 2016).

Based on the results of research conducted by Puspitasari et al (2024) showed that the most age was 50-65 years old 20 people (57.2%), high school education 15 people (42.9%), and unemployed 23 people (65.7%). The results of other studies, showed that the most gender was female 61 people (62.2%), aged 45-59 years 59 people (60.2%), junior high school education 36 people (36.7%), high school 36 people (36.7%), unemployed 58 people (29.2%), income <=4,600,000 62 people (67.3%) (Susilowati et al., 2024).

According to research conducted by Solikin & Heriyadi (2020), the majority of self-management was categorized as good (32.7%), sufficient (48%), and poor (19.4%). Other research showed that self-management was categorized as poor (20.0%), sufficient (42.9%), and good (37.1%) (Puspitasari et al., 2024). Another study by Susilowati et al (2024), showed that self-management was categorized as poor (36.7%), and good (63.3%). Other research results showed that self-management was categorized as independent (72.5%), and dependent (27.5%) (Putri, 2019).

b. The Relationship of DSME with Blood Glucose Levels and Lipid Profiles

Changing the behavior of diabetes mellitus patients is not easy; it requires continuous motivation. This motivation can be achieved in various ways, including providing management education, which is a crucial factor in daily self-management. Blood glucose levels (GDP, GD2PP, HbA1c) are checked. Screening for complications should be performed on each patient through a fasting lipid profile, including total cholesterol, high-density lipoprotein (HDL), low-density lipoprotein (LDL), and triglycerides (PERKENI, 2021).

Diabetes mellitus can cause chronic complications, which appear after a long period of suffering (Maulidya & Oktianti, 2021). Chronic complications can be prevented by self-management education, namely by controlling glucose levels. According to PERKENI (2021), fasting blood sugar (Normal: 70 – 99 mg/dL); 2-hour postprandial blood sugar (Normal: 70 – 139 mg/dL); hemoglobin A1c (HbA1c) (Normal: <5.7%); total cholesterol (Normal: <200 mg/dL); LDL (Normal: <100 mg/dL); HDL (Normal: Men >40 mg/dL; Women >50 mg/dL); triglycerides (Normal: <150 mg/dL). Based on the research results, it shows that drug therapy is effective in reducing blood glucose levels , namely metformin with a p-value of 0.000 <0.05 and glimepiride p-value of 0.000 <0.05 (Siswidiasari et al., 2025). Controlling diabetes mellitus by maintaining blood sugar levels close to normal, this can be done by carrying out therapy regularly and compliantly (Muhaymin & Andini, 2023).

According to the research results of Farida et al (2023), the level of treatment in the poor category and poor glucose levels was 12 people (13.8%); underway category and

experiencing uncontrolled glucose levels was 14 people (22.2%); moderate category and experiencing normal glycemia was 18 people (28.6%); moderate category and normal blood sugar was 31 people (49.2%); good category and normal blood sugar was 12 people (13.8%). The results of the Spearman rank test showed a significant relationship between self-management of treatment and blood sugar levels in type 2 diabetes mellitus patients, with an α value of 0.05, P Value of 0.000, and a correlation coefficient of 0.598.

One factor that can affect the quality of life of people with diabetes mellitus is the ability to perform self-management. People with diabetes mellitus require continuous and ongoing care to control blood sugar levels and prevent complications. People with diabetes mellitus who do not implement good self-management will have a greater chance of experiencing complications, which will affect their quality of life (Puspitasari et al., 2024). In this case, self-management plays a very important role in controlling blood sugar levels. Self-management covers various aspects, from diet management, regular exercise, monitoring blood sugar levels, to stress management (Farida et al., 2023). One factor that can affect the quality of life of people with diabetes mellitus is the ability to perform self-management. People with diabetes mellitus require continuous and ongoing care to control blood sugar levels and prevent complications. Diabetes mellitus sufferers who lack effective self-management practices are at high risk of complications, which can impact their quality of life (Puspitasari et al., 2024). Self-management plays a crucial role in controlling blood sugar levels. Self-management encompasses various aspects, from diet management and regular exercise to blood sugar monitoring and stress management (Farida et al., 2023).

According to the results of research conducted by Susilawati et al (2023), it shows a p-value = 0.35 meaning there is no relationship between self-management and changes in blood sugar levels. Respondents who have poor self-management are 89.1% and 10.9% who manage themselves well. Respondents who experience poor changes in blood sugar levels are 50.5% and good changes in blood sugar levels are 49.5%. Diabetes sufferers already understand several self-management actions but there are still not many diabetes mellitus sufferers who apply self-management in their daily lives, this also affects changes in blood sugar levels. The results of other studies obtained a p-value = 0.000 < α (0.05) so it can be concluded that there is an influence between Diabetes Self-Management Education (DSME) on changes in blood sugar levels in type II Diabetes Mellitus sufferers. Patients can carry out self-management management so that it can help reduce blood sugar levels (Avelina et al.,, 2022).

Patients with low adherence tend to experience therapy failure, resulting in uncontrolled blood glucose levels and potentially causing macrovascular and microvascular complications (Triastuti et al., 2020). Research results indicate that drug therapy is effective in reducing blood glucose levels (FBS), namely metformin with a p-value of 0.000 <0.05 and glimepiride with a p-value of 0.000 <0.05 (Siswidiasari et al., 2025). The normal value of blood sugar levels (FBS) according to the 2021 Indonesian Endocrinology Association (PERKENI) guidelines is said to be achieved if <126 mg/dL (PERKENI, 2021).

D. CONCLUSION AND SUGGESTIONS

Based on the results of the study, it shows that there is a relationship between diabetes self-management education with GDP p-value 0.022, weak-moderate correlation (r 0.32); GD2PP p-value 0.004, moderate correlation (r 0.4); HbA1c p-value 0.036, weak-moderate correlation (r 0.3); total cholesterol p-value 0.027, weak-moderate correlation (r 0.31); LDL p-value 0.015, very weak correlation (r 0.34); HDL p-value 0.008, weak-moderate correlation (r 0.37); triglycerides p-value 0.004, moderate correlation (r 0.4). Therefore, the better a patient's self-management skills, the more optimal their blood glucose control. Therefore, ongoing educational interventions are needed to improve self-management in patients with type 2 diabetes mellitus.

E. ACKNOWLEDGEMENT

Thank you to the Balerejo Madiun Health Center for granting permission to the researcher to conduct the research, as well as supporting and assisting in the implementation of this research.

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