



THE INFLUENCE OF DIABETES SELF-MANAGEMENT EDUCATION ON INCREASING KNOWLEDGE, SELF-MANAGEMENT, AND CURRENT BLOOD SUGAR LEVEL CONTROL IN TYPE 2 DIABETES MELLITUS PATIENTS

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ABSTRACT

Type 2 diabetes mellitus (DM type 2) is a serious problem worldwide due to the impact of the disease which can cause complications and reduce the quality of life of sufferers. Factors that cause this are due to lack of knowledge, self-management and chronic hyperglycemia. Therefore, it is necessary to carry out continuous educational interventions such as Diabetes Self-Management Education (DSME). The purpose of this implementation is to improve knowledge, self-management and control of random blood sugar levels in patients with type 2 DM. This type of quantitative research uses a one-group pre-test-post-test approach, a sample of 15 respondents and the sampling technique used was purposive sampling. The implementation time is April 21 to May 24, 2025 at Dr. H. Abdul Moeloek Regional General Hospital, Lampung Province. The measurement instruments used are Diabetes Knowledge Questionnaire (DKQ-24), Diabetes Self-Management Instrument (DSMI) and GDS measurement sheets. The analysis used is the paired t-test and the Wilcoxon test. The results of the implementation after being given 4 sessions of DSME showed an increase in knowledge as shown by a p-value of 0.003 (<0.05), an increase in self-management with a p-value of 0.001 (<0.05) and control of random blood glucose values with a p-value of 0.001 (<0.05). The 4-session ideo-based DSME had a positive impact on knowledge, self-management, and random blood sugar values because DSME is a continuous educational intervention that helps respondents understand their disease better.

Keywords: DSME; knowledge; random blood sugar; self-management

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INTRODUCTION

Diabetes mellitus (DM) is a body condition that occurs due to increased blood glucose levels in the body because the pancreas cannot produce insulin or cannot use insulin effectively (Rahmadani & Jihad, 2023). Diabetes mellitus (DM) remains a major problem in both low-income and high-income countries. The International Diabetes Federation (IDF) reported that in 2021, there were 537 million (20-79%) people with diabetes mellitus. According to IDF data, the Western Pacific has the highest prevalence of DM cases, with 206 million cases, followed by 90 million in Southeast Asia, and 73 million in the Middle East and North Africa (Idf & Atlas, 2021). In line with this, an increase in DM cases also occurred in Indonesia with the figure reaching 18.69 cases in 2020 (RISKESDAS, 2020). Lampung Province had an incidence of diabetes mellitus of 89,981 cases in 2024 with the epicenter of the incident in Bandar Lampung City with 18,644 cases (Dinas Kesehatan, 2024).

Diabetes mellitus (DM) is a serious global problem due to its complications, reduced quality of life, and increased economic burden (Liu et al., 2024). DM complications can occur due to uncontrolled blood glucose levels, which can lead to problems with the kidneys, eyes, blood vessels, nerves, and heart, even leading to amputation (Wayunah et al., 2020). To prevent complications in DM patients, self-management is necessary (Ulfa, 2024). DM self-management focuses on improving knowledge and lifestyle changes, including meal planning and physical activity habits (Ernawati et al., 2021).

One health education intervention that focuses on patient self-management behavior is Diabetes Self-Management Education (DSME), a program developed within healthcare services to improve patients' knowledge in managing their disease. The DSME intervention model utilizes guidance, counseling, and patient behavior to improve individual knowledge and skills in self-management (Handayani & Savitri, 2019). Independent and sustainable management of DM, which is included in DSME, is part of health education that not only involves knowledge and skills, but also psychological counseling if necessary to facilitate the lifestyle of diabetes patients (Rahmayunia Kartika et al., 2021).

Previous research conducted by Bekele et al., (2020) showed that diabetes self-management education (DSME) interventions had a positive impact on knowledge, self-management, and blood glucose levels, thereby minimizing the risk of complications in DM patients. DSME is a viable approach to providing ongoing education for DM clients. DSME strategies are developed within healthcare services to improve client compliance in managing their disease (Syikir et al., 2024). Efforts to control blood glucose levels to prevent complications of diabetes can be achieved by adopting a behavior that adheres to self-management. One of the factors influencing a person's behavior is knowledge (Afriyani *et al.*, 2020). Individuals with sufficient knowledge tend to act effectively to achieve their desired goals. However, lack of knowledge or misinformation can lead to deviant lifestyle behaviors, such as consuming unhealthy foods and not getting enough exercise (Ajzen et al., 2019).

Self-management behaviors are defined as behavioral patterns and habits related to maintaining health. Behaviors relevant to diabetes include a healthy diet, physical activity, glucose monitoring, adherence to appropriate medication, and eye and foot care (McSharry et al., 2020). Good self-management will develop patient skills in solving problems, increasing self-confidence, knowledge and controlling blood sugar levels (Apriyadi *et al.*, 2021). Knowledge is a collection of information, facts, skills, and understanding acquired through experience, learning, and research. Knowledge enables individuals to comprehend and explain the phenomena around them. Knowledge is grouped into six cognitive levels: knowledge, comprehension, application, analysis, synthesis, and evaluation (Lactona Eko Agus, 2024).

Self-management is an individual's effort to regulate their behavior through internal strengths to promote healthy behaviors and reduce harmful ones. Self-management includes medication adherence, disease management, exercise, diet, stress management, and utilization of health care facilities (Ren et al., 2026). Random blood glucose (RBG) is a blood glucose test performed regardless of the patient's last meal. This test is used to quickly determine blood glucose levels and is often used as an initial screening method for diabetes. RBG values are influenced by various factors such as food intake, physical activity, and the function of the insulin hormone in glucose metabolism. Therefore, random blood glucose testing is an important indicator in assessing glucose metabolism and monitoring glycemic control in diabetes patients (Febriani et al., 2025).

Diabetes Self-Management Education (DSME) is a systematic and ongoing health education process aimed at improving an individual's knowledge, skills, and ability to independently manage diabetes mellitus. The DSME program is designed to help patients understand their condition and make informed decisions regarding self-care, blood glucose control, and the prevention of long-term complications (Dewi, 2025). In its implementation, DSME integrates various important aspects of diabetes management, including adjusting a diet appropriate to the patient's metabolic needs, increasing regular physical activity, adherence to pharmacological therapy provided by healthcare professionals, regular blood glucose monitoring, and changes in health behaviors that support disease control. This approach focuses not only on providing information but also on developing patients' skills in performing self-care or self-care independently in their daily lives (Romdhoni et al., 2024).

Diabetes Self-Management Education (DSME) is a structured educational approach aimed at improving patients' ability to independently manage their diabetes mellitus. This program focuses on improving patients' knowledge, skills, and behaviors so they can effectively manage their disease in their daily lives. DSME encompasses various essential components of diabetes management, such as education about diabetes, dietary management, physical activity, adherence to pharmacological therapy, and self-monitoring of blood glucose levels (Margarita et al., 2025). Improving patient knowledge is one of the primary goals of DSME implementation. Systematically provided education can help patients understand the mechanisms of diabetes, factors that influence blood glucose levels, and the importance of maintaining a healthy lifestyle. Research shows that implementing a DSME program can significantly improve the knowledge scores of diabetes patients, as patients receive more comprehensive information about diet, physical activity, medication use, and blood sugar monitoring. This increased knowledge provides an important basis for patients to make informed decisions regarding their disease management (Hidayati et al, 2024).

In addition to increasing knowledge, DSME also plays a role in strengthening self-management skills in diabetes patients. Self-management is an individual's ability to monitor their health condition, establish a healthy lifestyle, and take necessary actions to independently manage a chronic disease. Through DSME, patients are trained to develop self-care skills such as diet management, blood glucose monitoring, foot care, and adherence to prescribed therapy. By improving self-management skills, patients become more active in the care process and are able to maintain ongoing control over their health (Margarita et al., 2025). Given the existing background, the purpose of this study was to improve knowledge, self-management, and control of random blood sugar levels in patients with type 2 diabetes.

METHOD

This study was quantitative, using a pre-experimental, one-group pre-test-post-test approach. The population for this study was all type 2 diabetes patients at Dr. H. Abdul Moeloek Regional General Hospital. The sample size was 15 respondents, and the sampling technique used was purposive sampling. Inclusion criteria included patients who had been diagnosed with type 2 diabetes mellitus by a doctor, were 18 years of age or older, were able to communicate well, were willing to participate in the study by signing an informed consent form, and participated in the entire study from pretest to posttest. Exclusion criteria included patients with cognitive impairment or communication disorders that could hinder data collection, patients with acute complications requiring immediate medical attention, and patients who did not complete all stages of the study or withdrew during the study.

The implementation period was from April 21 to May 24, 2025. The stages began with administrative processes at the research site, such as application permits and ethical reviews. Preparation for implementation included finding 15 respondents who met the criteria, obtaining informed consent and explaining the purpose of the intervention, followed by an initial pre-test. DSME Session 1 was implemented in person, followed by sessions 2-4 online (Zoom). Each session lasted one week. A final post-test was conducted one week after DSME Session 4. The measuring instruments used were the Diabetes Knowledge Questionnaire (DKQ-24), the Diabetes Self-Management Instrument (DSMI), and a random blood glucose measurement sheet, measured using a glucometer. Ethical approval was conducted through the Health Research Ethics Committee (KPEK) of Dr. H. Abdul Moeloek Regional Hospital, Lampung Province. Data analysis used normality tests, namely the Shapiro-Wilk test, followed by a paired sample t-test and the Wilcoxon test for non-normally distributed data.

RESULT

Table 1.

Respondent Characteristics

Respondent Characteristics	Category	f	%
Gender	Male	6	40,0
	Female	9	60,0
Age	40-45 year	2	13,3
	46-50 year	4	26,7
	51-55 year	6	40,0
	56-60 year	3	20,0
Education	Elementary School	3	20,0
	Middle School	2	13,3
	High School	5	33,4
	Diploma III	2	13,3
	Bachelor's Degree	3	20,0

Table 1 shows that 6 respondents were male (40.0%) and 9 were female (60.0%). Two respondents (13.3%) were aged 40-45, four (26.7%) were aged 46-50, six (40.0%) were aged 51-55, and three (20.0%) were aged 56-60. Three respondents had an elementary school education (20.0%), two (13.3%), five (33.4%), two (13.3%), and three (20.0%).

Table 2.

The Impact of DSME on Knowledge

Knowledge	Mean	Std. Deviation	CI 95%	p-Value
<i>Pretest-Posttest</i>	-9.5	10.4	-15.3 - -3.8	0.003

Based on table 2, regarding the effect of diabetes self-management education on knowledge in type 2 DM patients, the p-value was 0.003 (<0.05). This value indicates that DSME provision has an effect on knowledge in type 2 DM patients.

Table 3.

Effect of DSME on Self-Management

Self-Management	Mean	p-Value
<i>Pretest-Posttest</i>	8.00	0.001

Table 3 shows the effect of diabetes self-management education on self-management in patients with type 2 diabetes. The p-value was 0.001 (<0.05). This value indicates that DSME provision has an effect on self-management in patients with type 2 diabetes.

Table 4.

Effect of DSME on GDS Control

GDS Control	Mean	Std. Deviation	CI 95%	p-Value
<i>Pretest-Posttest</i>	100.33	31.4	82.9-117.7	0.000

Table 4 shows the effect of diabetes self-management education on blood glucose levels in patients with type 2 diabetes. The p-value was 0.000 (<0.05). This value indicates that DSME administration has an effect on blood glucose levels in patients with type 2 diabetes.

DISCUSSION

Respondent Characteristics

Gender

The frequency distribution of respondents shows that 6 (40.0%) were male and 9 (60.0%) were female, with more females than males. This is in line with research conducted by Rosita et al., (2022) This study showed a correlation between gender and the incidence of type 2 diabetes mellitus, with a PR of 2.15 (95% CI: 1.19-3.90). This indicates that female respondents have a 2.15 times greater risk of developing type 2 diabetes mellitus compared to male respondents.

There are two risk factors for diabetes mellitus: modifiable factors such as diet, physical activity, and body mass index, and non-modifiable factors such as age, family history, and gender. Several studies have shown that the majority of people with type 2 diabetes are female. Women are at higher risk of developing type 2 diabetes because they have a greater opportunity for physical development, body mass index, premenstrual syndrome, and increased postmenopausal fat

distribution, and body fat accumulates more easily due to hormonal processes in women (Rohmatulloh *et al.*, 2024). Researchers assume that women have a higher risk of developing type 2 diabetes than men, possibly due to hormonal, physiological, and social factors unique to women. Furthermore, lower activity levels and a tendency toward increased visceral fat post-menopause can increase insulin resistance, leading to type 2 diabetes.

Age

Based on the frequency distribution of respondents, there were 2 (13.3%) aged 40-45, 4 (26.7%) aged 46-50, 6 (40%) aged 51-55, and 3 (20%) aged 56-60. Based on these results, the age range of respondents with diabetes mellitus was highest between 51-55 years. This condition may be associated with natural physiological processes of aging, such as decreased organ function, increased comorbidities, and decreased resistance to oxidative stress and chronic inflammation, which are higher in older age. Research conducted by (Khan *et al.*, 2020) Epidemiological studies show that the global incidence of type 2 diabetes mellitus peaks at the age of 55-59 years. The results of this study indicate that 4.4% of the population aged 15-49 years have diabetes, 15% at the age of 50-69 years, and 22% at the age of >70 years. This indicates that the early 50s, including the 51-55 age range, are a critical period. The 50s, especially 51-55 years, are a crucial point where type 2 diabetes mellitus begins to peak due to decreased pancreatic function, increased insulin resistance, accumulation of visceral fat, and a less active lifestyle and metabolic syndrome that are common in this age group. The incidence of type 2 diabetes mellitus at the age of 51-55 years is the age group with the highest prevalence of diabetes according to many recent epidemiological studies. This occurs due to a combination of physiological factors such as decreased insulin, hormones, muscle mass and lifestyle patterns such as a high-sugar diet and lack of physical activity (Gwira *et al.*, 2024).

Researchers assume that individuals aged 51–55 years have a higher risk of developing type 2 diabetes than other age groups. This is due to various physiological changes that naturally occur at this age, such as decreased pancreatic β -cell function, increased insulin resistance, visceral fat accumulation, and decreased muscle mass. Furthermore, this age group is also often characterized by a sedentary lifestyle, unhealthy diet, and an increased prevalence of metabolic syndrome such as hypertension and dyslipidemia, all of which are strong risk factors for type 2 diabetes.

Education

Based on the frequency distribution of respondents, 6 (39.9%) had an elementary school education, 4 (26.6%) had a junior high school education, 3 (19.95%) had a high school education, 1 (6.65%) had a diploma, and 1 (6.65%) had a bachelor's degree. This is in line with research conducted by (Frimantama' *et al.*, 2024) showed that individuals with low education levels, from elementary school to high school, were found in 86.7% of the intervention group and 90% of the control group of type 2 diabetes patients. Low education levels carry a higher risk of developing type 2 diabetes, even after controlling for age and gender. The study showed that the difference in diabetes incidence between education groups reached 316-454 cases per 100,000 people per year. Furthermore, approximately 34-45% of the increased risk in low-education groups was mediated by obesity levels, smoking habits, and physical activity.

The social determinants of health theory states that a person's educational status is directly related to health knowledge, attitudes, and practices, including diet, physical activity, and access to health information and services. In this context, education acts as a "social buffer" that enables individuals to make better health decisions and prevent the development of chronic diseases such as diabetes (Lee *et al.*, 2024). According to researchers, education level can influence the incidence of diabetes mellitus. This is because education level influences an individual's mindset when making decisions, especially regarding lifestyle choices, including diet and physical activity.

DSME on Knowledge

Based on the results of a statistical analysis of the effect of diabetes self-management education (DSME) on knowledge in type 2 diabetes patients, a p-value of 0.003 (<0.05) was obtained, indicating that DSME administration has an effect on knowledge in type 2 diabetes patients. Research by (Rahmawati et al., 2021) A study conducted in the Trienggadeng Community Health Center (Puskesmas) area showed that providing DSME during several educational sessions significantly improved patient knowledge. Statistical tests showed a p-value of 0.000, indicating a highly significant difference between knowledge scores before and after the educational intervention. This finding indicates that structured education is highly effective in increasing patient understanding of diabetes management, including diet, physical activity, medication adherence, and blood sugar control.

Diabetes self-management education (DSME) is an effort to provide education on independent and ongoing diabetes management, encompassing an understanding of diabetes, the importance and necessity of diabetes control and monitoring, pharmacological and non-pharmacological interventions, and developing individual skills in diabetes management. The DSME method is necessary for patients to understand the complexity of care and the nature of the disease, which requires not only healthcare professionals but also the active participation of patients in their care (Rahmawati et al., 2021).

DSME is a structured educational program spanning four sessions: disease understanding, nutritional therapy, medication administration, blood glucose monitoring, medication consumption, and stress management. DSME involves a multidisciplinary team of doctors, nurses, nutritionists, and pharmacists. Systematic and interactive materials, using discussion and simulation methods, can improve health literacy not only in terms of information but also in-depth understanding of correct actions, particularly in managing diabetes mellitus. According to researchers, increasing knowledge is a crucial initial step in triggering patient behavior changes towards healthier outcomes. The success of DSME is greatly influenced by the delivery method used, active patient participation, and long-term continuity of education. Therefore, education should be provided periodically, using a participatory and culturally relevant approach, to ensure that the information presented is effectively understood and internalized by patients.

DSME on Self-Management

Based on the results of a statistical analysis of the effect of diabetes self-management education (DSME) on self-management in patients with type 2 diabetes, a p-value of 0.001 (<0.05) was obtained. This value indicates that DSME has an effect on self-management in type 2 diabetes patients. The provision of Diabetes Self-Management Education (DSME) has been shown to have a significant impact on improving self-management skills in type 2 diabetes patients. One of the most recent studies conducted by (Abdulsalam et al., 2025) demonstrated that a Health Literacy-based DSME (HL-DSME) intervention improved patients' health literacy scores and self-management behaviors, particularly in exercise and other self-care areas. The program was designed as a five-week interactive educational program, and the analysis revealed a significant difference between the intervention and control groups ($p < 0.001$). These findings suggest that DSME, which integrates health literacy, is highly effective in promoting better self-management behaviors.

The effectiveness of DSME in improving self-management was also confirmed in a longitudinal study in Taiwan that evaluated a DSME program within an integrated care system. Lai et al., (2024) reported that patients who participated in DSME regularly every three months for two years had significantly better blood sugar control ($HbA1c < 7\%$) and self-management adherence than patients who only received annual education. This demonstrates that ongoing DSME not only strengthens understanding but also forms consistent, long-term self-care habits.

Theoretically, improved self-management through DSME can be explained using health literacy and social cognitive theory. Health literacy is key because patients with a good understanding of

their condition are better able to understand medical instructions, recognize symptoms, and make informed decisions regarding disease management. Meanwhile, Bandura's social cognitive theory emphasizes the importance of self-efficacy, namely an individual's belief in their own abilities, which can be fostered through repeated education, practical experience, and support from healthcare professionals. These two theories explain that DSME functions not only as a medium for information transfer but also as a tool for patient empowerment (Lai et al., 2024). Researchers have found that structured and repeated education is a crucial component in developing strong self-management. Self-management is influenced not only by the amount of information received, but also by how frequently and effectively that information is reinforced through interaction and training. Furthermore, researchers emphasize the importance of an educational approach tailored to the patient's social context and literacy skills, so that DSME material can be effectively absorbed and applied in the daily lives of type 2 diabetes patients.

DSME on Random Blood Sugar Levels

Based on the results of a statistical analysis of the effect of diabetes self-management education (DSME) on blood glucose levels in type 2 diabetes patients, a p-value of 0.000 (<0.05) was obtained. This value indicates that DSME administration has an effect on blood glucose levels in type 2 diabetes patients. This is in line with research conducted by Arulmohi et al., (2017) Results showed that after 3 months, the intervention group experienced an average reduction in HbA1c of -1.3% (SD 0.4) and improvements in fasting and 2-hour post-prandial blood glucose levels ($p<0.001$). These findings indicate that DSME has a clinically significant effect on short-term glycemic control.

The reduction in blood glucose levels in people with type 2 diabetes through the Diabetes Self-Management Education (DSME) program can occur because this education can improve self-management behaviors such as adherence to medication, food choices, regular exercise, and blood glucose monitoring (Bekele et al., 2021). DSME works by improving health literacy, which can help patients understand, process, and apply diabetes-related medical information. Furthermore, repeated education, coupled with positive experiences, will increase self-efficacy, the belief in one's ability to manage the condition, which then encourages patients to consistently engage in self-management (Nugent et al., 2023). Researchers believe that intensive and ongoing education is key to producing real metabolic changes. DSME is thought to improve blood sugar monitoring habits, dietary adherence, and medication consistency, thereby directly reducing HbA1c and fasting glucose. DSME focused on the local context and delivered in an appropriate language and culture can have significant effects.

CONCLUSION

Based on the implementation results, 9 respondents (60.0%) were female. Six respondents (40%) were predominantly between 51 and 55 years old. Six respondents (39.9%) had the highest level of education, reaching elementary school. The DSME program significantly improved knowledge, self-management, and random blood sugar control before and after DSME. Continuing education is essential because human learning does not occur overnight but rather through repetition, reinforcement, and adaptation to changing individual and environmental conditions. In the context of health and nursing, continuing education is crucial to ensure individuals consistently understand, remember, and apply the information provided.

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