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THE EFFECT OF USING SMART DIABETES CALENDAR (SDC) ON THE SELF-EFFICACY OF DIABETES MELLITUS PATIENTS

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ABSTRACT
Diabetes mellitus is one of the fastest growing health emergencies worldwide in the 21st century and has the second largest negative impact on life expectancy. Diabetes management, such as increasing knowledge about the disease, treatment, and lifestyle modifications, is an efficient and effective way to manage the disease. Self-efficacy is the cultivation of patients' confidence in managing their disease so that their quality of life improves. Objective to determine the effect of using the Smart Diabetes Calendar (SDC) on the self-efficacy of patients with diabetes mellitus Method, The design used was a "quasi-experimental pre-post test with control group" with the intervention of a smart diabetes calendar (SDC). The sampling technique used was purposive sampling. Researchers selected respondents based on inclusion criteria and research objectives The inclusion criteria for this study were type 2 diabetes patients, aged 35-75 years, taking anti-diabetic drugs, not undergoing treatment in a hospital, and able to read and write. The research instrument used the General Self-Efficacy (GSE) scale. The sample size was 93 respondents. Data analysis used independent t-tests and paired t-tests. The results of this study showed an increase in the self-efficacy of DM patients after using SDC (p-value=0.000). The conclusion of this study is that the use of a smart diabetes calendar (SDC) increases the self-efficacy of diabetes mellitus patients. DM patients also increased their compliance and discipline in managing their disease.

Keywords: diabetes mellitus; self-efficacy; smart diabetes calendar

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INTRODUCTION

Diabetes is a global health emergency with the fastest increase in the 21st century. Diabetes mellitus (DM) is a chronic disease that can change the way the body converts food into energy. In DM, the body is unable to produce enough insulin or cannot use it properly. Serious medical problems such as heart disease, vision problems, nervous system disorders, and kidney infections can arise as complications of DM (CDC, 2023).

Worldwide, the number of people with DM is estimated to increase from 537 million in 2021 to 643 million in 2030 and 783 million in 2045 (International Diabetes Federation, 2021). Indonesia (Federation, 2021) ranks 5th with the largest number of DM sufferers in the world. In 2022, more than 6% or around 172 million people will have DM. The prevalence of DM in West Java reached 1.74% or 570,611 people (West Java Health Office, 2022). In 2021, Bogor City reported 17,059 DM patients, with the highest number of cases in West Bogor District at 3,778 (Bogor City Health Office, 2022).

The management of diabetes mellitus (DM) is a top priority, as patients face significant challenges in their treatment process that can worsen their disease. Proper disease management can reduce symptoms and complications, improve glycemic index, and reduce mortality and readmission rates (Nikpour et al., 2022). Effective control to avoid DM complications requires behavioral changes

that necessitate self-efficacy and self-care management (Shrivastava et al., 2013). Good diabetes management also improves patients' quality of life.

Self-efficacy is a concept that focuses on individuals' assessment of their ability to successfully perform a task in a given situation (Waddington, 2023). Self-efficacy in patients with diabetes refers to the belief that individuals can plan, achieve behavioral change, believe in themselves, and be capable of doing so, as well as the perception of their ability to adhere to a diabetes treatment regimen (Beckerle & Lavin, 2013; Liu, 2012). Self-efficacy plays a crucial role in helping DM patients perform daily tasks to manage their condition (Oluma et al., 2020). High self-efficacy is significantly correlated with good glycemic control and well-being in type 2 DM patients. Patients with high self-efficacy are 20 times more likely to undergo diabetes treatment (S et al., 2024).

The Smart Diabetes Calendar (SDC) is an intervention to optimize the self-management of diabetes mellitus patients using a calendar. The SDC contains information about managing DM. The diabetes calendar, in the form of a record sheet, is an important tool for monitoring the patient's condition and various daily behaviors to keep blood sugar levels under control and prevent complications. The SDC is a calendar that contains daily, weekly, and monthly activities for diabetes patients in managing their disease, including healthy eating, physical activity, taking medication/insulin, checking blood sugar levels, preventing complications, and maintaining a healthy lifestyle. The use of the SDC in the form of a wall calendar aims to improve patient compliance and discipline in managing their disease. The SDC also serves as a simple reminder of activities for DM patients without requiring additional costs, helping patients manage their disease more effectively and efficiently. People of all ages can use it. The aim of this study is to determine the effect of using the Smart Diabetes Calendar (SDC) on the self-efficacy of patients with diabetes mellitus. Specific objectives are: 1) To analyze the self-efficacy of DM patients before and after using the SDC. 2) To analyze changes in the self-efficacy of DM patients who use and do not use the SDC.

METHOD

The research design was a “quasi-experimental pre-post test design with control group” using the Smart Diabetes Calendar. Ethical procedure has been approved by the Ethics Committee of Stikes Kendal, Central Java (No. 005/EC/ KEPK_STIKES_ KENDAL/ VIII/2025). Informed consent was obtained from all respondents, with the presence of cadres in the research area as witnesses. This study was conducted in Bogor. The sampling technique used was purposive sampling. Researchers selected respondents based on inclusion criteria and research objectives . The researchers selected two health centres (puskesmas) with the highest population of diabetes patients based on data from Dinas Kesehatan kota Bogor and then the two health centres (puskesmas) selected kelurahan with the highest number of DM patients . The inclusion criteria for this study were type 2 diabetes patients, aged 35-75 years, taking anti-diabetic drugs, not undergoing treatment in a hospital, and able to read and write. The research instrument used the General Self-Efficacy (GSE) scale (Luszczynska et al., 2005). Statistical analysis employed parametric tests, specifically the paired t-test and independent t-test.

The research activities conducted were 1) Pre-testing of diabetes mellitus patients to measure self-efficacy in the intervention and control groups; 2) Research intervention. The use of the Smart Diabetes Calendar (SDC) was carried out twice in groups and twice individually. The first meeting was to provide education about DM and training in managing the disease. The second meeting involved training patients to use the SDC, starting with exercises on recording the activities of DM patients in managing their disease, including daily, weekly, and monthly activities. In the third and fourth meetings, patients carried out these activities with the guidance of the research team and cadres. 3) Post-test of diabetes mellitus patients to measure self-efficacy in the intervention and control groups.

The data were analyzed and processed using a computer program system. The data were analyzed univariately and bivariately. Sociodemographic characteristics were processed using univariate and bivariate analysis to determine the mean, standard deviation, and p-value. The intervention and control groups were analyzed and processed using the independent sample t-test and paired sample t-test.

RESULT

The research results were analyzed using univariate and bivariate analyses. Univariate analysis used descriptive statistics, including mean, standard deviation, minimum, and maximum. Bivariate analysis used parametric tests. The statistical test results are described below.

Table 1.
Age distribution of diabetes mellitus patients (n=93)

Variable	Groups	N	Mean	SD	Min-Max	*p-value*
Age	Intervention	47	62,98	7,814	42-74	0,904
	Control	46	62,76	9,567	38-75	

Table 1 shows that in the intervention group, the average age of respondents was 63 years, with the youngest being 42 years old and the oldest being 74 years old. Meanwhile, in the control group, the average age of respondents was 63 years, with the youngest being 38 years old and the oldest being 75 years old. There was no difference in age between the intervention and control groups (p-value=0.904).

Table 2
Distribution of respondents according to characteristics of DM patients (n = 93)

Variable	Categories	Intervention Groups (n = 47)		Control Groups (n = 46)		Total		*p-value*
		f	%	f	%	f	%	
Gender	Male	12	25,5	18	39,1	30	32,3	0,188
	Female	35	74,5	28	60.9	63	67,7	
Marital Status	Married	33	70,2	33	67,4	64	68,8	0,825
	Widow/Widower	14	29,8	15	32,6	29	31,2	
Education	Tidak sekolah	2	4,3	7	15,2	9	9,7	0,132
	SD-SMP	28	80,9	28	60,9	66	71	
	SMA	4	8,5	8	17,4	12	12,9	
	Perguruan Tinggi	3	6,4	3	6,5	6	6,5	
Family Income	< UMR	46	97,9	45	97,8	91	97,8	1,000
	≥ UMR	1	2,1	1	2,2	2	2,2	
Medication adherence	Always	40	85,1	29	63	69	74,2	0,036
	Sometimes	4	8,5	13	28,3	17	18,3	
	Never	3	6,4	4	8,7	7	7,5	
Duration Illness	< 6 month	2	4,3	2	4,3	4	4,3	1,000
	≥6 month	45	95,7	44	95,7	89	95,7	

Table 2 shows that there were no differences between the intervention and control groups in terms of gender (p-value=0.188), marital status (p-value=0.825), education (p-value=0.132), family income a monthly (p-value=1.000), and duration of illness ≥6 months (p-value=1.000). Differences between the intervention and control groups were observed in medication adherence (p-value=0.036).

Table 3
Distribution of blood glucose levels in diabetes mellitus patients before the 2025 SDC intervention (n=93)

Variable	Groups	N	Mean	SD	Min-Max	t	*p-value*
Blood Glucose	Intervention	47	226,96	96,534	-62.677-18.157	-1.094	0,277
	Control	46	249,22	99,683			

Table 3 shows no difference in blood sugar levels between patients with diabetes mellitus in the intervention and control groups (p-value=0.277).

Table 4
Analysis of self-efficacy before SDC use (n = 93)

Groups Variable	Groups	N	Mean	SD	95%CI	t	*p-value*
Self-efficacy	Intervention	47	27,04	2,813	-1,147 – 0,971	-0,165	0,869
	Control	46	27,13	2,296			
	Difference		0,09				

Table 4 shows no difference in self-efficacy between the intervention group and the control group before SDC use (p-value=0.869).

Table 5
Analysis of self-efficacy in the intervention and control groups before and after SDC use (n = 93)

Groups		N	Mean	SD	95%CI	t	*P-value*
Intervention	Before	47	27,04	2,813	-1,859-(-0,609)	-3,987	0,000
	After	46	28,28	2,998			
	Difference		1,24				
Control	Before	47	27,13	2,296	-0,188-0,3	0,513	0,607
	After	46	27,07	1,914			
	Difference		0,06				

Table 5 shows that there was a difference in the intervention group before and after the use of SDC, namely self-efficacy (p-value=0.000), and there was no difference in the control group before and after the use of SDC, namely self-efficacy (p-value=0.607).

Table 7
Analysis of self-efficacy and blood glucose levels after the intervention and control groups following SDC use (n = 93)

Groups Variable	Groups	N	Mean	SD	95%CI	t	*P-value*
Self-efficacy	Intervention	47	28,28	2,998	0.175-2.247	2.317	0.023
	Control	46	27,07	1,914			
	Difference		1,21				
Blood Glucose	Intervention	47	210.17	97.393	-80.975-(-1.511)	-2.062	0.042
	Control	46	251.41	95.459			
	Total	93	41,24				

Table 7 shows that there were differences between the intervention and control groups after using SDC, namely in self-efficacy (p-value=0.023) and differences in blood sugar levels of DM patients in the intervention and control groups after using SDC (p-value=0.042).

DISCUSSION

Diabetes mellitus and mental health are closely related; people with diabetes have a higher risk of experiencing conditions such as depression, anxiety, and emotional disorders. Diabetes has various effects on a person's overall health and well-being. This relationship is often two-way, as poor mental health can complicate diabetes management, which in turn can lead to complications. Complications caused by diabetes mellitus negatively impact overall well-being and reduce quality of life. Individual well-being plays a major role in the effectiveness of diabetes management, and psychological well-being is an important goal of care (Calli & Kartal, 2021). Diabetes mellitus (DM) requires continuous self-management and independence, which impacts patients' quality of life. Mental health support is essential for managing diabetes and improving overall quality of life.

The characteristics of DM patients show that the average age of patients is elderly, which is consistent with research showing that diabetes is a very common health condition in the elderly population. More than 29% of people over the age of 65 have diabetes (Care & Suppl, 2025). The prevalence of diabetes increases with age, and is highest among those over 60 years of age. One-third of the US population over 65 years of age has diabetes, with an estimated twofold increase in prevalence for the 65-74 age group, and a fourfold increase for the over 75 age group between 2005 and 2025. Diabetes in older adults is caused by a combination of genetic and environmental factors that occur alongside normal changes in carbohydrate metabolism with age. Age-related glucose intolerance involves changes in glucose-stimulated insulin release and resistance to insulin-

mediated glucose processing. Metabolic rate slows with age due to a decrease in lean body mass and lifestyle, resulting in a decrease in daily energy requirements, an increase in insulin resistance associated with weight gain and lack of physical activity, which is at the core of the pathophysiology of type 2 diabetes and metabolic syndrome.

The female sex is consistent with several studies showing that the prevalence of DM in women is much higher than in men. The risk of developing T2DM in women is five times higher than in men after adjusting for age, ethnicity, occupation, and household income (Puig-García et al., 2023). Biological differences between men and women in the clinical outcomes of type 2 diabetes are due to genetic and hormonal influences on pathophysiology, clinical manifestations, diagnosis, and response to therapy (Kautzky-Willer et al., 2016; Mauvais-Jarvis et al., 2020). Throughout their lives, changes in sex hormones cause women to experience greater variations in risk for cardiometabolic diseases, including type 2 diabetes. In addition, 'gender differences' arising from psychosocial and cultural processes, such as behavior, lifestyle, and attitudes toward prevention and treatment, also influence susceptibility and progression to type 2 diabetes (Kautzky-Willer et al., 2016; Mauvais-Jarvis et al., 2020; Nielsen et al., 2021).

This study also shows that patients with low education and low socioeconomic status are more likely to develop DM. This is in line with the results of studies showing that advanced age and low education levels are significantly associated with a higher prevalence of diabetes mellitus (DM) (Al-Taani et al., 2025). Higher education is associated with a lower risk of diabetes compared to low or medium education (Reinke, 2024). Low education is associated with a higher risk of lifestyle-related diseases (Sommer et al., 2015). Education has been shown to have a positive relationship with cognitive performance. Diabetes is an important lifestyle-related disease with an increasing prevalence worldwide. Individuals with lower levels of education may be more vulnerable to cognitive decline due to diabetes. Patients with diabetes have poorer cognitive performance than those without diabetes, and patients with diabetes have even poorer cognitive performance if they have lower levels of education (Reinke, 2024). Socioeconomic factors such as income, education, and living conditions have a significant influence on the prevalence and management of diabetes. Poor socioeconomic status significantly affects diabetes education, rendering it inadequate. As a result of lack of knowledge, economic constraints, and lack of physical activity, participants experience poor diabetes management, resulting in negative outcomes (Khan et al., 2024). Low socioeconomic status is associated with higher risks due to factors such as limited access to nutritious food and health services, unsafe or inaccessible environments for physical activity, and higher levels of stress.

The results of this study indicate that self-efficacy in diabetic patients increased after using the smart diabetes calendar (SDC). This is in line with several studies showing that the use of a diabetes calendar application as an educational medium can reduce HbA1c levels, lipid profiles, and insulin levels (Kusnanto et al., 2019). A diabetes self-care calendar can be used as a reminder tool for type 2 diabetes patients living in rural areas (Sugiharto & Hsu, 2020). The current general academic calendar, although useful in standardizing academic schedules, requires structural adjustments to better support holistic work skill development (Dr. Ganesha Acharya B & Anusha, 2025). Diabetes Self-Management Education (DSME) activities can help improve the ability of diabetes patients to perform self-care behaviors independently (Kartika et al., 2022).

The use of technology in diabetes treatment can facilitate better communication between nurses and patients, result in more accurate data collection, and provide a more comfortable life for patients. This study highlights the effectiveness of calendars as powerful educational tools that teach essential skills such as planning, time management, and the monitoring of personal commitments. . "Calendar " were also employed to help individuals make daily,weekly, and monthly notes about events, document lessons learned, and reflect on their personal growth. Calendars were used in this study because they are an educational for teaching chronology, planning, and monitoring personal

commitments, while “calendar journals” are used to make daily ,weekly and monthly notes about events, lessons learned, and reflections for educational or personal growth purposes. Calendars serve as dynamic teaching aids for skills such as time management, while calendar journals provide space for individuals to actively document and process their learning journey. This calendar method is not just beneficial; it is a vital strategy for diabetes management. It empowers patients to actively track their daily activities. With the calendar displayed prominently, often on a wall in their home, patients can easily access this vital resource, thus ensuring it remains a constant part of their daily routine and disease management plan. By adopting this approach, we can pave the way for a more organized, proactive, and empowered lifestyle for those living with diabetes.

Calendars act as dynamic teaching aids that promote skills such as time management, while calendar offer a space for individuals to actively record and process their learning experiences. Additionally, calendar serve as valuable resources for individuals to capture daily, weekly and montly notes on events, articulate lessons learned, and reflect on their personal growth journey. By utilizing calendars as dynamic teaching aids, patients not only develop crucial time management skills but also create a structured environment that fosters accountability.

Self-efficacy is a patient’s belief in their ability to maintain and improve their medical condition. Low self-efficacy levels result in low success rates among DM patients in performing self-care. Increased individual self-efficacy improves their adherence to prescribed treatments for chronic diseases. It also reflects how well a person can modify their behavior to improve their capacity for self-care. Self-efficacy has been applied to predict dietary habits, glycemic control, and weight management. As a result, a better understanding of self-efficacy is integrated into self-management program planning and promotes patient empowerment for better diabetes-related behaviors and outcomes.

Factors that influence self-efficacy in managing diabetes include family support, participation in diabetes education classes, high socioeconomic status, absence of complications, good glycemic control, and well-being. Follow-up for diabetes mellitus (DM) patients regarding self-management and disease control (SDC) compliance includes the following aspects: 1)Encourage the involvement of family and community members in the patient's care process.2) Help patients build the motivation and self-confidence necessary to manage their condition consistently.3) Ensure patients are regularly engaging in established activities, including monitoring their food intake, physical activities, medication adherence, and blood sugar levels.4) Regularly check for potential complications that may arise from the disease.5) Recommend the use of technology, such as medication reminder applications or digital blood sugar monitors, to aid in disease management.These components work together to improve patient outcomes and support effective diabetes management.

CONCLUSION

Self-efficacy in diabetic patients is the patient's belief in their ability to perform diabetes self-management behaviors, such as checking blood sugar, regulating diet, exercising, and taking medication. The use of a smart diabetes calendar (SDC) increases the self-efficacy of patients with diabetes mellitus . DM patients can improve their compliance and discipline in managing their disease. The SDC also serves as a reminder for patients' activities and tasks in managing their disease, making it more effective, efficient, low-cost, and accessible to people of all ages due to its use of simple technology.

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