International Journal of Public Health Science (IJPHS)
Vol. 14, No. 4, December 2025, pp. 1738~1746
ISSN: 2252-8806, DOI: 10.11591/ijphs.v14i4.26501

Self-management program impact on type 2 diabetes blood sugar control

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Article Info

Article history:

Received Jan 1, 2025
Revised Oct 2, 2025
Accepted Nov 3, 2025

Keywords:

Blood sugar control
Glycemic control behavior
Health care volunteer
Self-management program
Type 2 diabetes patients

ABSTRACT

Type 2 diabetes mellitus (DM) represents a major global public health concern. This quasi-experimental study assessed the effectiveness of a self-management program in aiding diabetic patients in controlling their blood sugar levels. The program implemented the self-management framework proposed by Kanfer and Gaelick-Buys, supplemented by social support from healthcare volunteers via home visits. Patients were selected through simple random sampling and subsequently divided into two groups, each comprising 30 patients. The experimental group received a self-management program, with progress monitored over a 12-week period. The control group was administered standard care. The Mann-Whitney U test and the Wilcoxon signed-rank test were employed to assess the data. The results indicated that the self-management behavior and blood sugar levels of both the experimental and control groups were similar before the experiment commenced. Significant differences were observed in self-management behavior and blood sugar levels between the experimental groups before and after the intervention, as indicated by a significance level of 0.05. However, this program has some limitations, including the fact that the evaluation did not include HbA1c levels, and the data was based on participants' self-reports, which may be subject to bias. The finding suggests that this self-management program can be implemented by healthcare professionals in the community to effectively manage blood sugar levels among type 2 diabetes patients to reduce the incidence of complications, with rigorous and continuous monitoring of behaviors required.

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1. INTRODUCTION

Diabetes is a persistent, metabolic disorder marked by high levels of blood glucose (or blood sugar), resulting in long-term harm to the heart, blood vessels, eyes, kidneys, and nerves [1]. The predominant kind of diabetes is type 2, typically found in adults, characterized by insulin resistance or insufficient insulin production by the body [2]. Over the past 30 years, the occurrence of type 2 diabetes has significantly increased in countries across all income brackets [3]. Approximately 422 million individuals across the globe are affected by diabetes, with the majority residing in low- and middle-income nations [4]. Additionally, diabetes is directly responsible for causing 1.5 million deaths annually. Both the incidence and the prevalence of diabetes have been consistently rising over the past few decades [5].

In 2014, the prevalence of diabetes among individuals aged 18 years and older was 8.5%. In 2019, diabetes accounted for 1.5 million fatalities, with 48% of those deaths occurring in individuals under the age of 70 [6]. Diabetes was responsible for an additional 460,000 deaths related to kidney illness, while approximately 20% of deaths from cardiovascular diseases can be attributed to elevated blood glucose levels [7]. From 2000 to 2019, there was a 3% rise in age-standardized death rates attributed to diabetes. The death rate attributed to diabetes has risen by 13% in nations with lower-middle income. In contrast, the global likelihood of dying from any of the four primary noncommunicable diseases (cardiovascular diseases, cancer, chronic respiratory diseases, or diabetes) between the ages of 30 and 70 declined by 22% from 2000 to 2019 [8].

Type 2 diabetes mellitus is a pathophysiological state in which ineffective cellular glucose utilization, stemming from inadequate insulin action, leads to persistently high levels of blood glucose. The pathophysiology of type 2 diabetes involves the potential for significant damage to both the nervous and vascular systems. The condition's development is multifactorial, with primary risk factors including obesity, a sedentary lifestyle, and genetic susceptibility. Consequently, early diagnosis through regular medical examinations and blood screenings is considered imperative for effective disease management. The prevalence is about 95%, and lifestyle modifications like maintaining a healthy weight, engaging in regular physical activity, consuming a nutritious diet, and avoiding tobacco use can help prevent or postpone the development of type 2 diabetes [9].

Inadequate glycemic control in patients with diabetes can precipitate a range of severe acute and chronic complications. Acute metabolic derangements include hypoglycemia, diabetic ketoacidosis, hyperglycemic hyperosmolar state, and hyperglycemic diabetic coma. Chronic complications are typically categorized by the size of the affected blood vessels. Microvascular pathologies include nephropathy, neuropathy, and retinopathy, which can lead to renal failure and vision loss. Macrovascular complications encompass conditions such as coronary artery disease (CAD), peripheral artery disease (PAD), and cerebrovascular disease, which are major contributors to cardiovascular events and lower limb amputations. It's crucial to educate patients about blood glucose control, lifestyle management, self-monitoring, and cessation of smoking [10]. Diabetes mellitus (DM) with inadequate glycemic control is a significant global health issue, particularly affecting those residing in low- and middle-income nations, such as Thailand [11]. DM negatively impacts the economy and quality of life for individuals and their families. Thailand, an upper-middle-income nation, has a high prevalence of DM among its population, with 9.6% of those aged 30 and older. In 2020, around 5 million Thais were diagnosed with DM [7]. The occurrence of diabetes mellitus (DM) in the Thai population was 10.8% among those aged 20 years and older. Additionally, the overall inadequate management of blood sugar levels was 29.5%, with 23.9% among males and 35.7% among women. Diabetic patients who have low socioeconomic levels and limited educational attainment are more likely to experience inadequate glycemic control [12].

A review of the relevant literature reveals several studies, both globally and within Thailand, that have examined the effectiveness of self-management programs for glycemic control. Programs focusing on education and social support have been found to significantly improve patients' self-care behaviors, as supported by various research [13]. In the Thai context, the involvement of village health volunteers (VHVs) has been identified as a critical factor for enhancing patients' diabetes management [14]. However, there remains a gap in the literature regarding the effectiveness of a program that integrates the Kanfer and Gaelick-Buys self-management framework with social support from volunteers, specifically within the context of a primary care setting like a subdistrict health-promoting hospital. This research is therefore significant, as it explores an approach that could inform the development of more effective community-based diabetes care systems.

Khao Raeng Subdistrict Health Promoting Hospital is a primary care facility that prioritizes meeting the needs of the public and offering high-quality, four-dimensional services. Diabetes, which is the leading cause of outpatient treatment requests in the area, is one of the major health issues, and the prevalence of diabetes appears to be on the rise. The statistics from 2017 to 2023 indicate the following number of cases: 170, 182, 192, 187, 192, 204, and 211, respectively. There are persistent statistics indicating that diabetes patients who are unable to effectively manage their blood sugar levels continue to experience no reduction in their condition. The numbers are 41, 64, 73, 63, and 64 cases from 2017 to 2021. Blood sugar levels in this patient group are monitored to maintain them within the proper range. Nevertheless, many individuals with diabetes remain incapable of maintaining their blood sugar levels within the normal range. This is due to their inability to effectively regulate their diets and physical activity. Despite the presence of public health volunteers who provide care, a deficiency in ongoing care persists. To effectively manage diabetes, individuals must engage in ongoing treatment by making consistent adjustments to self-care behaviors like a controlled diet, medication use, exercise, and stress management. Self-management can help prevent long-term problems and promote cognitive processes, decision-making, goal-setting, and collaboration with healthcare professionals. This approach has proven effective in managing chronic illnesses and can be incorporated into daily routines to improve disease control behavior [15].

In the present day, the concept of self-management programs for individuals with diabetes aims to enhance knowledge and skills, enabling them to develop strategies for managing symptoms, treatment, lifestyle changes, and emotional, psychological, social, and environmental aspects of the disease, thereby improving blood sugar control [16]. Thus, at Khao Raeng Subdistrict Health Promoting Hospital in Mueang District, Ratchaburi Province, the researcher has arranged a research project on the impact of a self-management program on blood sugar control behavior in patients with type 2 diabetes in cooperation with local authorities. Due to our acknowledgment of the significance of the notion of self-management. This document serves as a reference for enhancing the effectiveness of a diabetes care system by modifying the management of blood sugar levels in individuals diagnosed with type 2 diabetes. Additionally, it will aid in the prevention of diabetes-related issues that may arise in the patient. Enhances the overall well-being of patients. In addition to alleviating the financial burden of medical costs.

2. PROPOSED

The objectives of this study were: i) To compare the self-management behavior scores and blood sugar levels of type 2 diabetes patients in the experimental group before and after participating in the program; ii) To compare the self-management behavior scores and blood sugar levels between the experimental group, which received the self-management program, and the control group, which received standard care. Self-management behavior was measured using a researcher-developed questionnaire covering four key domains: adherence to a restricted diet, appropriate utilization of medicine, regular engagement in exercise, and effective foot care.

3. METHOD

This study is quasi-experimental in nature, comparing two groups before and after the intervention. The experimental group will be assigned the program according to the researcher's discretion. The control group will be provided with standard nursing care. The duration of the investigation was 12 weeks. Data was gathered from both the experimental and control groups prior to and following the experiment at Khao Raeng Subdistrict Health Promoting Hospital, located in Mueang District, Ratchaburi Province.

The study population consisted of individuals with type 2 DM receiving care at Khao Raeng Subdistrict Health Promoting Hospital. The sample was selected using purposive sampling based on the established inclusion criteria. Subsequently, 60 eligible participants were allocated into either the experimental group or the control group (30 participants each) using simple random sampling. The experimental group received the self-management program developed by the researcher for 12 weeks, while the control group received standard nursing care. The sample size was calculated with free statistical software for a quasi-experimental design; the significance level was 0.05, and the test's power was adjusted to 0.90. Based on the mean and standard deviation of two groups from a previous study [17], which used comparable variables and research designs, the impact size value was estimated to be 0.8124; 30 participants in each group were required for the analysis, after deducting 10% to account for any study error.

The researcher utilized a survey designed by them to gather data. The composition comprised three components. In the first section, a total of twelve items were employed to gather the overall characteristics of the participants. Part two of the study involved the use of forty-three questions to gather information on knowledge, perceived severity, considered susceptibility, perceived advantages, barriers, and cues to action related to DM. For part three, a total of nineteen questions were employed to gather data on self-management behaviors, including adherence to a restricted diet, appropriate utilization of medicine, regular engagement in exercise, and effective foot care. The self-management program for regulating blood glucose levels in individuals diagnosed with type 2 diabetes encompasses the subsequent activities: information regarding diabetes, dietary provisions for diabetics, medication, physical activity, and self-management (stress and foot care) over the course of a 12-week goal-setting period utilizing the self-regulation theory. Utilize blood glucose monitoring equipment available at the Subdistrict Health Promoting Hospital to assess blood sugar levels. Utilized the blood glucose monitoring equipment available at the Subdistrict Health Promoting Hospital to assess blood sugar levels.

To establish the instrument's validity, the item-objective congruence (IOC) index was utilized. A panel of three external experts assessed the alignment of each questionnaire item with the study's objectives. Items were scored on a three-point scale: +1 indicated congruence, 0 indicated the item required revision, and -1 indicated the item was not congruent. Before being interpreted, the expert ratings were combined and divided by three. Question items were removed from the survey if their average score was less than 0.5. Prior to being included in the questionnaire, questions with scores between 0.5 and 0.7 were revised. The final version of the questionnaire contained the items with scores higher than 0.7. Thirty persons who attended the DM clinic at Donka Sub-district Health Promoting Hospital and shared similar characteristics with the study group were

included in the questionnaire's pilot study. During this stage, an analysis was conducted to assess the feasibility, appropriateness of the words or sentences used, and the sequencing of the questions. The reliability of the questions was also evaluated. Finally, it was discovered that the final questionnaire's Cronbach's alpha was 0.72. After getting ethical approval from Muban Chombeung Rajabhat University to conduct this research, we got in touch with the director of the sub-district health-promoting hospital and discussed the goals of the study, including the intervention and data collection. On the day of data collection, all patients with diabetes mellitus type 2 were invited to participate in the study voluntarily. The study objectives, intervention, and blood specimen collection process were explained to those who expressed interest in taking part in the research. Following the provision of written informed consent, participants completed the questionnaire. Descriptive statistics were used to summarize the demographic characteristics of the sample. To analyze the intervention's effect, the Wilcoxon Signed Rank Test was employed to compare pre- and post-test self-management scores, while the Mann-Whitney U Test was used to assess differences between the experimental and control groups.

4. RESULTS AND DISCUSSION

63.30% and 73.30% of the participants in the control and experimental groups, respectively, were female. A large proportion (33.30%) of the control group was aged between 35 and 59. Over 60 was the average age of the experimental group, comprising 60.00% of participants. In the control group, 56.70% of them were married. Widows, divorcees, or separated people made up 60% of the experimental group. At 83.30% and 76.70%, respectively, the majority of participants in the control and experimental groups had not completed secondary school. Most of the control group had manual occupations such as farming, gardening, and general labor (40.00%). The experimental group primarily stayed at home, had no occupation, and consisted of housewives or others (60.00%). The control group had an income of less than 5,000 baht per month (63.30%), while the experimental group had an income below this threshold (56.70%). Both groups had insufficient revenue to meet their expenses. The majority did not have any other comorbidities and had been diabetic for more than five years. Almost all of them have never used tobacco products or alcohol. Most of them find it difficult to control their blood sugar levels within a normal range.

Pre-experiment knowledge regarding DM was analyzed, and the results indicated that the experimental group had a high level of knowledge (56.70%) compared to the control group's moderate level (63.30%). Following the experiment, the control group showed a predominantly moderate level of knowledge regarding DM, with 60.00%. In contrast, the experimental group exhibited a predominantly high level of knowledge regarding DM (86.70%), as shown in Table 1.

Before the experiment, the control group's perceived susceptibility and perceived severity regarding DM were primarily high, at 73.30%, according to the analysis of factors related to this perception. In contrast, the experimental group also showed a high level, at 90.00%. Following the trial, the experimental group also perceived susceptibility and perceived severity regarding DM to be high (100%), while the control group generally perceived vulnerability and perceived severity regarding DM to be high (83.30%), as shown in Table 2.

We conducted an examination of cues to action, perceived benefits, and barriers to DM. Before the experiment, both the control group and the experimental group had a high level of taking care of their health, with 93.30% of participants in each group reporting this. Following the experiment, both the control group and the experimental group exhibited high levels of cues to action, perceived benefits, and barriers in relation to taking care of their health. The control group had these factors at a level of 93.30%, while the experimental group had them at a slightly higher level of 96.70% as shown in Table 3.

Prior to the experiment, the control group displayed a predominantly high level of self-management behavior, at 56.70%, while the experimental group also exhibited a high level of self-management behavior, at 70.00%. The control group exhibited self-management behaviors mostly at a high level, accounting for 66.70%, whereas the experimental group had a significantly higher proportion of self-management behaviors at a high level, reaching 96.70% as shown in Table 4.

Comparative analysis revealed significant changes in the self-management behavior and blood sugar levels of the experimental group before and after the experiment, at a significance level of 0.05. The mean scores on self-management behavior for the experimental group have shown a greater gain compared to the pre-experiment period. In addition, compared to the pre-experiment period, the average blood sugar level decreased, as shown in Table 5.

Contrast the disparity in self-management behavior scores prior to and following the experiment among the experimental and control groups. Prior to the trial, the research findings indicated that there was no discernible distinction in self-management behavior scores between the experimental and control groups. After conducting the experiment, we discovered that the experimental group exhibited considerably better self-management behavior scores compared to the control group, with a statistical significance level of 0.05. Regarding the comparison of blood sugar levels before and after the experiment between the experimental group and the control group, the research findings indicate that there was no disparity in blood sugar levels

between the two groups prior to the experiment. The experiment demonstrated that the experimental group had superior performance compared to the control group in terms of blood sugar levels, with a statistically significant result at a significance level of 0.05, as shown in Table 6.

Table 1. Knowledge regarding DM (n = 60)

Level	Control group (n = 30)				Experimental group (n = 30)			
	Before		After		Before		After	
	n	%	n	%	n	%	n	%
Low	7	23.30	4	13.30	3	10.00	0	0.00
Moderate	19	63.30	18	60.00	10	33.30	4	13.30
High	4	13.30	8	26.70	17	56.70	26	86.70
$\bar{x}$ (S.D.), Range	7.87 (1.74), 4-11		8.40 (1.57), 6-11		9.17 (1.95), 3-11		10.93 (1.08), 8-12	

Table 2. Perceived susceptibility and perceived severity regarding DM (n = 60)

Level	Control group (n = 30)				Experimental group (n = 30)			
	Before		After		Before		After	
	n	%	n	%	n	%	n	%
Low	3	10.00	0	0.00	1	3.30	0	0.00
Moderate	5	16.70	5	16.70	2	6.70	0	0.00
High	22	73.30	25	83.30	27	90.00	30	100
$\bar{x}$ (S.D.), Range	30.80 (4.97), 20-36		31.43 (4.08), 22-36		32.17 (4.70), 12-36		34.57 (1.25), 32-36	

Table 3. Cues to action, perceived benefits, and barriers to DM (n = 60)

Level	Control group (n = 30)				Experimental group (n = 30)			
	Before		After		Before		After	
	n	%	n	%	n	%	n	%
Low	0	0.00	0	0.00	1	3.30	0	0.00
Moderate	2	6.70	2	6.70	1	3.30	1	3.30
High	28	93.30	28	93.30	28	93.30	29	96.70
$\bar{x}$ (S.D.), Range	50.77 (4.35), 37-57		51.33 (3.85), 40-57		51.70 (7.31), 19-57		54.53 (2.74), 44-57	

Table 4. Self-management behavior to DM (n = 60)

Level	Control group (n = 30)				Experimental group (n = 30)			
	Before		After		Before		After	
	n	%	n	%	n	%	n	%
Low	1	3.30	1	3.30	2	6.70	0	0.00
Moderate	12	40.00	9	30.00	7	23.30	1	3.30
High	17	56.70	20	66.70	21	70.00	29	96.70
$\bar{x}$ (S.D.), Range	44.77 (7.35), 19-53		45.70 (6.36), 24-53		45.47 (7.73), 19-56		49.60 (3.41), 38-56	

Table 5. Comparative of self-management behavior and blood sugar levels of the experimental group before and after the experiment (n = 30)

Factors			Experimental group				
			N	Mean rank	Sum of ranks	*Z*	p-value
Self-management behavior	Pre-post	Negative ranks	23	12.00	276.00	-4.216	<0.001
		Positive ranks	0	.00	.00		
Blood sugar levels	Pre-post	Negative ranks	13	7.00	91.00	-3.181	0.001
		Positive ranks	0	.00	.00		

Table 6. Comparative of self-management behavior and blood sugar levels between the experimental and control groups before and after the experiment (n = 60)

Factors	Experimental group		Control group		*Z*	p-value
	Mean rank	Sum of ranks	Mean rank	Sum of ranks		
Self-management behavior						
Pre	31.68	950.50	29.32	879.50	-0.527	0.599
Post	36.52	1095.50	24.48	734.50	-2.682	0.007
Blood sugar levels						
Pre	30.93	928.00	30.07	902.00	-0.192	0.848
Post	22.22	666.50	38.78	1163.50	-3.675	<0.001

The self-management program's blood sugar control behavior results showed that, at the significance level of 0.05, comparison analysis demonstrated a significant difference between the experimental group's pre- and post-experiment blood sugar levels and self-management behavior. The mean self-management behavior score of the experimental group exhibited a more significant rise as compared to the pre-experiment period. Furthermore, in comparison to the period before the experiment, there was a reduction in the average blood sugar level. After conducting the experiment, it was determined that the experimental program resulted in a significantly higher average self-management behavior score among diabetic patients in the experimental group compared to the control group. It demonstrates that knowledge and skill development are promoted through training activities, which include counseling and goal-setting practice for patients. Patients can independently control their condition by recording the outcomes of their Dextrostix tests. Document the dietary intake and physical activity based on the principles outlined [18], which align with the outcomes of patient self-management. The village health volunteers offered aid and help throughout the entire procedure. The patient's ability to independently care for themselves at home resulted in an augmentation in self-assurance among the patients in the experimental group [14], [19]. It was observed that type 2 diabetic patients who were unable to regulate their blood sugar levels and received self-management promotion exhibited increased levels of diabetes awareness and improved diabetes self-management skills compared to their pre-experiment levels and compared to the control group. This may be due to the fact that patients are more likely to recognize diabetes as a health threat and consciously implement healthy behaviors if they have a greater understanding of the disease and its severe complications. In contrast, the risk of type 2 diabetes is increased in people with inadequate self-reported health literacy [20]-[22]. The level of perceived severity positively influenced self-care activities, indicating that higher perceived severity was associated with better self-care behaviors [16], [23].

The study's findings indicate that the intervention was effective. Initially, both the experimental and control groups were comparable, with no significant differences in their pre-test self-management behavior scores or blood sugar levels. However, post-experiment analysis revealed that participants in the experimental group significantly outperformed the control group on both outcome measures. The intervention focused on enhancing patients' self-management capabilities through skill-building exercises, including training on blood glucose measurement (Dextrostix) and developing individualized goals for nutrition and exercise [24], [25]. Taking medications as prescribed, exercising regularly, changing your diet, taking care of your feet, and checking your own blood glucose levels are all parts of glycemic control that are affected by how often you do them. Each additional point on the diabetes self-management scale reduces the risk of suboptimal glycemic control by 5%. The objective effectiveness of FPG control among diabetic patients will be greater if they engage in more self-management behaviors. Health practitioners and therapists should make an effort to utilize self-care techniques in a way that complements other therapeutic and educational approaches. Improving life quality, encouraging self-care, and lowering blood sugar levels are the main objectives, especially for the elderly who don't practice self-care [26]. Self-care is a purposeful strategy for preserving one's physical, emotional, and mental well-being [27]. Individuals suffering from chronic illnesses may undergo alterations in their overall well-being and way of life. Modifying your decisions and actions is the most advantageous aspect of self-care. These techniques involve overseeing crucial elements such as drugs, physical activity, nutrition, sleep, emotional state, medical resources, and caregiving. The American Diabetes Association (ADA) recommends key dietary modifications for managing diabetes, including monitoring carbohydrate and fiber intake, promoting weight loss, and reducing the consumption of cholesterol, saturated fat, trans fat, and sodium. While these nutritional strategies are fundamental for disease management, effective treatment also requires supplementary guidelines that account for personal and social factors to enhance patient outcomes [28], [29].

A collaborative health promotion intervention equipped with the necessary competencies should be assigned to assess the needs and develop, implement, and evaluate relevant empowerment programs at the household and community levels [30]. Team-based care (TBC) is a patient-centered, multidisciplinary approach that tailors interventions to individual patient needs, considering factors like health literacy, behavioral capacity, and clinical severity. This model is associated with numerous positive outcomes, including enhanced quality of life, improved physical and mental health, and reduced healthcare utilization, such as fewer hospitalizations and emergency department visits. Additionally, TBC has been shown to modestly increase patient satisfaction. TBC interventions facilitate increased frequency and regularity of interactions between patients and healthcare professionals, thereby providing patients with greater opportunities to address health concerns [13]. The finding suggests that this self-management program can be implemented by healthcare professionals in the community to effectively manage blood sugar levels among type 2 diabetes patients to reduce the incidence of complications, with rigorous and continuous monitoring of behaviors required.

4.1. Practical implications for healthcare professionals

The findings from this study offer several practical applications for healthcare professionals aiming to improve community-based diabetes care: i) Program adaptation and implementation: Healthcare professionals can adapt the structure of this self-management program—which includes education, practical

training, goal-setting, and follow-up—for implementation in other primary care settings to empower patients; ii) Emphasis on collaborative goal-setting: The goal-setting process was a core component of the program's success. Clinicians should facilitate collaborative goal-setting with patients, helping them define measurable and achievable targets for diet, exercise, and self-monitoring; ii) Leveraging community health volunteers: The support from village health volunteers (VHVs) through home visits was crucial for reinforcing behaviors and building patient confidence. Healthcare systems should invest in training and empowering VHVs to act as essential extenders of the healthcare team; iv) Use of self-monitoring tools: The use of logbooks and personal blood glucose monitoring devices (Dextrostix) enabled patients to track their own progress and understand the direct impact of their behaviors. Professionals should train patients in these skills and use the collected data to collaboratively adjust care plans.

The study's findings should be interpreted in light of two primary limitations. First, due to budgetary and temporal constraints, HbA1c levels were not measured, which prevented an objective assessment of glycemic control. Second, the reliance on self-reported data introduces the potential for recall bias and social desirability bias. In addition, a comparison analysis of HbA1c values ought to be included in future research. We should carry out long-term follow-up studies on self-management behavior to guarantee effectiveness. Evaluating improvements in blood sugar control and self-management practices is the goal.

5. CONCLUSION

The diabetic self-management program specifically targets the behavioral aspects of blood sugar control in individuals diagnosed with type 2 diabetes. Workshops are available to offer education and practical training in a range of topics, such as diabetes awareness, dietary considerations for diabetic patients, and medication management. Appropriate physical activity and personal control. Additionally, there exists a self-management guidebook specifically designed for those with diabetes. The guidebook includes a diverse range of recording forms. This enables patients to retrieve it for additional analysis. The activity structure emphasizes the practice of self-management skills, such as goal-setting and data gathering, for patients. The program was designed to improve patient self-management through a self-regulation process. This process includes several stages: information processing and evaluation, decision-making, behavioral action, self-monitoring, self-evaluation, and self-reinforcement. By engaging in this program, participants with diabetes gained a greater appreciation for proactive health management. The acquisition of knowledge and skills for effective behavioral control is expected to lead to improved glycemic control. This study contributes to the existing body of knowledge by demonstrating the effectiveness of applying the Kanfer and Gaelick-Buys self-management framework combined with social support from health volunteers in a Thai primary care context—an approach that has been underexplored. The findings emphasize that empowering patients to set goals and self-monitor is a key strategy for improving glycemic control, distinguishing this intervention from traditional, didactic health education models.

Based on this study's limitations, several recommendations for future research are proposed: i) Long-term follow-up studies should be conducted to assess the sustainability of self-management behaviors and their effects over time; ii) Future research should incorporate objective clinical indicators, such as HbA1c levels, to provide a more robust evaluation of the program's impact on glycemic control; iii) Studies could explore the program's effectiveness in diverse contexts, such as urban settings or among patient populations with different comorbidities, to enhance the generalizability of the findings.

ACKNOWLEDGEMENTS

We would like to thank all the staff of Khao Raeng Subdistrict Health Promoting Hospital and Muban Chombueng Rajabhat University, which support research funds. And thank you to all the participants who took part.

FUNDING INFORMATION

Authors state no funding involved.

AUTHOR CONTRIBUTIONS STATEMENT

This journal uses the Contributor Roles Taxonomy (CRediT) to recognize individual author contributions, reduce authorship disputes, and facilitate collaboration.

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C : **C**onceptualization
M : **M**ethodology
So : **So**ftware
Va : **Va**lidation
Fo : **Fo**rmal analysis
I : **I**nvestigation
R : **R**esources
D : **D**ata Curation
O : Writing - **O**riginal Draft
E : Writing - Review & **E**diting
Vi : **Vi**sualization
Su : **Su**pervision
P : **P**roject administration
Fu : **Fu**nding acquisition

CONFLICT OF INTEREST STATEMENT

Authors state no conflict of interest.

ETHICAL APPROVAL

The Ethics Committee for Research involving Human or Animal Subjects, Muban Chombeung Rajabhat University, Ratchaburi, Thailand (COA No.002/2566), authorized all study instruments and protocols, including consent to participate. A voluntary agreement was obtained from each participant subsequent to receiving both an oral and written explanation, at which point they affixed their assent through signature.

DATA AVAILABILITY

Data availability is not applicable to this paper as no new data were created or analyzed in this study.

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