

The impact of structured education on knowledge and self-efficacy in type 2 diabetes mellitus patients

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Abstract

Patients diagnosed with Type 2 Diabetes Mellitus (T2DM) need to acquire knowledge and self-confidence to effectively engage in self-care activities. A structured education program has the potential to influence knowledge, self-efficacy, and self-care behavior. This study aimed to investigate the impact of education on the knowledge, self-efficacy, and self-care of individuals with T2DM. The research employed a quasi-experimental non-equiva-

lent control group design with purposive sampling. The total sample size consisted of 60 participants, with 30 in each group. The intervention group attended a four-session T2DM structured education program conducted by internal medicine specialists, nurses, nutritionists, and pharmacists, while the control group continued with their usual monthly check-ups. The results of the independent t-test revealed differences in knowledge, self-efficacy, and self-care between the intervention and control groups in the post-test assessment. Education for T2DM patients was found to be effective in enhancing knowledge ($p=0.000$), self-efficacy ($p=0.000$), and self-care ($p=0.000$), making it a recommended component of self-management education to prevent complications. The implications of this study may assist hospitals in developing Standard Operating Procedures (SOPs) for implementing structured education programs for individuals with Type 2 Diabetes Mellitus as a means of enhancing patients' management skills for T2DM.

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Introduction

Diabetes Mellitus (DM) remains a global problem,¹ and its prevalence has increased in developing countries.² Type 2 Diabetes Mellitus (T2DM) is one of the non-communicable diseases that continues to rise in prevalence and mortality rates over the years.^{3,4} T2DM is a chronic condition characterized by decreased responsiveness to insulin and reduced insulin production by pancreatic β cells resulting in long-term hyperglycemia.⁵ The International Diabetes Federation (IDF) estimates that there are currently 463 million people with diabetes, and this number is expected to rise to 700 million by 2045, with 90% being T2DM.⁶ The IDF also predicts a substantial increase in T2DM cases from 10.7 million in 2019 to 13.7 million in 2030.⁵ With 10 million adults diagnosed with diabetes, Indonesia ranks seventh in the prevalence of diabetes, following China, the United States, Brazil, Russia, and Mexico. The rising prevalence of T2DM is a significant global concern, and if left unmanaged, it can lead to various complications, including vascular issues, neuropathy, and other related problems.^{7,8} A previous study found that 76.4% of T2DM patients suffer from at least one complication.⁹ Meanwhile, in West Sumatra province, out of 19 municipalities, Padang is one of the cities that has a high prevalence of T2DM, with a prevalence rate of 2.47%.¹⁰ Effective prevention of long-term complications necessitates a strong foundation of knowledge to support self-care activities.¹¹ A structured education program is crucial to ensuring that T2DM patients have the knowledge and abilities necessary for self-care.¹² Self-management for type 2 diabetes treatment includes dietary regulation, physical activity/exercise, blood glucose monitoring, medication adherence, and self/foot care. A structured education program has been created and tested multiple times in Indonesia called the Indonesian Group-Based Diabetes Education Program (InGDEP).¹³ Malini, Copnell, and

Moss (2017) created this concept.¹⁴ The high prevalence of type 2 DM is caused by unchangeable risk factors, such as gender, age, and genetic factors. The second is modifiable risk factors, such as smoking habits, education level, occupation, physical activity, alcohol consumption, Body Mass Index (BMI), waist circumference, and age.¹⁵ There are 4 pillars of DM management: education, medical nutrition therapy, physical activity, and pharmacological therapy. Education about knowledge of T2DM is crucial for controlling risk factors and preventing complications.¹⁶ Positive knowledge and mindset have been shown to improve the self-care practices of T2DM patients.¹⁷ Knowledge is the result of sensory perception and leads to the acquisition of new knowledge, particularly about T2DM.¹⁸ Knowledge plays a vital role in enhancing self-efficacy, enabling individuals to perform proper self-care activities.¹⁹ Several studies have demonstrated that education programs for T2DM patients are effective in boosting self-efficacy, which, in turn, significantly influences self-management.⁹ Self-efficacy refers to an individual's belief in their capacity to initiate, motivate themselves, and act, with potential effects on cognitive, motivational, affective, and selection processes.²⁰

In the context of T2DM, self-efficacy relates to an individual's confidence in their ability to manage their blood sugar effectively and serves as a valuable framework for understanding and predicting the behavior and commitment of T2DM patients.^{21,22} There is a clear connection between self-efficacy and T2DM self-care, with self-efficacy significantly impacting a patient's ability to engage in self-care activities positively or negatively. Increased self-efficacy has been linked to improved self-care.²³ Self-care encompasses active practices by patients aimed at improving their physical condition and maintaining health through measures such as dietary choices, physical exercise, blood sugar monitoring, and preventive healthcare services.¹¹ T2DM patients require ample support in terms of resources, information, and self-confidence to effectively implement self-care.²⁴

Effective management of T2DM through self-care can be facilitated through structured and continuous education, aligning with the principles of the social learning theory, which emphasizes cognitive components and promotes understanding and evaluation of learned material.²⁵ Data from medical records of University hospital revealed an increasing number of T2DM patients in the Outpatient Internal Medicine ward, with a total of 364 patient visits during that period. Among these patients, four had less than 50% knowledge about T2DM, one had knowledge above 50%, and none had an excellent level of knowledge. Some patients were uncertain, while two were confident in their ability to manage diabetes self-care activities. Regarding self-care, a small number of patients demonstrated poor self-care, while none exhibited good self-care behavior. Nurses at the outpatient ward noted the absence of a structured and continuous education program for T2DM patients, with only occasional counseling and information provided through QR barcode scanners and leaflets. Based on the preliminary study, researchers identified that there is a need for providing an education program that suit with the hospital situation. Lack of self-care management of T2DM patients could increase complications and a reduced quality of life for T2DM patients. A viable solution involves implementing a health education program, which is part of the development of the InGDEP method. This includes applying simulation or demonstration methods in regular educational classes for T2DM patients in the outpatient setting. The educational class will be based on adapting the InGDEP concept to hospital conditions, modifying learning methods, and enhancing interactions in educational sessions. The educational program will follow the social learning theory, emphasizing the cognitive com-

ponent of individuals' minds, leading to better understanding and evaluation of the learned material. Moreover, educational materials will align with the pillars of management (diet, physical activity/exercise, medication, and lifestyle) established by the Indonesian Endocrinology Association (2017).⁷ The method will involve employing an active learning approach in educational classes, fostering cohesion between participants and educators. To address this gap and enhance the knowledge, self-efficacy, and self-care of T2DM patients, the researchers proposed a solution. The suggestion involves incorporating simulation or demonstration using the InGDEP technique into routine teaching for T2DM patients at the outpatient clinic.¹³ The research question guiding this study was: What is the effect of educational classes on the knowledge, self-efficacy, and self-care of T2DM patients in Outpatient University Hospitals? Thus, this study aimed to investigate the impact of an educational program for T2DM patients on their knowledge, self-efficacy, and self-care.

Materials and Methods

Study design

This study employs a quantitative quasi-experimental non-equivalent control group design to establish a cause-and-effect relationship. It utilizes a pre-test and post-test with a control group design, focusing on a structured education program provided to T2DM patients to assess its impact on knowledge, self-efficacy, and self-care.

Intervention

Researchers divided respondents into two groups: a control group with 30 participants and an intervention group with 30 participants. The intervention group was further subdivided into two educational classes, each consisting of 15 respondents. The educational classes spanned four weeks, with two sessions held per week, covering the same material. The provided material included concepts related to diabetes management and lifestyle, dietary practices, food organization, physical activity, and medication management. Each session was conducted by healthcare professionals, including doctors, nutritionists, and nurses.

Sample size and sampling method

The study included T2DM patients from the Internal Medicine Outpatient Clinic at University Hospital in Padang. There was an average of 121 patient visits per month from June to August 2022, totaling 364 visits over three months. The study involved 30 participants in the intervention group and 30 in the control group, determined using the Slovin formula. Purposive sampling was employed with specific inclusion and exclusion criteria. Inclusion criteria included T2DM patients proficient in reading and speaking without cognitive deterioration. Exclusion criteria encompassed patients with communication problems, psychiatric issues, diminished hearing, kidney dysfunction, cardiovascular problems, and poor eyesight.

Study tools

To measure participants' knowledge, the DKQ-24 Diabetes Knowledge Questionnaire: A 24-question survey assessing knowledge of diabetes mellitus with options of true, false, or don't know answers.¹⁹ The questionnaire used for this study has previously been translated and validated by Malini *et al.*, with a Cronbach alpha for the Indonesian version of DKQ-24 of 0.603. For measuring self-efficacy, this study used Self-Efficacy for Diabetes Scale: an eight-item survey graded on a Likert scale of 1 to 10 to evaluate self-efficacy, with a higher score indicating greater confidence. This questionnaire

has been adopted previous study which underwent reliability and validity tests, with a Cronbach alpha value of 0.87.²⁶ Meanwhile, Summary of Diabetes Self-Care Activities (SDSCA) questionnaire was used, and consists of 17-question survey, originally created by Toobert, Hampson, and Glasgow in 2000 and modified by Agrimon (2014), used to assess self-care practices over the past seven days following education. The Cronbach alpha value for the Indonesian version is 0.474.²⁷

Research ethics

Ethical approval for this study, ensuring subject welfare and human rights, was obtained from the Research Ethics Committee of the Faculty of Nursing at Universitas Andalas in Padang under approval number 029.laiketik/KEPKFKPUNAND.

Data analysis

The analysis employed both univariate and bivariate techniques. Univariate analysis assessed the knowledge, self-efficacy, and self-care levels of T2DM patients during pre-test and post-test in both the intervention and control groups. It included descriptive statistics such as distribution, presentation, maximum and minimum values, standard deviation, and mean with a 95% Confidence Interval. Bivariate analysis examined the mean differences and the impact of education on T2DM patients' knowledge, efficacy, and self-care before and after the intervention, as well as between the intervention and control groups to support the research hypothesis. Normality was checked using the Shapiro-Wilk test, and parametric tests such as paired-sample T-tests and independent T-tests were applied to pre-test and post-test data for knowledge, self-efficacy, and self-care in both groups.

Results

The purpose of this study was to determine how structured education affects knowledge, self-efficacy, and self-care in the management of Type 2 Diabetes Mellitus. Based on Table 1, all characteristics of respondents in the intervention and control groups are homogeneous (p value >0.05). Respondents in the intervention group were predominantly pre-elderly (45-59 years old, 70%), had secondary

education (40%), worked as IRT (40%), suffered from T2DM for ≤ 5 years (57%), and had a family history of T2DM (87%). Table 2 shows the average knowledge, self-efficacy, and self-care of T2DM patients in outpatient University Hospital Padang in the intervention and control groups before and after education classes. In the intervention group, the average value of knowledge after being given educational classes increased (9.73). Likewise on self-

Table 1. Characteristics of intervention and control group respondents (n=60).

Characteristic	Group intervention n=30 (%)	Homogeneity test control n=30 (%)
Gender		
Man	11 (37)	14 (47)
Woman	19 (63)	16 (53)
Age		
Adults (20-44 years)	2 (7)	3 (10)
Pre-elderly (45-59 years)	21 (70)	13 (43)
Senior (60 years or older)	7 (23)	14 (47)
Education		
Lower education	6 (20)	5 (17)
Secondary education	12 (40)	18 (60)
Higher education	12 (40)	7 (23)
Work		
Teacher	0 (0)	1 (3)
IRT	12 (40)	13 (43)
Merchant	2 (7)	2 (7)
Pensioner	0 (0)	4 (13)
Farmer	0 (0)	2 (7)
Civil servants	7 (23)	4 (13)
Self-employed	9 (30)	4 (13)
Duration of T2DM Diagnosis		
≤ 5 years	17 (57)	16 (53)
$>5-10$ years	9 (30)	10 (33)
$>10-15$ years	3 (10)	4 (13)
≥ 15 years	1 (3)	0 (0)
Family history of T2DM		
Exist	26 (87)	25 (83)
None	4 (13)	5 (17)

Table 2. The effect of educational classes on knowledge, self-efficacy, and self-care (n=60).

Variable	Group	Mean Pretest	Mean Post-test	Mean difference
Knowledge	Intervention	10.00	19.73	9.73
	Control	9.10	7.43	-1.66
Self-efficacy	Intervention	4.23	7.54	3.31
	Control	4.46	4.36	-0.10
Self-care	Intervention	3.15	5.14	1.98
	Control	2.98	3.00	0.02

Table 3. Differences in knowledge, self-efficacy, and self-care between intervention and control groups of T2DM patients during the post-test (n=60).

Variable	Group	Mean difference	Sig (2 Tailed)	t
Knowledge (Post)	Intervention	12.300	16.077	0.000
	Control			
Self-efficacy (Post)	Intervention	3.183	17.289	0.000
	Control			
Self-care (Post)	Intervention	2.133	15.536	0.000
	Control			

efficacy (3.31), and self-care (1,98). After being given education, there is an increase in the mean value, it can be seen where the mean difference has increased. While in the control group, the trend was to experience a decrease in the average value for knowledge (-1.66), self-efficacy (-0.10) during the post test. Meanwhile, for self-care (0.02), there is only a slight difference from the average value during the post-test.

Meanwhile, Table 3 shows the results of the Independent Samples T Test on the intervention and control groups obtained knowledge ($p=0.000$), self-efficacy ($p=0.000$), and self-care ($p=0.000$). This means that there are differences in knowledge, self-efficacy, and self-care in the intervention and control groups during the posttest at University Hospital Outpatient ward.

Discussion

In this study the class education that adopted from structured health education program, conducted by having an interpersonal collaboration between health professionals. The team consist of healthcare teams (doctors, nurses, nutritionists, pharmacists) who collaborate to deliver educational materials on various health topics.¹³ Collaboration between the presenters and nurses, when presenting the topic, served as an elaboration in this study. For instance, the nurse instructed the class on pharmacology on how to administer insulin therapy. Educators encourage patients to participate in the learning process through group discussions and practices based on learning objectives. Active involvement of educational participants and demonstrations/simulations can maximize learning, creating cohesion between educational participants and educators.²⁸ According to Leo *et al.* (2022), there is a significant positive relationship between educational linkage behavior and affecting participants' motivation in achieving goals. Based on the results of this study, there was an influence from the provision of educational structure on knowledge, self-efficacy, and self-care.²⁹

The increased knowledge in the intervention group was attributed to continuous education over four weeks, the provision of pocketbooks for Type 2 Diabetes Mellitus, and the use of simulation/demonstration methods in delivering material. The results align with Hailu's research on the influence of education on increasing knowledge.¹⁹ The education in this study comprised six sessions lasting 1-1.5 hours each, focusing on T2DM concepts and intervention behaviors. Significant improvements were noted in knowledge regarding dietary recommendations and foot care practices.

The decline in knowledge levels in the control group was due to not receiving the same treatment, namely ongoing education on the concept of T2DM. These patients only underwent routine internal medicine poly check-ups. While they received information about their health from internal medicine specialists, detailed explanations about T2DM and structured self-care management were lacking. Information in short-term memory can be transferred to long-term memory through effort and practice in a conscious state with repetitive processes. Another reason for declining knowledge levels is forgotten information. According to cognitive theory, information is processed by the reasoning system and stored in permanent memory. However, real-world experiences sometimes contradict theory, making it challenging to recall diligently learned information. Boredom can also lead to a sense of redundancy in one's actions.³⁰

Meanwhile, self-efficacy in T2DM patients represents an individual's self-confidence in their ability to manage blood sugar lev-

els.²¹ The study found significant differences in self-efficacy between the intervention and control groups. These results are related to the patient's mastery of self-care, increasing their confidence in correctly performing self-care. Self-efficacy positively contributes to improved self-care. Increased self-efficacy in self-care is influenced by the education provided.²³ The results of this study align with similar research, which indicates the effect of education on increasing self-efficacy.³¹ In addition to education, patients received health information through leaflets and videos. Another study also reported an influence on self-efficacy levels after education in Discharge Planning.³² Thus, it can be concluded that patients with Type 2 Diabetes Mellitus can increase their knowledge about T2DM management through education provided in a structured education program. This process involves adding information, sharing positive experiences in T2DM management, and increasing confidence to control blood sugar levels, live better, and avoid T2DM complications.

Self-care behavior in T2DM patients was assessed by asking respondents about diabetes self-care activities in the last seven days after receiving education. These routine activities included diet, physical activity (exercise), foot care, blood glucose monitoring, and medication. In this study, the intervention group reported more frequent dietary adjustments (6 days a week) compared to the control group (4 days a week). Align with similar study, where the intervention group performed dietary self-care for an average of 6 days a week, while the control group did so for 4 days a week.³³ Dietary regulation in the intervention group resulted from the respondents' ability to adjust their food intake based on their needs. However, the control group had lower dietary self-care because they lacked understanding in setting their diet according to their requirements.

For Physical Exercise: The intervention group engaged in physical self-care more frequently, averaging 5 days a week, compared to the control group, which averaged 3 days a week. These results are consistent with similar a study which the intervention group participated in physical activity 5 days a week.³³ The difference occurred because the intervention group, after attending T2DM education classes, tried to be more physically active than the control group. Respondents in the intervention group engaged in physical activities more effectively than the control group. There was no significant difference in self-care related to medication use. Both the intervention and control groups had an average medication self-care routine of 3 days a week. This lack of improvement in medication adherence was because both groups struggled with proper medication usage. Patients often forgot to take their medication the required number of times per day (two or three times), resulting in suboptimal adherence.^{34,35} Both the intervention and control groups monitored their blood sugar levels an average of 2 times a week during post-tests. However, most respondents checked their blood sugar levels the day before their routine internal medicine poly check-ups. This indicates that respondents did not have the necessary tools to check their blood sugar levels regularly on their own. The intervention group reported better diabetic foot self-care, averaging 6 days, compared to the control group's 3 days. These results are consistent with Indaryati's study,³³ which found that the intervention group performed diabetic foot self-care for an average of 6 days, while the control group did so for 3 days. The improvement in diabetic foot self-care in the intervention group was due to a better understanding of the risks associated with diabetic feet and how to care for them among the patients. Most respondents failed to dry the areas between their toes after wetting their feet, unaware that moisture in these areas could increase the risk of fungal growth and foot infections.⁷

Limitations

This study has several weaknesses, namely the limited research time, which prevented the examination of long-term effects and follow-up activities. Additionally, the sustainability of this education program relies on the commitment of health workers, emphasizing the importance of their dedication to implementing health education programs.

Conclusions

In summary, the study highlights the positive impact of structured educational interventions on the knowledge, self-efficacy, and self-care practices of patients with Type 2 Diabetes Mellitus. These findings underscore the significance of patient education as an integral component of diabetes management. The results of this study can contribute to the hospital's efforts in providing education to T2DM patients. Implementing educational class programs is a viable alternative based on the research findings. This study serves as evidence for the management of T2DM patients in hospitals, particularly in the development of health education programs. Therefore, it is recommended that the hospital establish a policy for creating standardized operational procedures for the implementation of educational classes for T2DM patients. Additionally, consideration should be given to the development and application of the role of educators among health workers, fostering collaboration in healthcare services.

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