Self-management Effectiveness on the Quality of Life of Type 2 Diabetes Mellitus Patients during the COVID-19 Pandemic in Aceh, Indonesia

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Abstract

BACKGROUND: Type 2 diabetes mellitus (DM) is a comorbid factor with a double risk of increased morbidity and mortality due to COVID-19. Therefore, diabetic patients need to prevent COVID-19 seriously. However, they also need to regularly check their condition in health-care services, such as hospitals and community health centers, making them more vulnerable to COVID-19 infection. One factor playing a significant role in controlling diabetes is self-management. Self-management activities can increase independence in caring for and controlling the health of diabetic patients. Then, it also enhances self-efficacy to improve the quality of life among diabetic patients.

AIM: This study aimed to examine the effect of self-management on quality of life among patients with Type 2 DM.

METHODS: Fifty patients with type 2 DM consented to participate in the study. The patients were assigned to either the control group receiving standard care or the experimental group receiving standard care and self-management. The program was constructed using Kanfer's three self-management steps, including self-monitoring, self-assessment, and self-reinforcement. The effect of the intervention was measured by the WHO Quality of Life Questionnaire (WHOQOL-BREF), consisting of 26 statement items on a 5-point Likert scale and a self-management intervention evaluation checklist. Data were analyzed using an independent sample t-test.

RESULTS: The results showed a significant difference between the pre- and post-intervention in the experimental group's quality of life of type 2 DM patients ($P = 0.000$ and $\alpha = 0.01$).

CONCLUSION: This study found that self-management effectively increases the quality of life among diabetic patients. The health-care providers, especially the nurses interested in community and family health nursing, are suggested to improve the self-management of diabetic patients to prevent complications and improve the quality of life of the patients.

Introduction

Diabetes mellitus (DM) is of threatening disease during the pandemic, with an incidence between 20 and 79 years of age. DM continues to increase worldwide, and by 2025, it is predicted to increase to 72% or 333 million [1]. Data from global studies show that the number of people with type 2 DM in 2015 has reached 415 million people. If no action is taken, it will increase to 642 million by 2040 [2].

In Indonesia, DM is the sixth largest cause of death in all age groups. The prevalence of diabetes is dominated by the number of undetected patients and do not take medication, by 73% of the total diabetics in Indonesia. In Indonesia, the prevalence of people with diabetes reached >8.5 million in 2013. Moreover, Indonesia is the seventh country globally, after China, India, the United States, Brazil, Russia, and Mexico, with the largest population of people with diabetes. It is estimated that the number of people with diabetes will increase from 8.5 million to 21.3 million in 2030. In Indonesia, the highest prevalence of DM is in the provinces of West Kalimantan and North Maluku (11.1%), followed by Riau (10.4%) and Aceh (8.5%), while the lowest was in the provinces of Papua (1.7%) and NTT (1.8%). In Aceh province, 1.8% of people diagnosed with DM and 0.8% experienced symptoms of DM [3].

Diabetes causes serious complications, such as blindness, kidney failure, heart failure, stroke, neurological disorders, amputation, and impotence. The role of nurses is critical for the prevention of these complications. Nurses are responsible for teaching people with DM through self-management consisting of controlling blood sugar, diet, physical activity, diabetic foot care, and medication. Self-management activities can be carried out through intervention and education by nurses in increasing the independence of type 2 DM patients in caring for and controlling their

health. Self-management aims to improve the ability of self-efficacy in preventing and controlling diabetic complications, enhancing the quality of life [1].

Quality of life is an effort to maximize happiness and satisfaction with a life consisting of physical, functional, psychological, and social dimensions. Quality of life is a general term to express health status. Health-related quality of life includes functional limitations that are physical, mental, social, and spiritual.

COVID-19 pandemic caused a significant change in type 2 DM patients, especially in performing self-health checks and controlling blood glucose due to the activity restriction policy. People are reluctant to go to community health centers, because they try to avoid infection or the risk of being exposed to the COVID-19 virus. This circumstance causes type 2 DM patients' health condition to be unmonitored, even though type 2 DM is a comorbid disease (Comorbid factor) with twice the risks of causing morbidity and mortality due to COVID-19 compared to individuals without a history of DM [4].

The previous studies found that DM is the main risk factor for severe pneumonia and sepsis due to viral infections. DM patients with COVID-19 infection have a 50% higher risk of causing death than non-DM patients [4]. Due to the COVID-19 pandemic, diabetic patients experienced difficulties reaching health-care centers due to restrictions on physical and social activities, so independent handling is needed in controlling blood sugar at home through self-management activities. Self-management is the most important effort in caring for type 2 DM patients during this COVID-19 pandemic, and it is predicted to increase the quality of life among diabetic patients. However, the study on self-management, especially in diabetic patients during COVID-19, remains limited. This study will significantly contribute to health-care providers in caring for patients with type 2 DM.

Methods

Research design

This study was an experimental study using a two-groups pre-post-test design. The objective of this study was to examine the effect of a self-management program on the quality of life of type 2 DM patients in Aceh, Indonesia.

Instruments

The research instrument was the World Health Organization's Quality of Life Questionnaire (WHOQOL-BREF), consisting of 26 statement items on a 5-point Likert scale, and the self-management evaluation checklist consists of diabetic diet, physical activity, and blood sugar control, foot care, and medication.

Population and sample

This study used a medium effect size with a power of 0.08, a 95% confidence level, and an alpha of 0.05 [5]. The sampling procedure was random sampling from two villages with the highest number of DM patients in the working area of the Baitussalam Community Health Center. The data were obtained from diabetic patients recorded as sufferers of type 2 DM for 6 months. Samples were respondents who agreed to participate in this study, randomly allocated to the experimental and control groups, each consisting of 25 respondents. The sample criteria were type 2 DM patients, DM duration of 6 months, no complications from diabetic ulcers, no symptoms of COVID-19, no visual and hearing impairments, literate, and owning a communication device (mobile phone). Respondents were given information on research objectives and participation in this study. Respondents also signed a written informed consent to be involved in this study.

Data analysis

Data analysis involved were descriptive and inferential statistics. Descriptive statistics covered the frequency, percentage, mean, and standard deviation, while inferential statistics was an independent sample t-test with a pre-post control group design to assess the mean difference between the experiment and control groups [6].

Sampling procedure

The sampling procedure of this study started by selecting the sample for the experimental and control groups. The respondents were randomly assigned to the experimental or control group. Then, the research assistants collected the demographic data and measured the quality of life using WHOQOL-BREF in the two groups of respondents (pre-test score). After the respondents completed the baseline data, the researchers performed 4 weeks of intervention for the experimental group. In the 1st week, the respondents in the experimental group received intervention related to the standard care and self-management program face to face. Then, in the next weeks (the 2nd, 3rd, and 4th weeks), the intervention was given by phone. The researchers also encouraged the respondents to perform health behaviors and keep a log record. Then, 1 month after the intervention, the quality of life was measured in the experiment and control groups. The score was then analyzed using a t-test to compare the mean between the two groups.
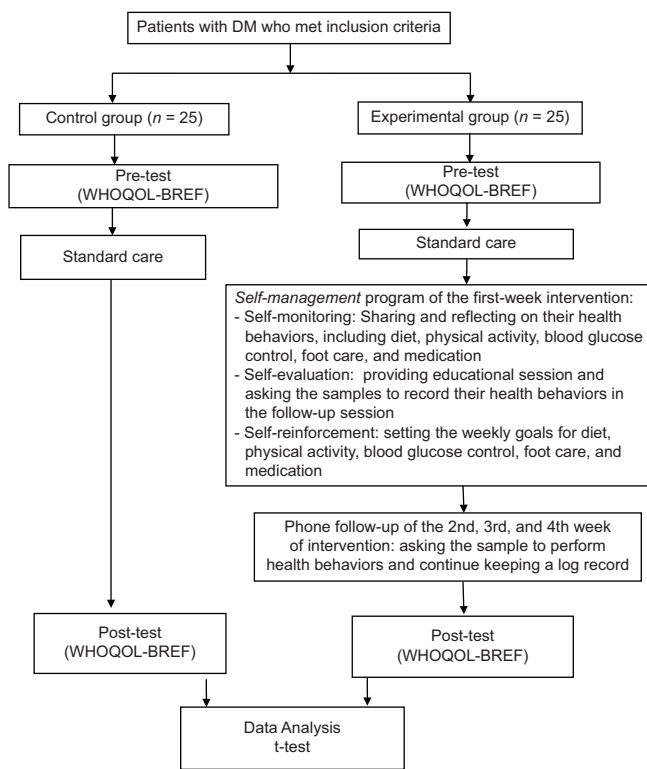
Schema 1: Data collection and implementation of the study

Ethical consideration

This research has obtained ethical approval from the Ethics Committee of the Faculty of Nursing, Universitas Syiah Kuala, Aceh (approval number: 113003090621).

Results

Characteristics of respondents

The characteristics of respondents in this study are shown in Table 1.

Table 1 shows the average age of respondents in the experimental group, with mean ± SD being 59.52 ± 9.74 and 53.60 ± 10.40 in the control group. Based on the education level, 64% of the experimental and 88% of the control group respondents had basic level education. In addition, 60% and 64% of the experimental and control group respondent were housewives. Concerning the duration of suffering from DM, most respondents have been diagnosed with DM for 6–10 years (56% and, respectively, in the experimental and control groups). There were 84% of respondents in the experimental group and 96% of the control group had received information related to DM. Around 88% of the experimental and 84 % of the control group respondents had complications due to DM.

Table 1: The demographic data of the experimental and control groups (n = 50)

Demographic data	Experimental group (n = 25)		Control group (n = 25)	
	f	%	f	%
Age (years) mean (SD)	59.52 (9.74)		53.60 (10.40)	
Gender				
Male	4	16.0	7	28.0
Female	21	84,0	18	72.0
Educational level				
None	3	12.0	0	0
Elementary	16	64.0	22	88.0
Junior high school	1	4.0	2	8.0
Senior high school	5	20.0	1	4.0
Occupation				
Unemployed	5	20.0	2	8.0
PNS/TNI/POLRI	2	8.0	0	0
Farmer	0	0	4	16.0
Laborer	1	4.0	1	4.0
Entrepreneur	2	8.0	2	8.0
Housewife	15	60.0	16	64.0
Marital status				
Married	16	64.0	21	84.0
Widowed	9	36.0	4	16.0
Length of time suffering DM				
Short (1–5 year)	5	20.0	1	4.0
Medium (6–10 years)	14	56.0	14	56.0
Long (>10 years)	6	24.0	10	40.0
Receiving information about DM				
No	4	16.0	1	4.0
Yes	21	84.0	24	96.0
Complication of DM				
No	3	12.0	4	16.0
Yes	22	88.0	21	84.0
Suffering from other diseases				
No	16	64.0	12	48.0
Yes	9	36.0	13	52.0

Quality of life before intervention

Table 2 shows that 88% of each experimental and control group had a moderate quality of life on the pre-test of the self-management intervention.

Table 2: Comparison of the pre-test quality of life scores between the experimental and control groups (n = 50)

Quality of life	Experimental group (n = 25)		Control group (n = 25)	
	f	%	F	%
Low	2	8.0	3	12.0
Medium	22	88.0	22	88.0
High	1	4.0	0	0

Then, data analysis using Mann–Whitney U-test shows no difference in the quality of life of type 2 DM patients in the pre-intervention between the experimental group and the control group, with p-value = 0.054 (α = 0.05), as shown in Table 3.

Table 3: Difference of the pre-test quality of life scores between the experimental and control groups (n = 50)

Variable	Experimental group (n = 25)	Control group (n = 25)	T	p-value
	M (SD)	M (SD)		
Quality of Life	49.33 (11.54)	43.97 (8.60)	−1.92	0.054

df = 1, t = Mann–Whitney U-test, P < 0.05.

Quality of live after intervention

The comparison of QOL between experimental and control group is shown in Table 4. It shows that 64% of the experimental group respondents had a high quality of life. In comparison, 88% of the control group respondents had a moderate quality of life. Then, the data analysis using *Mann–Whitney U-test* indicates the significant difference in the quality of life

Table 4: Comparison of the post-test quality of life scores between the experimental and control groups (n = 50)

Quality of life	Experimental group (n = 25)		Control group (n = 25)	
	F	%	f	%
Low	0	0	3	12
Medium	9	36	22	88
High	16	64	0	0

of type 2 DM patients in the post-intervention between the experimental and the control groups, with p = 0.00 (α = 0.01) (Table 5).

Table 5: Difference of the post-test quality of life scores between the experimental and control groups (n = 50)

Variable	Experimental group (n = 25)	Control group (n = 25)	t	p-value
	M (SD)	M (SD)		
Quality of Life	75.03 (6.20)	47.16 (5.75)	−6.05	0.00

df = 1, t = Mann–Whitney U-test, P < 0.05.

Discussion

Self-management is an independent effort of type 2 DM patients in managing behavior and controlling normal blood glucose levels. It consists of diet settings, exercise, foot care, blood sugar control, and DM medication. Self-management efforts aim to control blood sugar and prevent hyperglycemia to reduce complications from type 2 DM. The outcome of self-management is to achieve a better quality of life so that patients with DM can achieve optimal health and well-being.

Self-management interventions produce physiological, psychological, and behavioral change outcomes. The physiological outcomes are related to blood glucose, blood pressure, HbA1c, and body mass index [7]. Psychological outcomes relate to the quality of life, self-efficacy, illness perception, and emotional distress, and behavioral outcomes relate to the achievement of goal setting, problem-solving, and blood glucose control. Self-management behavior can also develop problem-solving skills and increase self-efficacy and individual knowledge in managing problems [8].

The results showed a significant difference in the quality of type 2 DM patients in the pre and post-intervention groups of the experimental group, with p = 0.00. Then, data analysis using Mann–Whitney U-test indicates a significant difference in the quality of life of type 2 DM patients between experimental and control groups in the post-intervention. One of the important aspects of the self-management intervention is diet management that meets the essential elements of carbohydrates, proteins, and fats. Patients with DM need between 50 and 60% carbohydrate, 10–15% protein, and 20–25% fat of the total daily calorie needs. Protein intake is 1 g/kg/day or 0.8 g/kg/day in diabetic patients with renal impairment [4].

In this study, the DM diet self-management intervention was carried out through health education for 60–90 min in session I. Respondents were also given materials and brochures related to a diabetes diet that is recommended at home. This self-management follow-up activity is carried out every week 4 times, guided by the self-management checklist sheet through phone, because the COVID-19 pandemic is still happening. Dietary interventions are more important in controlling the patient's eating patterns than will help them in managing blood glucose. This is supported by a previous study reporting that dietary interventions with targeted dietary regulation show an increase in diet quality, use of fruits, intake of vegetables, and restriction of dietary sodium sources [4].

Furthermore, this study found a significant improvement in the quality of life of DM patients in the experimental group receiving the interventions regarding health education, especially for physical activity and monitoring for 1 month of self-management program implementation. Data which were analyzed using Mann–Whitney U-test show the magnitude of the effect of health education on patients in carrying out regular physical activity. This study is in line with another study finding a significant relationship between physical activity and quality of life in the elderly with type 2 DM. Good and regular physical activity can improve the quality of life in DM patients. Health education can achieve it [9].

In addition, a study on patients with type 2 DM showed a significant relationship between physical activity and the quality of life of patients with type 2 DM [10]. Type 2 DM is a chronic disease with the impact of weakness, damage, and even disability during the patient's life due to the complications that he suffers. This will affect the patient's overall quality of life. Physical activity is one of the pillars in managing type 2 DM and the basis of therapy, because it affects several aspects of type 2 DM, including blood glucose concentration, insulin action, and lowering cardiovascular risk factors.

Physical activity can increase heart rate, blood pressure, and myocardial contractility. Clinical findings show that 60 min of exercise can increase vasodilation in arteries. Exercise can affect blood vessel walls by increasing antioxidant defenses (reducing oxidative stress), nitric oxide ability, and arterial pressure, which can cause dilation of arterial walls, and peripheral blood vessel pressure[11].

This study reveals a relationship between physical activity and the quality of life of people with type 2 DM. The focus of identification was done by asking about the activities usually carried out, from activities of heavy level (sports activities), moderate (transportation, household activities, and light exercise) to light (walking <10 min). People with type 2 DM should maintain physically active behavior by doing household activities (cleaning the house, cooking, and washing), caring for plants, relaxing, cycling, walking for between

10 min and 30 min, and doing other activities, which makes breathing a little heavier than usual [12].

Furthermore, this study shows a very significant quality of life in the experimental group after receiving health education interventions about foot gymnastics and foot care and monitoring for 1 month, with an average of 75.03 (6.20), compared to the control group who did not get the intervention, with an average of 47.16 (5.75). This proves that health education about foot exercises and foot care is one way to reduce blood sugar levels in DM patients to improve their quality of life. During the study, the researchers taught the experimental group the correct way of foot care and foot exercises, with phone follow-up for every patient's activities at home, especially for foot care and daily foot exercises. This study is supported by the previous study reporting an increase in the quality of life in type 2 DM patients before and after being given foot exercises. This study indicates a significant difference in the quality of life of patients with type 2 DM before and after foot exercise [13].

Foot exercise activities prevent further complications of DM. Leg gymnastics is a movement to train the small muscles of the legs and improve blood circulation. Leg exercises carried out daily continuously and systematically can increase the sensitivity of cells to insulin so that blood sugar will enter the cells for metabolic processes. Leg exercises done regularly and independently can control the blood sugar so that quality of life can be achieved for diabetic patients [11].

A study on patients with Grade 2 diabetic ulcers showed that the quality of life of the patients was in the poor category (19 people or 57.6%) [14]. The quality of life of a person with diabetes is lower than that of a non-diabetic. Complications of diabetic ulcers greatly affect and have a large negative effect on a person's quality of life. There was a significant relationship between quality of life and diabetic ulcers in DM patients with diabetic ulcers, because it could inhibit activities, increase treatment costs, and patient dependence on family members [14], [15].

DM is a complex chronic disease that requires continuous strategic intervention to reduce the risk of complications. In general, the goal of DM management is to improve the patient's quality of life. Education and ongoing support for DM self-management are vital to preventing acute complications, reducing the risk of long-term complications, and improving quality of life. Diabetes self-management plays an important role in improving the quality of life of people with diabetes. One of the diabetes self-management interventions is monitoring blood sugar levels [16], [17], [18].

Blood sugar monitoring is one of the main components of diabetes self-management, which has been shown to improve glycemic control in DM patients. Especially for patients with diabetes who receive intensive insulin therapy, it provides therapeutic benefits from structured blood glucose measurements, such as postprandial glucose detection, identification of glucose patterns, and increased HbA1c values and associated complications [19], [20], [21]. Blood sugar monitoring is very helpful for patients to know their blood sugar levels so that patients know the fluctuations in blood sugar levels, including knowing when hypoglycemic complications arise early. Monitoring blood sugar alone is part of an integrated strategy to improve management for those at risk of hypoglycemia or those with diabetes who are starting new treatments, performing certain activities, and changing treatment [22]. Not controlling blood sugar regularly and non-adherence to the therapeutic regimen increase risk of hypoglycemia, affects physical function, decreases consciousness, and causes brain damage [23].

The frequency of monitoring blood sugar in patients with type 2 diabetes is recommended based on individual factors, such as type of treatment (oral medication, insulin, and/or lifestyle changes), HbA1c value, risk of hypoglycemia, and treatment goals. Blood glucose monitoring is useful for people with type 2 diabetes who take insulin or certain medications that can cause hypoglycemia. People with type 2 diabetes using insulin are recommended to check their blood sugar regularly, depending on the type and amount of insulin used. Blood glucose monitoring is also useful for people with type 2 diabetes taking insulin or certain drugs that can cause hypoglycemia. Type 2 diabetes without insulin treatment with diet and exercise alone does not require daily blood sugar testing. It has been shown that blood glucose control is better in patients who apply blood sugar monitoring than in those who do not [24], [25], [26], [27].

The frequency of blood glucose self-monitoring correlates with HbA1c and is considered an important factor for obtaining good glycemic control [28]. Blood sugar monitoring improves glycemic control in the short and long term and performs better than ever before. Furthermore, blood sugar monitoring can improve glycemic control in patients newly diagnosed with type 2 diabetes, with lower HbA1c [29].

The National Institute for Health and Care Excellence recommends that routine blood sugar monitoring can be used as a benchmark to see the success of diabetes management carried out and can be used as motivation to keep blood sugar levels within normal limits. In particular, monitoring blood sugar independently and periodically increases the patient's awareness of hypoglycemia. It provides an appropriate strategy for preventing significant hypoglycemic risks [30].

People with diabetes have a high risk of experiencing health problems. Lack of control of blood sugar levels can affect various organs and cause cardiovascular disease, blindness, kidney failure, and lower extremity amputations. Providing intensive anti-diabetic therapy, early screening, diagnosis, encouraging a healthy diet, regular check-ups, and

diabetes health education are critical in reducing diabetes complications. Adherence to anti-diabetic medication is a major challenge in diabetes treatment. This is influenced by the nature of treatment or complexity of treatment, cost, side effects of treatment, and risk of hypoglycemia [31].

Furthermore, an important intervention to help people with diabetes control blood sugar levels and prevent various complications is an intervention to increase self-management through diabetes medication. Diabetes self-management education can be defined as an ongoing process to facilitate the knowledge, skills, and abilities needed for self-care of people with diabetes [32]. This research on the Acehnese people shows that efforts to improve self-management, including medication, can improve the quality of life of people with diabetes. The existence of information and skills provided in research interventions is one of the important components that can increase respondents' adherence to diabetes treatment which, in turn, improves patient quality. The results of this study are supported by previous studies recommending that health promotion regarding knowledge and general perceptions of chronic diseases, such as diabetes, should be included in disease control and prevention strategies. Education about diabetes, including its pathophysiology and adherence to treatment plans, has been shown to improve long-term patient outcomes [31].

Type 2 diabetes is a disease that requires lifelong treatment and is a significant health problem and a heavy burden on society. The COVID-19 pandemic can affect the patient care process. As previously noted, diabetic patients have a higher risk of infection with COVID-19, especially during periods of poor glycemic control. Recent investigations have reported that in COVID-19 infection, DM is one of the most common comorbidities. In addition, diabetic patients with COVID-19 have a higher risk of ICU admission and death [32].

The high risk of being infected with COVID-19 in people with diabetes raises the concern of people with diabetes going to hospitals and health services during the pandemic. It makes it difficult for health professionals to monitor the patient's condition, and it is challenging to motivate and support the self-confidence of diabetic patients. Providing information related to the benefits of intensive treatment in diabetic patients can increase the patient's knowledge about the disease process and its treatment. This intervention can affect the attitudes and behavior of patients related to diabetes medication. In addition, the interventions provided can also reduce the concerns of the sufferers during COVID-19 to improve their quality of life.

This research is also supported by previous research showing the importance of self-management for diabetics, especially to increase self-confidence. The study showed that training patients on self-management practices and being involved in the daily management of Diabetic Foot Ulcers (DFU) could increase self-confidence

and increase patients' active role in self-management by expressing their needs and preferences. It also increases patient involvement in their care and decision-making regarding treatment options [33].

Limitations

The limitations of this study are the number of samples that do not meet the expected target. Instead of 30 respondents planned for each group, only 25 respondents were available due to the restrictions on community activities (PPKM) due to COVID-19 by the government in connection with the cities of Banda Aceh and Aceh. The majority of respondents were in the red zone of COVID-19 infection.

Conclusion

Self-management has a significant effect on preventing complications due to DM and improving quality of life. The self-management intervention in this study consisted of diet, physical activity, blood sugar control, diabetic foot care, and medication. Nurses can implement self-management activities through educational interventions in increasing the independence of type 2 DM patients in caring for and controlling their health, especially during the COVID-19 pandemic. It is necessary to have an active role for nurses and the availability of sources of health-care facilities, such as health centers, in controlling the patient's blood glucose condition through home visits or monitoring routine health checks of patients with type 2 diabetes.

Acknowledgment

Clinical Implications

This study has a significant contribution for the health-care providers especially community and family health nurses in the community health center. The result of study indicated the importance of self-management for controlling blood glucose of diabetic patients and also preventing the complication of DM. The health-care

provider including the nurses are suggested to enhance self-managements of patients for maintaining health and increasing well-being.

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