ORIGINAL RESEARCH

EFFECT OF DIABETES CARE (DM CARE) ON ANXIETY AND BLOOD GLUCOSE LEVELS DIABETES MELITUS PATIENTS

Mareta Dea Rosaline[1] , Duma Lumban Tobing[1] , Diah Tika Anggraeni[1]
[1]Faculty of Health Science, Veteran National Development University Jakarta, Indonesia
Jl. Raya Limo no 7, Depok, West Java, Indonesia

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Corresponding Author:
Mareta Dea Rosaline
Email :
maretarosaline@upnvj.ac.id

Abstract

Type 2 Diabetes Mellitus (T2DM) is a chronic metabolic disorder commonly associated with physical and psychological complications, including anxiety. Optimal diabetes management requires effective self-care management, which can be enhanced through structured Diabetes Self-Management Education (DSME). The integration of digital health technology, such as mobile-based educational applications, offers a promising strategy to support diabetes management in primary healthcare settings. This study aimed to determine the effect of the Diabetes Care (DM Care) application on anxiety levels and blood glucose levels among patients with T2DM. A quantitative pre experimental study with a one-group pretest–posttest design was conducted at Limo Primary Health Center, Grogol Subdistrict, Depok City. A total of 40 patients with T2DM were recruited using consecutive sampling. The intervention consisting of DSME is delivered through an Android-based DM Care application . Anxiety levels were measured using the Hamilton Anxiety Rating Scale (HARS), and blood glucose levels were assessed as random blood glucose using a glucometer. The data were analyzed using the Wilcoxon Signed Rank Test with a significance level of $p < 0.05$. The results showed a significant reduction in anxiety levels and blood glucose levels following the intervention. The mean anxiety score decreased from 30.40 to 7.50, while the mean random blood glucose level decreased from 213.88 mg/dL to 127.88 mg/dL ($p = 0.000$). In conclusion, the DM Care application significantly reduced anxiety levels and blood glucose levels among patients with T2DM and may serve as an effective digital nursing intervention to improve self-care management and clinical outcomes in primary healthcare settings

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1. Introduction

Diabetes Mellitus (DM) is a chronic disease characterized by hyperglycemia due to impaired insulin secretion, insulin action, or a combination of both. The prevalence of type 2 diabetes mellitus continues to increase globally and is a major challenge in healthcare, particularly at the primary healthcare level [1]. Indonesia ranks fifth in the world with the highest number of diabetes sufferers in the adult age group, namely around 19.5 million people [2]. National data shows that the prevalence of diabetes in Indonesia reaches 11.3%, with DKI Jakarta Province being among the areas with high prevalence (Data and Information Center of the Ministry of Health of the Republic of Indonesia, 2020; Riskesdas, 2019). Uncontrolled hyperglycemia in the long term can cause various acute and chronic complications that impact the quality of life of sufferers (American Diabetes Association [ADA], 2023). In addition to physical impacts, sufferers of type 2 diabetes mellitus are also susceptible to psychological problems, one of which is anxiety. Anxiety is a feeling of fear, a feeling of worry that cannot be avoided and a feeling of threat or dangerous things that can cause symptoms [6]. Anxiety in DM sufferers will affect the increase in blood sugar levels to become unstable, even though they have done a diet, physical exercise or taken medication properly, because this is caused by an increase in the hormone cortisol and the hormone ketolamine so that it can worsen the health condition experienced by sufferers [5]. Anxiety in DM sufferers often arises due to concerns about complications, lifestyle changes, and dependence on long-term medication. Prolonged anxiety conditions can trigger a stress response through an increase in the hormones cortisol and catecholamines, which then contribute to increased blood glucose levels and worsen glycemic control [7]. The success of Diabetes Mellitus management is very dependent on the ability of sufferers to carry out optimal self-management. This is in line with research [8] which states that of the 30 respondents who experienced type 2 DM, the majority experienced stress and anxiety in the moderate and severe range, where 10 people (33.3%) each, diabetes sufferers tend to have excessive anxiety, one of which is due to worry due to ignorance regarding their disease, worry about the treatment that must be carried out such as regulating food, controlling blood sugar, taking medication, exercise, and so on, which sufferers need to undergo throughout their lives.

Diabetes Self Management Education (DSME) is a structured educational approach aimed at improving patients' knowledge, skills, and abilities in performing self-care, including diet management, physical activity, blood glucose monitoring, medication adherence, and stress management [9]. DSME is recommended as an integral part of nursing care for DM patients because it has been proven to increase active patient involvement in managing their disease [10]. Several studies have shown that DSME is effective in improving psychological and physiological outcomes in patients with Diabetes Mellitus. Previous studies have reported that DSME interventions have a significant effect on reducing anxiety levels and improving glycemic control in patients with type 2 DM [11]. However, the implementation of DSME with simple and easily accessible educational media on an ongoing basis is still limited in primary health care. Efforts to overcome the weaknesses of type 2 DM self-care management in controlling blood glucose levels that are developing in the community to minimize DM complications can be done by utilizing technological developments.

The increasingly rapid development of technology, especially computer and communication technology, or often called the Information and Communication Technology (ICT) era [12]. The era of information and communication technology is utilized so that the provision of health information is increasingly developed [13]. Researchers are trying to innovate by developing a diabetes care application that

utilizes technological developments in providing information as anxiety detection and in controlling blood glucose levels. The Diabetes Care (DM Care) application developed in this study differs from previous DSME interventions by offering an integrated digital self-management education platform that simultaneously addresses psychological outcomes (anxiety reduction) and physiological outcomes (blood glucose control). The application combines structured educational content, medication and activity reminders, dietary management guidance, physical exercise programs, relaxation techniques, and anxiety management within a single mobile-based system. This integrated and continuous approach is designed to strengthen patient self-management behaviors and improve both mental and metabolic outcomes in patients with type 2 diabetes mellitus, particularly in primary healthcare settings. Based on this background, this study aims to analyze the effect of Diabetes Care on anxiety levels and blood glucose levels in type 2 Diabetes Mellitus sufferers as an effort to strengthen education-based nursing interventions in primary health care.

2. Methods

This study uses a quantitative approach, with a pre-experimental research design with a one-group pre-test and post-test design . This study included patients diagnosed with type 2 diabetes mellitus who were registered at the Limo Community Health Center, Grogol Village, Depok City. Participants were required to be able to read Indonesian, own and operate an Android-based smartphone, and be willing to use the Diabetes Care (DM Care) application throughout the study period, with written informed consent obtained prior to participation. Patients were excluded if they had type 1 or gestational diabetes, acute or severe chronic diabetes-related complications, diagnosed psychiatric disorders or ongoing anxiety treatment, cognitive or sensory impairments that interfered with application use, participation in other diabetes education programs, or inability to complete the intervention period. The study was conducted in the Limo Community Health Center (Puskesmas) working area, Grogol Village, Depok City. The study population was patients with type 2 diabetes mellitus registered at the health center. The study sample consisted of 40 respondents selected using *consecutive sampling techniques* according to inclusion and exclusion criteria. The intervention, in the form of self-education media using the Diabetes Care application, was delivered in two sessions over three weeks. The educational intervention was provided through the Android-based "Diabetes Care" (DM-CARE) application downloaded by the respondents. This application contains health education related to DM management materials, medication schedule reminders, exercise, diet, relaxation, and anxiety management for DM patients. The DM material was explained during the PTM posbindu activities. This study was conducted for 30 days by collecting *pre-post-test anxiety questionnaires* and measuring blood sugar levels. Anxiety levels were measured using **the Hamilton Anxiety Rating Scale (HARS)**, while blood glucose levels were measured using **a glucometer** (random blood sugar).

3. Results

Table 1. Respondent Characteristics Based on Age (n=40)

Variables	Mean	Elementary School	Min-Max	95% CI
Age	51.3	9,685	32-74	48.20-54.40

Table 1 shows that the 40 respondents had a mean age of 51.3 years with a standard deviation of 9.685 years. The youngest respondent was 32 years old, while the oldest was 74 years old

Table 2. Respondent Characteristics Based on Gender (n= 40)

Gender	Frequency	Percentage (%)
Woman	28	70 %
Male	12	30 %
Total	4 0	100%

Table 2 show that of the 4 0 respondents i n the majority were female, 28 respondents (7 0 %) and 12 respondents were male (30 %).

Table 3 . Respondent Characteristics Based on Occupation (n=4 0)

Work	Frequency	Percentage (%)
Civil Servants/TNI/Polri	2	5%
Employee Private	5	12.5%
Self-employed	11	27.5%
Factory worker	1	2.5%
Housewife	20	50%
Pastor	1	2.5%
Total	**40**	**100%**

Table 3 show that the 4 0 respondents, the majority were housewives, consist of 2 0 respondents (50 %) and only 1 (2. 2 %) respondent worked as a factory worker

Table 4 . Respondent Characteristics Based on the Length of Time Suffering from Diabetes Mellitus (n=4 0)

Long-term Diabetes Mellitus	Frequency	Presentation
<1 year	9	22.5%
1-2 years	3	7.5%
2-3 years	7	17.5%
>3 years	21	52.5%
Total	4 0	100%

Table 4 show that the 4 0 respondents, the majority, 21 respondents (52.5 %) had suffered from diabetes mellitus for more than 3 years and only 3 respondents (7.5 %) had suffered from diabetes mellitus 1-2 years.

Table 5. Overview of Anxiety Levels and Blood Sugar Levels Before And After Being Given DM CARE (n=40)

Variables	Mean	Median	Elementary School	Min-Max	Standard Error
Anxiety Level					
Before	30.40	31.50	5,439	13-39	0.860
After	7.50	7	2,439	4-14	0.386
Blood Sugar Levels					
Before	213.88	207.50	49,428	143-374	7,815
After	127.88	129.50	16,077	100-187	2,542

Based on the results table analysis 5 menus show from 40 respondents sufferers DM Type 2 before the Diabetes intervention is carried out Average care anxiety level score is at the value 30.40 with median value 31.50, namely in category severe anxiety. After done intervention Diabetes *Care* average level score anxiety is at in mark 7.50 And median value as big as 7 experience decline become No There is anxiety. Next, average score quality Sleep before done intervention as big as 11.28 with the middle value 11 where all respondents have good sleep quality bad , that where after done intervention , average quality score Sleep respondents decrease as big as 3.68 in category Good . Then average the blood sugar level score amounting to 213.88 and mark the middle is 207.50 with a maximum value of 374 which is sugar levels blood in category bad before done intervention. Then after it is done intervention score average level sugar blood respondents there is a reduction or decrease with a value of 127.88 and a middle value of 129.50 Where have a level normal blood sugar.

Table 6. Analysis Influence Diabetes *Care* (DM Care) On the Anxiety Level of Type 2 DM Patients (n=40)

Variables	Min	Max	Elementary School	P Value
Anxiety Level				
Pre-test	13	39	5,439	0,000
Post test	4	14	2,439	

Based on results analysis data use *Wilcoxon* test *Sign t -test* on table 6 show difference mark pre test to post test there is a decrease level anxiety from before to after the intervention was implemented Diabetes *Self Management Education* (DSME) has mark significance of 0.000 (p- value <0.05), or less from 0.05 which It means H 0 rejected And H a accepted , so that can withdrawn conclusion that there is an influence Diabetes Care (DM Care) towards anxiety level sufferers DM Type 2

Table 7. Analysis Influence Diabetes Care (DM Care Against Blood Sugar Levels in Type 2 Diabetes Patients (n=40)

Variables	Min	Max	Elementary School	P Value
Blood Sugar Levels				
Pre-test	143	374	49,428	0,000
Post test	100	187	16,077	

Based on results analysis data use *Wilcoxon* test *Sign t -test* on table 7 show difference mark pre test to post test there is decrease in blood sugar levels from before to after the intervention Diabetes Care (DM Care) own mark significance i of 0.000 (p-value <0.05), or not enough from 0.05 which It means H0 is rejected and H a accepted , so that can withdrawn conclusion that there is the influence of Diabetes Care (DM Care) on level sugar blood of Type 2 DM sufferers

4. Discussion

The analysis results show that of the 40 Type 2 DM respondents before the intervention using the Diabetes Care (DM Care) application, the average anxiety level score was 30.40 with a median of 31.50, which is in the severe anxiety category. After the intervention, the average anxiety score was 7.50 and the median of 7 decreased to no anxiety. This is in line with the results of research [14] that there were 12 (75%) type 2 DM sufferers who had moderate anxiety levels and 4 (25%) sufferers with mild anxiety before the intervention, then experienced a decrease in anxiety levels to mild anxiety 11 (68%), moderate anxiety 3 (18.7%) and no anxiety 2 (12.5%). Anxiety is a condition when a person experiences feelings of continuous and deep fear, non-specific or unclear causes, but there are no problems in assessing realistically, there are no problems in personality, still good, disturbed behavior but within normal limits. This condition can be a signal for someone in facing a sense of threat [6]. Based on the results of research [15] stated that most respondents experienced moderate levels of anxiety, where a person's anxiety level is influenced by changes in current health conditions and will change along with changes in perceived health conditions. When health conditions worsen, this will also affect the level of anxiety of diabetes mellitus sufferers, and vice versa. This is supported by [7] the average level of bad anxiety

occurs in type 2 DM sufferers when facing various problems related to their disease, and experiencing major changes such as diet should not overeat, must reduce consumption of some favorite foods, often feel thirsty which makes DM sufferers drink and urinate frequently, get tired quickly because their physical condition is getting worse, the need for routine consultations to health services, even experiencing or high risk of complications, so that sudden changes in their lives make diabetes sufferers have high anxiety. The decrease in anxiety can be influenced by several factors. According to [14] it can be influenced by gender, length of suffering, level of education, age and occupation, similarly according to Stuart and Laraia in [6] there are interpersonal, behavioral, biological and disease factors. According to [15] anxiety is prone to be experienced by individuals who have chronic diseases, one of which is DM, therefore to control anxiety by carrying out self-management education and stress management which can reduce the causative factors and add information to increase knowledge related to the disease, change behavior and have positive anxiety coping.

Based on statistical tests, it shows that Diabetes Care (DM Care) through the provision of applications has an effect on the level of anxiety of type 2 diabetes mellitus sufferers. DM Care is an educational application that provides knowledge and skills related to self-management of diabetes sufferers. DM Care application education contains a menu for consuming medication according to recommendations, managing a healthy diet or food, monitoring blood sugar, doing physical activity or exercise and being able to manage stress due to diabetes. Self-management education using the application aims to provide motivation in decision-making, self-care, problem solving or solutions, improving quality of life and collaboration with the medical team to obtain better health [11]. Education using the DM Care application aims to provide knowledge, confidence and skills to carry out self-management of patient care, develop goals, solve problems and overcome emotions and stress experienced by DM sufferers, not only health counseling, but also encouraging participation and cooperation of diabetes sufferers [16]. One of the management is managing worry or anxiety. In this study, researchers conducted Diabetes Self-Management Education (DSME) through the DM Care application media which was carried out for 2 sessions, where each session lasted 90 minutes. Session 1 provides education in the form of DM concepts (definition, types, risk factors, signs and symptoms, complications of DM) and DM management (education, nutrition, pharmacological therapy, physical exercise, stress management and self-monitoring of blood sugar). Session 2 implements physical activities in the form of diabetes gymnastics and anxiety management in the form of deep breathing relaxation techniques. This is done for 3 weeks by sufferers through the use of the application as a guide and reminder to carry out management according to the date and day on the observation sheet on the application media, so that they can carry out management according to activities, where the level of anxiety decreases, it can be seen that the initial level of severe anxiety is 82.5% to 100% no anxiety and p-value = 0.000 (<0.05).

In a state of anxiety or the presence of physical and psychological stressors in the body, the hypothalamus pituitary will activate the sympathetic nervous system of catecholamines to fight to fight as a defense mechanism of the body due to anxiety, then releases CRH corticotropin-releasing hormone which stimulates increased secretion of the hormone cortisol, one of its functions is to provide a lot of energy by increasing blood sugar levels, during active sympathetic stimulation to the adrenal medulla resulting in increased epinephrine release, both of which have an impact on the hormone insulin and glucagon in the pancreas, which reduces the work of insulin and increases glucagon or blood sugar levels so that sugar will accumulate in the blood and there is an increase or high sugar in the body [17]. There is a decrease in the level of anxiety due to the provision of independent educational interventions in

which there is education, methods and treatment of anxiety management and physical activity can add information on worries due to ignorance related to the disease, create a sense of comfort and regularly train the body to respond to anxiety better so that there is a decrease in catecholamine hormones and cortisol hormones which anxiety and blood sugar levels also decrease [7]. This is supported by [14] education as one way to convey health information to diabetes sufferers in particular, so that it can increase knowledge, change a person's behavior for the better and form positive coping to manage the anxiety they experience.

Based on the results of statistical tests, it shows that Diabetes Care (DM Care) has an effect on blood sugar levels in type 2 diabetes mellitus sufferers. Proven by the results of the Wilcoxon Signed Rank Test statistical test showing that the p-value = 0.000 (<0.05). This is supported by research [18] entitled "The Effect of the DSME Program on Reducing Blood Sugar Levels in Type 2 DM Patients at RSU.Royal Prima Medan" states that there is a significant effect of DSME intervention on reducing blood sugar levels in type 2 diabetics with a p-value = 0.007 (<0.05). Reducing blood sugar levels by providing self-management education increases the way of thinking and provides positive experiences for healthier living behaviors, also creating good attitudes which improve the quality of life and independent attitudes during treatment [18]. Supported by [19] that blood sugar levels will decrease if you do physical exercise such as gymnastics or sports regularly, because the muscles will use stored sugar so that the sugar will decrease and increase insulin sensitivity. This is in line with [20] that the attitude of sufferers shows a better direction by managing nutrition properly, reducing consumption of sweet drinks, taking medication regularly as recommended and doing physical activity and routinely monitoring blood sugar. From the implementation of DSME, sufferers can change their attitudes and behavior in carrying out daily care management so they can feel recovery in order to maintain blood sugar levels and minimize complications.

5. Conclusion

The use of self-education media with the use of the DM Care application has an effect to level anxiety sufferers diabetes type 2 mellitus which in a way simultaneously influence tan enhancer behavior attitude sufferers, so from That For control sugar blood with do management education self And management activity physique Also management stress can increase ability somebody in management self-care And increase control from metabolic use increase better clinical outcomes for controlling blood sugar . decreased blood sugar levels after given intervention Where information about the disease he suffered from increased and there was motivation or desire For do What Which Already in get related management self , as well as Because existence improvement management maintenance diabetes that done by the sufferer who controlled with activities per day through media applications on mobile phones to carry out physical exercise, diet, drink medicine , management anxiety , and control sugar blood. Recommendations for Future Research should apply randomized controlled trial designs with larger sample sizes and longer follow-up periods to evaluate the long-term effectiveness of the DM Care application. The inclusion of objective indicators such as HbA1c and fasting blood glucose is recommended to strengthen clinical outcome assessment. Further development may also explore personalization features and integration with healthcare provider monitoring systems.

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